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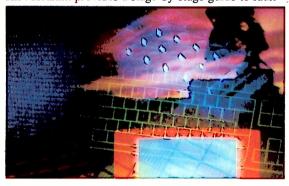
Specification of video resolution and other matters.

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Test Report: The JBC Advanced Soldering Station



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Digital TV is here!

elcome all to the age of digital TV, the latest stage in the fascinating development of TV technology - from Nipkow's disc, patented in 1884 as "a television machine", to Boris Rosing's proposal to use a CRT as the receiving display device and his demonstration of a TV system in 1907, also in that year Dieckmann's demonstration of a CRT for TV reception, to Zworykin's patent application for an electronic TV system in 1923, to Baird's experiments in the mid-Twenties and the work by EMI and RCA in the late Twenties and early Thirties that led to practical, all-electronic TV, to the start of electronic TV broadcasting in the mid-Thirties, then to the development by GE and RCA of colour TV systems in the Forties. Colour TV transmissions in the USA started in 1954, using basically the system developed by RCA. It took rather longer for colour to be added to TV in the UK, until December 2nd 1967 to be exact. Our December 1967 cover featured the famous test card F with Carol and her blackboard, and announced that "colour is here". I thought it would be appropriate to head this leader similarly.

Things were not to stand still. As soon as the first stage of the conversion to colour broadcasting at UHF had been completed, the IBA's Experimental and Development Department was given the task of undertaking a study of the likely impact of digital techniques on television. The studies began in 1968-9 – the IBA was interested in the control of unattended networks, developments in studio technology, and the problem of standards conversion. At this time the studios were originating signals in 625-line form, but broadcasting had to be at both 625 and 405 lines. This meant the need for accu-

rate, stable conversion from one to the other. There was also the need to convert US 525-line signals to 625-line form.

Development was incredibly rapid. A line-rate digital standards converter was developed in 1970-71 - stimulated by a significant fall in the price of relatively fast digital storage devices. It used four-line interpolation, and was demonstrated to the broadcasting industry in March 1971. The next step was the development of a fieldrate digital converter, which came to be known as DICE (Digital Intercontinental Conversion Equipment). Work on it started in November 1971. One year later an experimental converter was in operation. It was used to feed a converted broadcast of the US presidential election to the whole of Europe in November 1972. At the time it was the fastest computer in the world - it needed to be to handle in real time the amount of data involved. By early 1973 it was in full oneway use, and by the spring of 1975 it was in full two-way (525-625, 625-525) use. There were demonstrations at the IBC in 1974, Montreux in 1975 and the NAB in 1976.

Digital TV had arrived, but not as a consumer electronics prospect. There were what appeared to be insuperable problems here. For a start the transmission bandwidth problem: the more information you transmit, the greater the bandwidth required, and all those digital samples amount to far more data than a simple analogue waveform. Then there was the fact that the cost of a digital decoder would have been prohibitive. So there things rested for a while as far as consumer digital TV was concerned, though advances in studio equipment, in particular image manipulation, continued.

Work that was relevant to the prospect of digital transmission was nevertheless car-

ried out. What was required was data compression. NTL, as the IBA's engineering division had become, established that with some programme material - not just still pictures - the video redundancy rate is as high as 98 per cent. The next step was to try to establish an international standard for TV compression, hence the MPEG (Motion Picture Experts Group) which started work in 1988. By the early Nineties efficient compression algorithms had been developed. The MPEG-2 compression standard had been established by 1993, and the European DVB (Digital Broadcasting) project was set up to implement it. Two further developments made this practical - digital signal processing chips and memory devices at mass-market prices. The result - set-top receiverdecoders at a subsidised £200. Interesting that just as this latest development in TV depended on another technology, semiconductor devices, in an earlier era development of the CRT was held up until vacuum pumping technology had significantly improved!

What are we going to do with the multitude of channels that this latest chapter in the story of TV has brought us, and what comes next? It seems doubtful whether the broadcasters will be able to do justice to the possibilities that have opened up – how can you fill all that channel time with worthwhile material? And even if you could, how much viewing can be fitted into a 24-hour day? The future seems to be flat screens (expensive at present, and of questionable longevity) and all that multimedia business – the internet, interactive TV, home shopping and so on. Are we to become total slaves to the screen? Probably, hopefully

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Indexes for Vols. 38 to 47 are available at £3.50 each from SoftCopy Ltd., who can also supply an eight-year consolidated index on computer disc. For further details see page 65.

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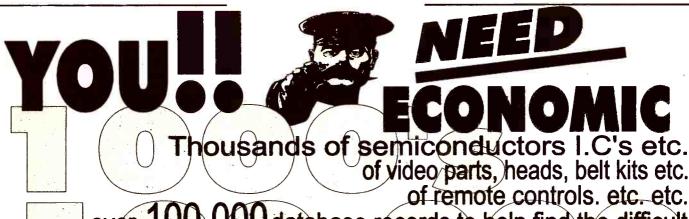
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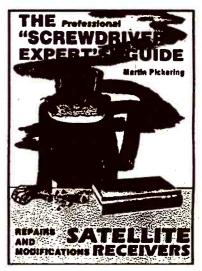
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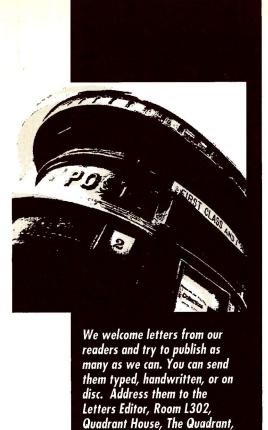
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	2N3440	0.72	2SC4517A	3.14	BA3918	6.41	BC850C	0.41	BU506D	1.80	CNY75B	0.52	RG2	0.64	TDA1015	1.37	TDA8218	4.62
1	2N3773	1.52	2SC5129	6.82	BA4558	0.69	BC856B	0.21	BU506DF	2.31	D2VREM	16.95	RGP10G	0.26	TDA1044	1.43	TDA8350Q	3.56
	2N3904	0.32 0.11	2SC5149	7.69	BA5406 BA5412	2.14	BC858	0.21 0.24	BU508A BU508AF	1.29	DCREG	13.95	RGP15G RGP15J	0.33 0.17	TDA1060 TDA1085C	2.65 2.74	TDA8380 TDA8391	2.53 7.69
	2N4401 2SA1012	0.11 1.17	2SC536 2SC945	0.30 0.11	BA5412 BA6209	2.48 1.18	BC858B BC858C	0.24 0.19	BU508AFI BU508AFI	1.32 1.37	DTA114ES DTC124ES	0.31 0.77	RGP30M	0.17	TDA1085C	1.85	TDA8391 TDA9503	2.13
	2SA1013	0.35	2SD1138	0.94	BA6209N	1.95	BC859A	0.18	BU508APH	1.00	DTC14EF	0.18	S2000A	2.57	TDA1170N	2.57	TEA1039	2.11
	2SA1015	0.11	2SD1207	0.57	BA6219B	1.77	BC875	0.45	BU508D	1.56	DTC144ES	0.19	S2000A3	3.59	TDA1170S	2.05	TEA2018A	2.29
1	2SA1015Y 2SA1016	0.98 0.26	2SD1292 2SD1330	0.64 0.31	BA6247 BAS32L	3.42 0.67	BCY59 BCY71	0.26 0.28	BU508DF BU508V	1.88 2.40	FR605 FXT749	1.90 0.43	S2000AF S2000N	1.46 3.59	TDA1175 TDA1519A	9.40 4.87	TEA2029C TEA2029CV	7.04 3.54
	2SA1010	0.26	2SD1330 2SD1398	2.14	BAT43	0.52	BD131	0.26	BU806	1.03	H1000L	5.50	S2055AF	2.24	TDA1521A	2,91	TEA2031A	4.26
	2SA1020Y	0.53	2SD1426	3.51	BAT85	0.96	BD132	0.26	BU807	0.60	HA13119	2.09	SAB3035	3.06	TDA1524A	5.25	TEA2164	3.40
	2SA1145 2SA1302	0.36 4.45	2SD1439 2SD1441	5.86 5.98	BAV20 BAV21	0.26 0.21	BD136 BD139	0.24 0.31	BU908 BUF405A	1.68 2.99	HA13150 HA13151	15.12 18.24	SG264A SGSIF344	12.88 10.70	TDA1554Q TDA1557Q	8.12 4.23	TEA2164G TEA2165A	4.39 9.58
	2SA562	0.18	2SD1441 2SD1453	3.85	BAX14	0.21	BD139	0.31	BUH515	2.14	HM6251	14.32	SL1431	2.82	TDA1557Q	7.69	TEA2103A	3.32
	2SA673	0.18	2SD1497	4.74	BC107B	0.20	BD234	0.52	BUH515D	2.14	IRFBC40	2.65	SR2KN	1.29	TDA1675A	3.85	TEA2261	3.68
1	2SA683	0.36	2SD1541	4.96	BC108	0.24	BD241A	0.38	BUH517	6.24	JC501	4.86	STA441C STK4132II	3.86	TDA1904 TDA2005	1.63 1.83	TEA5101A TEA51 0 1B	6.48 6.48
	2SA684 2SA733	0.43 0.18	2SD1545 2SD1546	6.84 7.69	BC108C BC109B	0.15 0.28	BD243 BD243C	0.45 0.44	BUK444500 BUL54AR	B 3.47 1.27	KA2206 KA22066	1.37 2.40	STK4132II	6.80 8.44	TDA2005	1.00	TEA5170	2.57
	2SA933	0.60	2SD1548	5.95	BC141	0.36	BD244C	0.43	BUT11	0.65	KBU602	2.18	STK4142II	9.40	TDA2030H	0.91	TIC106D	0.82
	2SA940	0.82	2SD1554	3.25	BC182	0.14	BD317	1.78	BUT11A	0.95	KIA6210AH	6.15	STK4152II	10.95	TDA2030V	0.00	TIC246D	1.54
	2SA950 2SA952	0.18 0.18	2SD1555 2SD1556	2.65 5.11	BC182L BC184L	0.14 0.06	BD433 BD434	0.29 0.31	BUT11AF BUT12A	1.18 1.17	KSR1004 LA4282	0.21 5.11	STK4192II STK5332	15.63 2.82	TDA2050 TDA2541	4.56 1.12	TICP106D TIP110	0.72 0.35
	2SA966	0.69	2SD1650	2.48	BC212	0.12	BD435	0.38	BUT12AF	1.87	LA4705	6.41	STK5342	4.07	TDA2577A	3.45	TIP111	0.57
	2SA970	0.19	2SD1651	2.38	BC212L	0.18	BD436	0.52	BUT18AF	1.37	LA6324	3.25	STK5372H	6.84	TDA2578A	3.20	TIP112H	0.77
1	2SA984 2SB1010	0.38 0.35	2SD1761 2SD1815	0.94 0.86	BC237 BC237B	0.12 0.19	BD437 BD438	0.52 0.38	BUT56A BUW11A	1.19 1.54	LA7116 LA7830	1.70 1.88	STK5481 STK72 5 3	8.12 10.51	TDA2579A TDA2581Q	4.91 2.57	TIP120 TIP2955	0.40 0.89
	2SB1143	0.35	2SD1815 2SD1858	0.43	BC237B	0.19	BD839	0.57	BUW12A	2.99	LA7832	2.40	STK730-060	11.65	TDA2593	1.12	TIP2955	0.03
	2SB1243	0.69	2SD1877	2.14	BC238B	0.16	BD901	0.52	BUX84	1.03	LA7833	5.98	STK73410II	6.82	TDA2611A	0.64	TIP3055	1.08
	2SB560	0.43	2SD1878	2.63	BC239	0.04	BD911	0.52	BUZ71A	1.03	LA7835	3.51	STK7348	5.74	TDA2653A TDA2822M	4.70	TIP31A TIP41C	0.41
	2SB649A 2SB688	0.77 1.61	2SD1879 2SD1884	2.23 3.35	BC258 BC307	0.09 0.06	BD912 BDW94C	0.63 0.60	BUZ77B BUZ80	4.27 3.52	LA7837 LA7838	8.53 2.65	STK73907 STR10006	10.48 3.94	TDA3301B	1.37 9.12	TIP42A	0.65 0.35
	2SB774	0.99	2SD1887	3.56	BC307B	0.15	BF199	0.18	BUZ90A	3.40	LC7132	4.70	STR11006	7.37	TDA3505	2.40	TIP42C	0.52
	2SB793	1.71	2SD1889	2.14	BC308	0.09	BF240	0.11	BUZ90AF	3.30	LED3G	0.10	STR50020	6.38	TDA3560	6.13	TIPL761A	1.85
	2SB892 2SC1383	0.35 0.32	2SD2012 2SD400	0.86 0.34	BC309B BC327	0.10 0.10	BF245A BF258	0.19 0.04	BY127 BY133	0.14 0.08	LN1203N LM317T	3.25 1.29	STR50103 STR50103A	4.48 5.56	TDA3561A TDA3562A	3.85 6.62	TIPL791A TL072CP	2.48 1.03
	2SC1740	0.16	2SD400F	1.20	BC238	0.14	BF324	0.18	BY184	0.33	LM324N	1.48	STR5142M	13.25	TDA3565	2.74	TL082	1.04
	2SC1740S	0.84	2SD467	0.57	BC337	0.14	BF420	0.21	BY227	0.13	LM339N	0.50	STR54041	5.15	TDA3576B	10.31	TLP731	1.95
	2SC1815	0.17	2SD669A	0.79	BC338	0.06	BF421	0.24	BY228	0.26	LM358N LM381	0.52	STR5412	4.55 3.42	TDA3592A TDA3603P	4.60	TMP47C432A	AP8189 21.84
	2SC1815Y 2SC1846	0.12 0.52	2SD718 2SD837B	1.90 1.12	BC368 BC369	0.18 0.18	BF422 BF423	0.19 0.14	BY229 BY255	1.34 0.14	LM386N	4.27 0.57	STR58041 STR59041	8.11	TDA3650	5.62 9.27	TMP47C434N	V355 5
	2SC2023	3.18	2SD856	0.79	BC372	0.53	BF458	0.31	BY298	0.15	M293B1	21.34	STR6020	6.07	TDA3653B	1.54		16.63
	2SC2120	0.69	2SD965	0.26	BC546A	0.11	BF459	0.43	BY299	0.18	M494B1 M51182L	11.85	STR61001 STRD4420	10.86	TDA3653CQ TDA3653CQ	2.82 2.57	TOP204YAI U2829B	4.19 3.40
	2SC2229 2SC2230	0.35 0.55	2SD965R 2SK1118	1.05 3.40	BC546B BC547	0.12 0.11	BF469 BF487	0.35 0.57	BY399 BY448	0.16 0.30	M51182L M54544L	1.88 2.48	STRD4420 STRD6008X	11.17 8.66	TDA3653CQ TDA3654	1.44	U2829B U4614B	5.78
	2SC2235	0.36	2SK135	11.02	BC547A	0.04	BF494	0.12	BY476	1.00	M58655P	4.96	STRD6202	12.89	TDA3654Q	2.82	UC3842	0.74
V	2SC2236	0.36	2SK1507	5.56	BC547B	0.11	BF758	0.32	BYD14J	0.35	MC13002P	7.69	STV5730ST	4.00	TDA4500	4.66	UC3844	1.20
	2SC2240	0.21	2SK241	0.69	BC548	0.11	BF759 BF788	0.38 0.52	BYD33D BYD33J	0.12 0.16	MC1310P MC34063API	0.85 2.65	STV9379 T6071V	11.12 2.99	TDA4503 TDA4505E	4.00 7.35	UPC1365C UPC1378H	1.95 15.33
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Video Resolution

Sutton, Surrey SM2 5AS.

I endorse all that Eugene Trundle says about the MB-SWISS 4 test cassette (October issue pages 842-3): it's a godsend. He appears to be a bit surprised at being able to see the cassette's 3MHz gratings. Here's why I think he can.

First, a reminder of video resolution basics. Viewing tests carried out in the Sixties showed that with a typical screen size, viewing distance and a picture consisting of 500 or more lines most viewers didn't notice the line structure. With the system I 625-line specification, 50 lines are lost to field blanking. This leaves 575 active lines.

It's reasonable to assume that a TV system's horizontal and vertical resolution should be equal. So with a picture whose aspect ratio is 4:3, the video bandwidth should be able to cope with $1.33 \times 575 = 767$ lines, i.e. $767 \div 2$ black/white line pairs. The field rate required to avoid excessive flicker is 50Hz, so the active line time is 52μ sec. On this basis it would appear that the video bandwidth should be $[(767 \div 52) \div 2]$ MHz = 7.4MHz, yet the allocated channel bandwidth is 5.5MHz.

This is because of the mysterious Kell factor, which was explained to me while I was a trainee engineer at the BBC's Engineering Department. The Kell factor is best illustrated by imagining a 'scene' that consists of a

Letters

large card on which many horizontal black and white lines of equal, thin width are printed. When this is scanned by a camera and displayed on a monitor, one might think that - with careful adjustment of the camera's zoom, the camera-card distance, etc. - the monitor could be made to display 575 lines (say 288 black and 287 white). Even if this could be achieved, the slightest vertical movement of the camera or card would result in the lines of the simple test card falling between the camera's scanning lines, the result being a grey blur.

This theory was investigated, the net result being that the 'real' vertical resolution of a TV system was decreed to be less than the number of active scanning lines by what is known as the Kell factor. Various texts quote different values, but 0.75 seems to be a general consensus. When this is applied to the system I resolution calculation above, a 5.5MHz channel bandwidth is adequate to maintain equal horizontal and vertical resolution.

With respect to the VHS system, Eugene is correct in saying that 3MHz equates to 312 lines and 3.2MHz, the upper VHS luminance limit, to 333 lines. I suggest however that this is the theoretical maximum resolution. The oft-quoted 260 lines is, as far as I understand it, a 'real-world' resolution which is acceptably close to 333 x Kell.

To summarise, for a 'real' 260-line resolution a theoretical resolution of $260 \div 0.75 = 346$ lines is required. This is approximately equivalent to an upper luminance limit of 3.2MHz.

Andy Barkley, B.Sc., MIEE, C.Eng.,

Andy Barkley, B.Sc., MIEE, C.Eng Ufford, Suffolk.

Bicycles

I hope Donald Bullock (September) isn't suggesting that bicycle repair is an easy option for the domestic electronics technician.

While not denying that safety is paramount when dealing with electricity, descending a hill in the dark at 40 m.p.h. is hardly the time to discover a defect in the brakes. Neither is complexity confined to VCRs etc.: try delving into a five-or seven-speed hub gear or an integrated brake/gear lever — or how about building bomb-proof wheels for a camper plus his gear?

This sort of thing can be just as challenging as a system control fault. I know – I do both. And yes there are cowboys in the bicycle trade as well. I do however find building wheels very therapeutic – and I can't remember when a TV or VCR fault had that effect! Roger Burchett, Hythe, Kent.

Security System

One of my customers had a problem. He was having trouble with a neighbour and had installed a camera which was switched on by using an IR detector to apply the mains supply. The camera's output was fed to a VCR which was switched to record 24 hours a day. This worked all right, but he was getting fed up with having to wade through hours of tape to check on any wrongdoing, not to mention having to change the tape every eight hours. Could the VCR be arranged to record only when the mains supply came on?

This would no doubt be possible with considerable modification, but we came up with a much simpler solution. The only VCRs that will start to record as soon as the mains is applied are the old key-operated ones. So out came a 3V22 which had been destined for the tip. With a new set of belts and a new compatible drum I had a very satisfied customer who now has his modern VCR in normal use again.

Laurie Watkinson, Telesonic Services, Holsworthy, Devon.

TELETOPICS

ONdigital's Plans

ONdigital has unveiled its launch plans for the world's first digital terrestrial TV service, which will start on Sunday, November 15th – the 29th anniversary of the start of BBC-1 in colour. Two basic subscription packages will be on offer. One will provide six primary channels, of the viewer's choice, for £7.99 per month, the other the full set of primary channels (at least ten) for £10 a month. Premium channels, from BSkyB and others, will cost £5-£18 a month extra.

ONdigital expects about 70 per cent of the population to be able to receive its full service (three digital multiplexes) at the start of transmissions: the figure should rise to 90 per cent by the end of the first year. In areas where all three multiplexes are not receivable initially, the full range of programming will be available at homes that can receive multiplexes B and C. Those that can receive only multiplex B will get a more limited choice and be charged at £19.99 a month for the primary and premium channels available.

Set-top boxes are to be made by Philips, Pace, Sony, Nokia, Toshiba and Grundig, though only Pace and Philips are expected to have products available at stores for the launch of the service.

ONdigital is to offer a free, next-day service to help viewers who have an installation and/or reception problem, and will install a new aerial if necessary 5-15 per cent of subscribers are expected to experience problems, many because of faulty aerials. Installation will be for one set of the viewer's choice multi-set installations and telephone line connections will cost extra. The installation work is to be carried out by a new Granada division, Digital TV Services. ONdigital has estimated that the average cost per customer will be about £30-£50 - some believe that this is rather optimistic.

An e-mail service is to be added in mid-1999. Viewers will be able to buy an infra-red linked keyboard then send and receive messages across the internet from their TV set. The messages will be stored temporarily in the user's set-top box before being sent on their way. ONdigital is to offer a store-and-forward service: messages can be stored at the company's servers before being sent to or from the user's set-top box. Early next year ONdigital is to introduce an information service – news, weather, sport etc. This will be

free: additional payment may be required for the e-mail service. Next year ONdigital intends to offer pay-perview and impulse-view services requested by telephone or via a modem built into the set-top box.

ONdigital thinks that it may be possible to add a further six new channels across its three digital multiplexes within the next two-three years, once improved digital compression systems become available. To start with ONdigital will be transmitting five channels within each multiplex at an average data rate of 4-4-5Mbits/sec.

The company says that six-channel digital surround sound is possible, though users will probably require a plug-in module to extract the surround-sound signals from the transport stream and decode them.

Set-top boxes for ONdigital's DTT services are expected to be available at over 5,000 retailers before Christmas. They will cost about £200 when the viewer subscribes to ONdigital. Plug-in conditional access modules are not expected to be available until about six months after the launch of the service. They will cost about £30 each to produce but will be free to subscribers.



Pioneer has launched a 50in. widescreen plasma display panel, Model PDP501MX (see photograph above), which the company claims is the first XGA data display device in this size. The pixel arrangement is 1,280 (horizontal) x 768 (vertical), giving a total pixel count of over 980,000. This enables the display to provide bright, full-colour data and motion-picture images from a wide variety of sources, including computer-generated text and graphics. The depth is only 9.8cm, while the viewing angle is over 160° (horizontal and vertical). Power consumption is 555W.

Motorola's Multimedia System

In a move aimed at establishing a consumer electronics standard, Motorola launched the first system that brings together digital TV and audio, the internet, 3D computer games and other multimedia technologies all in one box. system, code-named Blackbird, was demonstrated at the recent International Broadcasting Convention in Amsterdam and is now being offered to set-top box and other manufacturers. Motorola expects the system to appear in consumer products within six

Blackbird is described as an open, i.e. interoperable, exten-

sible multimedia architecture that combines the functions of a broadband router, a network computer and a digital home theatre system. It's the first to be able to handle interactive 3D graphics, Java, MPEG video, hi-fi audio, internet access, electronic commerce and broadband networking in a single unit.

Blackbird is based on a combination of the strengths of Motorola's PowerPC processor and communications capabilities with its ProjectX media architecture. Typical consumer products could sell for between \$300-\$700 (£175-£410).

On show at Live '98

The Live '98 public consumer electronics exhibition was held at Earls Court at the end of September. Several companies had planned to demonstrate digital terrestrial TV live, but poor signal conditions in the exhibition hall led to either cancellations or inferior results. There were nevertheless plenty of digital TV receivers and set-top boxes on display.

Philips introduced two widescreen receivers that incorporate decoders for terrestrial digital TV, the 28in. Model 28DW6734 and 32in. Model 32DW6834. The photograph below shows the 28in. model. Both models incorporate a Dolby Pro-Logic decoder – the 32in. model uses FM links to wireless speakers for the rear surround channels. The sets will receive the free digital TV channels and can be upgraded for ONdigital's

pay channels. Philips is discussing with SkyDigital how the sets can be configured for reception of digital satellite TV. There will also be terrestrial and satellite digital TV set-top boxes from Philips.

Sony is to market two digital TV sets under the Wega brand name, Models KV28DS60 (28in.) and KV32DS60 (32in.). They include 100Hz scanning, a Dolby Pro-Logic decoder and SmartLink. The digital reception arrangements are the same as with the Philips models mentioned above. Sony also has a set-top box, Model VTXD500U, for digital terrestrial TV.

showed Nokia the new Mediamaster Model 9800S, which is designed to receive digital TV channels from a number of satellites. It incorporates Satscan software, has an electronic programme guide (EPG) with a 256-colour menu, and can store up to 2,000 channels. The Nokia Mediamaster Model 9850T designed for digital terrestrial TV. It includes a CI (Common Interface) slot and a built-in modem, and can handle data rates up to 15Mbits/sec. Nokia has been testing this receiver around the country to enable its software and hardware to be fine tuned. A vehicle was built for the tests, which were carried out in conjunction with Castle **BBC** Transmissions, the ONdigital. There were tests of both 16:9 and 4:3 signals, and a sophisticated hi-fi system was used to monitor sound reception. Canal Plus, which is responsible for the DTT EPG, used the vehicle to test its system.

Several companies showed flatscreen TV sets. Sharp had on display a set with a prototype PALC (Plasma Addressed Liquid Crystal) screen that was 112cm wide, 76cm high and just 20cm thick. The Philips Model 42PW9982C features 100Hz technology and a 13-speaker Dolby Pro-Logic sound system. Pioneer was showing its 50in. plasma display panel, Model PDP501MX – see page 7.

Sony launched its first portable DVD player, the DVD Discman Model DVPS715. It can handle DVD Video, Video CD and audio CD discs. Power can be mains derived or from a lithium-ion camcorder battery. Other features include PAL/NTSC playback and S Video and composite video sockets, enabling it to be connected to most TV sets and many computer monitors. Pioneer showed a new DVD player, Model DV717.

Panasonic launched its first DV VCR, Model NVDV1000, which has 16-bit digital audio with 32, 44·1 or 48kHz sampling, also a 12-bit, four-channel mode with 32kHz sampling. Connections include iLink, RS232 serial data and a 5-pin editing terminal. Editing includes video insert, audio dubbing and timing control.

Sharp showed a prototype hi-fi system with a DAB tuner.

The Philips Model 28DW6734 widescreen IDTV receiver.



Digital TV News

CWC has launched a low-cost cable pay-TV service that includes a telephone line and a basic channel package. It will be upgraded to digital free of charge and will cost £9.99 a month. NTL is to offer DTT and digital cable viewers an interactive, internet-based service that includes home shopping, banking and information.

SkyDigital has dropped two features from its electronic programme guide because of software problems. Favourite Programmes, which lets viewers create a list of favourite channels, and Personal Planner, which reminds viewers when a favourite programme is about to start, have been removed from the first version of the EPG but are expected to become available at a later date.

The DVB steering board has chosen Java as the standard programming language for the next generation of set-top boxes. A number of systems, including Open TV, MHEG and Mediahighway, were considered. Microsoft's Windows CE was not submitted for consideration. The board would like to see the development of plug-ins to enable other

systems to run on top of Java.

The ITC has warned digital TV broadcasters that the new services could suffer if customers find their campaigns confusing. It had also been trying to ensure full interoperability between DTT and digital satellite TV, but has been told by the government that its plans were too ambitious. The government seems to consider that interoperability should be a long-rather than a short-term goal. As a result the ITC has ruled that TV sets can be designed for specific services, but wants them to have a common interface slot.

Internet News

Dixons has become an internet service provider, offering customers free access to the network apart from the usual telephone charges at the local rate. The Dixons service is called Freeserve and in addition includes a news service provided by the Press Association, e-mail addresses and 5MB of space to set up your own web site. The aim is to increase the number of internet users in the UK and thus sales of PCs, modems etc. At present about five per cent of householders use the internet though 20 per cent have a PC.

British Interactive Broadcasting has dropped plans to offer limited internet access as part of its interactive satellite TV service. The company wants to emphasise that its service is an alternative to the internet for TV viewers.

Direct Memory International is marketing the WebPal internet box. Designed by NewCom Inc., the box incorporates a world wide web browser and an e-mail service, using a TV set or VGA monitor for the display. There are outputs for S video, composite video or VGA monitor connection. A built-in 33-6kbits/sec modem provides the telephone line internet link. The WebPal comes with a remote control unit, and a remote keypad is available as an optional extra. For further details apply to Direct Memory Intenational, Strand House, Main Street, Cork, Ireland. From the UK phone 00 353 21 841 222, fax 00 353 21 842 232. In Ireland it's 021 etc. The e-mail address is sales@dmil.ie

Servicing Qualifications
An agreement between the Electronics Examination Board and City &

An agreement between the Electronics Examination Board and City & Guilds has established a new Progression Award in electrical and electronics servicing. The award, which will eventually supersede the present Course 2240, provides 'underpinning' knowledge for the sector's National Vocational Qualification (NVQ). C&G will oversee the written examinations while the EEB will administer and assess the practical side. Colleges and training centres are expected to start switching to the new system in September 1999.

An agreement signed last year established C&G and the EEB as joint Awarding Body partners for the Electrical and Electronics Servicing NVQ.

Ross becomes Recoton

Ross Consumer Products is to move from Bolton to Walkden, Manchester and will in future be known as Recoton UK – Recoton is the name of its US parent company. The new address is Recoton UK, Towngate Business Centre, Lester Road, Walkden, Manchester M38 OPT, phone 0161 702 5000, fax 0161 702 5001, e-mail

info@rosscp.com

Recoton is a major electrical accessory company with over twenty consumer brands. These include Acoustic Research (computer accessories) and Jensen (automobile and home audio products).

Free Advice

The advent of digital transmissions has prompted the BBC to revise its arrangements for providing technical information. A new reception advice service is available from 8 a.m. to 7 p.m. Monday-Friday on 0870 010 0123.

Granada has set up a service to answer queries relating to digital TV. The number to call is 0800 056 2772.



CPC has released its latest catalogue, dated 1999.
Over 72,000 products are listed in the 2,216 pages
– the range includes electronic, electrical and mechanical spares and accessories. Aiwa, Philips, Sony and TDK are amongst the leading brands represented.
Over 10,000 new products have been added.

Thousands of new cross-references have been added to the video heads and spares range, while layout improvements include a new calculator/watch battery chart with additional equivalents and a camcorder battery table with model and battery type cross-references. Various product ranges such as laboratory equipment, white goods and plumbing, have been removed from the main catalogue to their own separate brochures.

The new catalogue is available to CPC account holders free of charge. To open an account, phone 01772 654 455 or go to CPC's web site at www.cpc.co.uk

There is also a comprehensive, pocket-sized cross-reference remote control booklet that lists over 10,000 models. It includes both manufacturers' original and compatible remote control units. Copies can be obtained free of charge – quote order code SURE-MOTE.

CPC has reached an exclusive distribution agreement with Akura. Over 5,000 spare parts for the full range of Akura products will be stocked. As with all original manufacturers' spares, CPC is offering a Partfinder service to enable customers to check prices and availability without having to quote a part number – the make, model and a brief description enable the item to be identified.



Labgear has restyled its range of MultiSet signal boosters and has introduced new packaging to make clear to customers the uses and benefits of a signal booster. The 1-way booster has been renamed Handyboost while the 2-, 3- and 4-way signal booster-distributors are now named Handylink 2, 3 and 4.

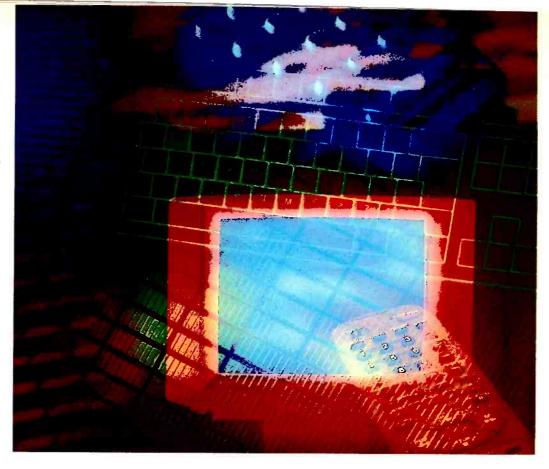
For further details of Labgear products phone 01223 366 521 or fax 01223 316 483.

STBs that Record?

It has been suggested that the next step in the development of digital set-top box technology will be to add a record facility. By incorporating a computer hard disc system, several hours of programmes could be stored for subsequent viewing. As the cost of hard disc storage is falling rapidly, this is a prospect that could well be realised within the next couple of years or so.

What will be involved when digital set-top boxes and integrated digital TV receivers start to come your way?

K.F. Ibrahim* provides an introductory guide based on the technology in current use



introduction to

Digital TV Servicing

Ithough we talk about digital TV, the signal picked up by an LNB (assuming a satellite transmission) is an analogue one. It consists of I (In-phase) and Q (Quadrature) modulated carriers. This is the signal handled by the tuner, which in addition to producing the IF signal incorporates synchronous demodulators to provide analogue I and Q outputs. See Fig. 1. These signals have to be converted to digital form before they can be passed to the digital processing and decoding section of the receiver. Hence the dual ADC shown between the tuner and the digital processing section. The final outputs, whether in UHF, composite video or RGB form, or multichannel sound, are of course again in analogue form.

Thus a digital TV receiver/decoder can, for the purposes of servicing, be looked at as consisting of separate analogue and digital sections. The analogue parts comprise the tuner at the front end and the PAL encoding and UHF modulator (if required) sections at the back end. The digital parts consist of the digital processing and decoding that's carried out in between, the software programming and control section, and the ADC and DAC converters.

Fault-finding in digital set-top boxes and integrated digital TV receivers will follow fairly conventional practice—the use of a logic probe and/or oscilloscope to check data, address and control signal paths, and the use of a meter and oscilloscope to check the conditions at the pins of the various ICs used.

Signal Tracing

Tracing the path of the signal is a logical way of locating a faulty stage. It involves checking both analogue signals and digital data streams at relevant points through the decoder/receiver. The absence of a signal such as the I or Q modulation or a data stream will result in total failure of the picture, sound or both. Partial failure, such as a single data or address line fault, may result in total or intermittent picture loss, a broken up picture, loss of or distorted sound or both.

A logic probe can be used to check the presence of digital bit streams. It's a logic-state test instrument that indicates the logic state at the test point selected. Indication is given of logic 1 (high), logic 0 (low), an open-circuit condition or the presence of a data stream.

Two indicator LEDs indicate high or low. If there's an open-circuit or an indeterminate logic state, you get no illumination from the LEDs. The presence of digital activity (a bit stream) is shown by flickering LEDs or a special indicator. Use of a pulse stretcher will enable pulses as narrow as 10nsec to be detected.

Although a logic probe doesn't enable waveforms to be examined, it nevertheless provides a fast and simple method of checking for digital activity. When you need to examine real-time waveforms, an oscilloscope has to be used.

An oscilloscope will display analogue and digital waveforms, enabling amplitude, frequency and time measurements to be made. The analogue signals in a digital TV receiver are not dissimilar to those in an analogue receiver, and can be displayed by a normal analogue oscilloscope that has adequate bandwidth. To examine data bit streams however a digital storage oscilloscope with a minimum bandwidth of 100MHz and a sampling rate of 500 million per second or over is required. It can also be used to display and examine analogue signals.

*K.F. Ibrahim is a Senior
Lecturer at the College of North West London.
This article is an edited extract from the forthcoming second edition of Mr Ibrahim's book Television Receivers, published by Longman.

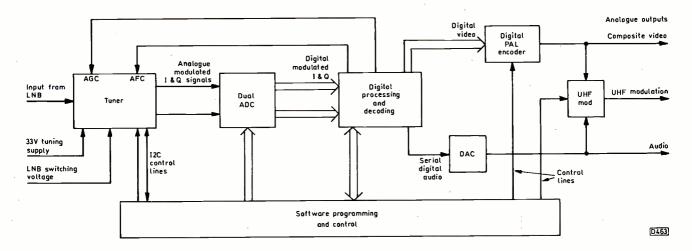


Fig. 1: Simplified block diagram of a digital satellite TV decoder, to show the analogue and digital sections. A digital terrestrial TV decoder follows the same lines, the main difference being in the form of the received modulation – QPSK with a satellite transmission, COFDM with a terrestrial transmission – and hence the type of digital decoder required.

A storage oscilloscope captures part of the data bit stream, stores it and then displays the waveform on its screen for examination and measurement. This is repeated for another part of the data stream and so on. Unlike analogue circuitry, in which a test point will have its own unique signal in terms of waveshape, frequency and amplitude, the sequence of ones and zeros in a data stream has the same general waveshape and amplitude regardless of its location in the overall circuit.

Timing and Control

In a microprocessor-based system, failure can occur because of wrong or missing clock signals or incorrect timing of data and control signals. A timing/synchronisation fault can result in partial or total failure of the system.

A multi-trace oscilloscope enables the timing and synchronisation of several data and control bit streams to be checked by displaying two or more data streams simultaneously. A typical multi-trace display, showing the time relationship between the chip select (CS) and output enable (OE) control signals, a data line and the clock input to a memory chip, is shown in Fig. 2.

Checking a Suspect Chip

The absence of an output from a digital signal processing chip does not necessarily mean that the chip is faulty. In microprocessor controlled and based systems, the absence of an IC output could be the result of one of several factors. Clock pulses could be missing; a control signal could be missing or incorrect; there could be a software routine problem; errors could be present on data or address lines; an associated memory chip could be faulty; a reset state could be incorrect; and of course a DC supply could be low or missing.

In general, before a suspect IC is replaced the following should be checked:

- (1) That the IC is receiving its DC supply voltage at the relevant pins. If not, trace the supply back to source to find out where it goes missing. There could be a shorted decoupling capacitor, a dry-joint, a print crack, an open-circuit filter coil, an open-circuit feed resistor or switching transistor or a fault at the regulated source.
- (2) That the chip is operating at the correct clock frequency. Use an oscilloscope to check the clock pulses. A counter will check their frequency. Where the chip has

more than one clock input, they must all be checked.

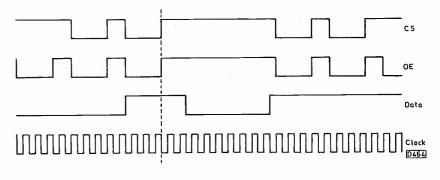
- (3) That the chip is receiving the correct instructions from the microprocessor or microcontroller chip or both. This involves checking control signals and data and address lines.
- (4) That the software in use is valid and up-to-date.

The DC checks can be carried out using a digital voltmeter (DVM) to measure the voltage at the relevant pins of the chip. The clock signal can be checked using an oscilloscope with an adequate frequency response. The clock pulses must have:

- (1) A fast-rising square shape.
- (2) An amplitude of between 3.5-5.25V, nominally around 4.8V (assuming operation with a 5V supply).
- (3) The correct frequency, which can be calculated from the periodic time of the waveform.

The control lines can be checked by using a logic probe to test for digital activity or a storage oscilloscope to examine the waveforms of the various signals, such as chip select (CS), acknowledge (ACK), read/write (W/R), strobe (STR) and interrupt request (IRQ). Use a logic probe or DVM to check the reset (RST) line. It's normally active low, i.e. when taken low it resets the chip, after which it goes high. Thus an active-low reset line should normally be high. The data and address lines can be checked for digital activity using a logic probe or an oscilloscope.

Fig. 2: A multitrace oscilloscope enables the timing and synchronisation of various data and control bit streams to be checked. The pulse streams shown here relate to a typical memory chip.



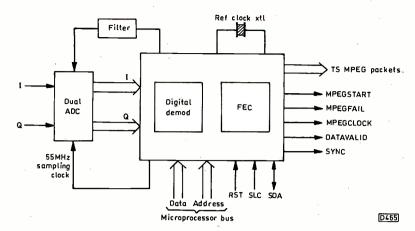


Fig. 3: Block diagram of the channel decoder section of the receiver, incorporating the digital demodulator and FEC.

Software

Faulty software, i.e. out-of-date, deleted or corrupted, may interrupt a data stream. Software processing routines are usually stored in a flash memory chip. Rewriting or upgrading can be carried out by using a PC linked to the receiver via an RS232 port – the PC loads new software in the flash memory. The alternative is to replace the flash memory with a newly programmed one.

Checking the Tuner

The tuner carries out the usual functions, i.e. frequency conversion, amplification and filtering, plus synchronous demodulation of the input to produce analogue IF outputs that carry the digital modulation. Synchronous demodulation is similar to the demodulation of the chroma signal in a PAL decoder. The local oscillator is controlled by an AFC voltage that's obtained from the subsequent digital demodulator. Fig. 1 shows the basic inputs and outputs.

When the tuner switches on it attempts to lock to a default known as the 'home channel'. If it fails to do so, a search sawtooth waveform appears at the AFC input pin. At the same time the AGC input produces maximum tuner gain. A DVM can be used to check the LNB supply/switching voltage.

Checking the Channel Decoder

This is the section that follows the dual ADC, see Fig. 3. The signal inputs consist of the digital I and Q QPSK (Quadrature Phase Shift Keyed) carriers in the case of a

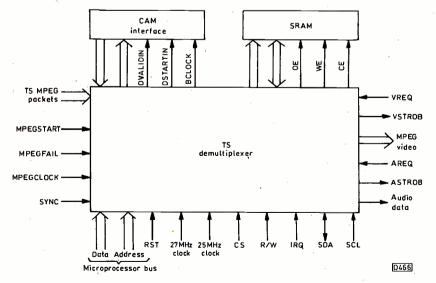


Fig. 4: Block diagram of the transport stream demultiplexer section of the receiver. The demultiplexer sorts out the transmitted MPEG data packets, selecting the ones required for the programme being received.

satellite transmission or, in the case of a terrestrial transmission, the band of I and Q COFDM (Coded Orthogonal Frequency Division Multiplex) carriers.

The function of this section of the receiver is to convert the incoming carriers to a digital data stream known as the transport stream, i.e. digital demodulation, and to carry out forward error correction (FEC). The former operation is carried out by a QPSK or COFDM processor chip. Forward error correction compensates for errors in the received signal.

The general procedure for testing data processing/decoding chips is to check:

- (1) The input and output data streams.
- (2) The processing and other clock signals.
- (3) The microprocessor control and communication signals.
- (4) Any memory data/address bus and control signals.

To test the channel decoder section of the receiver, check the output data lines that provide the transport data stream (TS) one by one for digital activity, using a logic probe or an oscilloscope. The transport stream consists of packets of MPEG data (compressed video and audio).

The sampling clock output to the dual ADC is normally set at twice the symbol (modulation) rate. With a symbol rate of 27.5Msymbols per second, the sampling clock will run at 55MHz. This clock pulse stream should be present even when there is no input to the receiver.

If there are no transport data signal outputs, check the I and Q inputs, the operation of the sample and reference clocks, then the control signals and the microprocessor data and address communication buses. Some of the control signals and their characteristics are as follows:

MPEGSTART output: Goes high for the first byte of each transport stream MPEG data packet.

MPEGFAIL output: Goes low if the packet contains errors (despite the FEC).

DATAVALID output: Goes high for the 188 bytes of the packet and low for the following 16 checksum bytes.

SYNC output: Goes high when the data synchronisation is correct.

RST (reset) input: This is normally high if 'active low' (to reset) and vice versa.

SCL: The I²C control line clock pulse input.

SDA: The I²C data line.

Checking the TS Demultiplexer

The inputs to the transport stream demultiplexer chip, see Fig. 4, include the MPEG data packets and the MPEGSTART, MPEGFAIL and MPEGCLOCK signals from the channel decoder. Its function is to sort out the MPEG data packets as required, reassembling the video and audio packets for the selected programme in the correct order. The packets are then passed to the MPEG video and audio decoders.

If any video or audio output data line is inactive, check the control inputs from the channel decoder then the 25MHz demultiplexer and the 27MHz pixel system clocks. If a clock signal is missing, check back to source. The conditional access module (CAM) is connected to this section of the receiver. To test it, check the input and output data streams to and from the CAM interface, first with an encrypted programme then with a 'free' (unencrypted) programme. The CAM control signals should also be checked, using a logic probe or an oscilloscope. These are as follows:

BCLOCK (byte clock): Provides the delay required to unscramble data.

DSTARTIN: Goes high for the first byte of a data packet

DVALIDIN: Goes high when the data is free of errors.

Check the demultiplexer control lines for digital activity – CS (chip select), R/W (read/write), IRQ (interrupt request), RST (reset), SCL (I²C bus clock) and SDA (I²C bus data). These lines are only occasionally active of course.

Absence of video data output could be the result of a faulty VSTROB (video strobe) output or a faulty VREQ (video request) input from the MPEG video decoder. Data transfer between the demultiplexer chip and the MPEG video decoder chip occurs only when the latter activates VREQ to indicate its readiness to receive data. The MPEG data is then strobed through by the VSTROB signal.

Similarly for the audio output, which is a serial data line. In this case the MPEG audio decoder activates AREQ and the data is strobed by ASTROB.

The associated SRAM memory chip can be tested by checking for digital activity on its data and address lines and the read/output enable (OE) and write enable (WE) control lines. The chip enable (CE) line, being active low, should normally be low. A faulty SRAM memory chip will result in total video and audio failure.

MPEG Video Decoding and Digital PAL Encoding

These sections of the receiver are shown in block diagram form in Fig. 5. The MPEG video decoder converts the received data packets into multiplexed luminance (Y), red chroma (CR) and blue chroma (CB) digital data. The input and output data streams can be checked using a logic probe to test for digital activity or an oscilloscope to display real-time waveforms.

Check the 27MHz pixel system clock and the decoder processing clock, then the two lines VREQ and VSTROB that control the transfer of data between the MPEG demultiplexer and decoder chips. Also check the microprocessor bus and control signals.

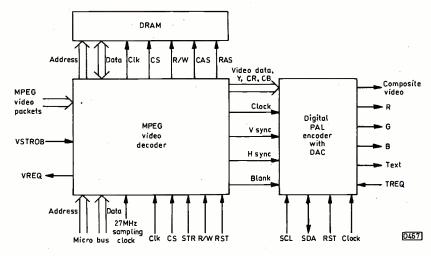
The associated DRAM chip can be tested by checking its data, address and control lines. A faulty DRAM chip will result in total video collapse. Partial memory failure, such as a single data or address line failure (open-circuit, permanently high or permanently low) could result in no picture or an intermittent or broken-up picture.

The video input to the PAL encoder chip is still in digital form. This chip converts the input to conventional analogue RGB and composite video outputs.

MPEG Audio Decoding

The MPEG audio decoder chip (see Fig. 6) receives serial PCM (Pulse Code Modulated) data from the demultiplexer chip and converts it to digital stereo left and right audio outputs. Two control signals, AREQ and ASTROB, regulate the transfer of the compressed data from the demultiplexer to the MPEG decoder chip.

The decoder is followed by a digital-to-analogue con-



verter which has sampling clock and audio data inputs. These can be checked by logic probe or oscilloscope as previously outlined. A simple analogue oscilloscope can be used to check the outputs.

The decoder chip has an associated DRAM chip which can be tested in the normal way. A faulty audio memory chip will normally cause loss of the audio signals. Partial faults cause loss of sound sync or intermittent or broken-up sound.

Fig. 5: Block diagram of the MPEG video decoder and digital PAL encoder sections of the receiver.

Start-up Sequence

A set-top box is normally never switched off: it remains in the standby mode when not in use. Its microprocessor, microcontroller and the processing chips remain set and ready to receive and process data.

When a receiver/decoder is switched on from cold however it goes through a comparatively lengthy process of setting, initialising, configuring and programming the control and signal processing chips. This involves the downloading of software routines from a flash memory chip to the microprocessor, DRAM memory and other chips. The process is known as the start-up or boot-up sequence.

The main stages of the start-up sequence are as follows:

- (1) The power supply voltages build up to the operating levels.
- (2) The microprocessor and microcontroller chips are set by taking their respective RST pins to 5V.
- (3) The other processing chips are set in the same way.

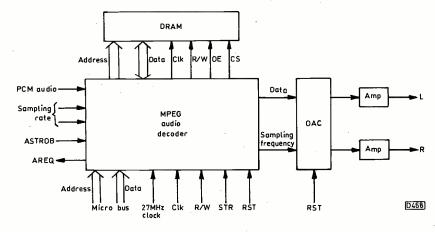
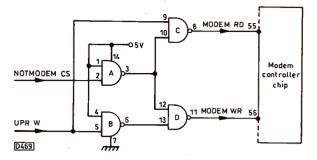


Fig. 6: Block diagram of the MPEG audio decoder and DAC sections of the receiver.

Fig. 7: A simple logic circuit, with four NAND gates, used for pulse steering. See testing logic devices.



- (4) Software is downloaded in two stages. The first relates to the microprocessor and microcontroller chips, with digital activity present on the micro bus and control lines only. The second stage involves initialising and programming the channel decoder, the transport signal demultiplexer and the MPEG video and audio decoder chips.
- (5) The sampling frequency generated by the digital demodulator is set.
- (6) The channel decoder begins to search for the default channel, known as the home channel. If a signal is detected, the channel decoder locks to it and data is received, processed and decoded. Picture and sound are then produced.

If the home channel cannot be detected, the channel decoder searches for other default channels. Failure to lock to any incoming signal is indicated by a "no signal" message on the screen.

The start-up process, which takes up to two minutes to complete, is made known to the user by means of coded

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symbols on the receiver's LED display and messages on the screen.

Testing Logic Devices

Digital TV receivers incorporate a large variety of logic devices such as gates, flip-flops, counters and inverters. These can be checked for stuck-at faults (stuck at one when a pin is shorted to the supply line, or stuck at zero when a pin is shorted to chassis) and open-circuit faults. Such faults are usually caused by a failure within the IC. Stuck-at and open-circuit faults can be detected by using a logic pulser in conjunction with a logic probe.

The logic pulser will change the logic state at an IC or test point then change it back again, i.e. it drives a low pin high then low and a high pin low then high. Testing a logic device such as a gate consists of using the pulser to alter the conditions at an input pin and checking the

effect at the output with the logic probe.

Consider for example the simple steering network shown in Fig. 7. It's used in a Pace receiver-decoder to set the read (RD) and write (WR) control signals fed to the modem controller chip. A 7400 quad NAND chip is used to provide the steering. Gate A can be checked by placing the pulser at pin 2 and using a logic probe to monitor the output at pin 3. Since the other input (pin 1) is at 5V, changing the state at pin 2 should result in a change at the output pin indicated by a flicker on the probe. No probe indication suggests a fault in the circuitry connected to pin 2, pin 3, pin 10 or pin 12. Repeat the process at the other gates until the source of the stuck-at fault (if one is present) is found. It can be confirmed by placing both the pulser and probe on the suspect pin. The diagnosis is confirmed if pulser operation doesn't result in a flicker from the probe.

Once an IC pin is identified as being stuck at zero or one, the cause of the short-circuit to earth or the DC supply voltage respectively must be established. If pin 8 (Fig. 7) of the chip is found to be stuck at zero for example, either this pin or pin 55 of the following modern controller chip is shorted to chassis. Identifying where the fault lies can be done by checking with a very sensitive ohmmeter or by using a current tracer in conjunction

with a pulser.

A current tracer senses the magnetic field created by a flow of fast-rising pulses, giving an indication of their presence by means of an indicator light or a constant-tone sound. The power must be switched off when a current tracer is being used. Place the pulser at one of the suspect pins, say pin 8. If the short-circuit is at pin 55 of the modem control chip, pulses from the pulser will flow from pin 8 to pin 55. The tracer will detect the presence of the current at pin 55. If the short-circuit was at pin 8 however there would be no current pulses at pin 55.

In Conclusion

The chip function divisions assumed in this article relate to the current generation of digital TV processing chips. It's likely that increasing numbers of functions will be integrated into fewer chips as the technology develops. See for example the article on pages 698-701 of the August issue of *Television*.

So there we are, for the moment anyway. Good hunting!

For course information on digital television servicing see advertisement on page 74 of this issue.

30% discount for *Television* readers on two hand-held multimeters

Vann Draper is offering over 30% discount to readers of *Television* on two professional-quality hand-held multimeters. The MX450 normally sells at £41.13 and is available to readers at only £29 inc vat and delivery.

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Frequency (LP310) 2k, 20k, 200k, 2M, 20MHz auto range

Features of the MX450

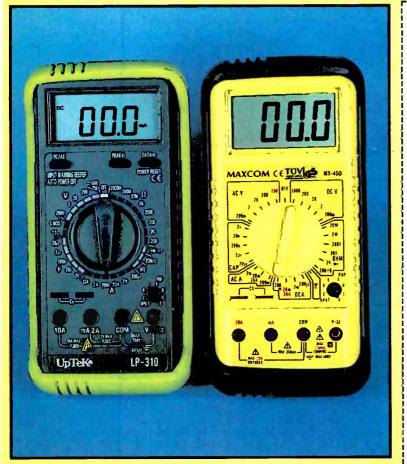
3.5-digit, 30-range dmm
AC & DC volts
AC & DC current to 20A
Resistance & capacitance
Diode, continuity & transistor tests
Overload protection

Protective rubber holster

Features of the LP310

3.5 digit 44-range dmm
AC & DC volts
AC & DC current to 10A
Resistance & capacitance
Diode, continuity & transistor tests
Frequency to 20MHz
Logic test
Overload protection
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Test Report

New soldering equipment is required to deal with digital circuitry on high-density PCBs. Steve Beeching tries out an advanced system designed to meet the need and also cope with standard soldering requirements

The JBC Advanced So



Advanced Soldering Station

t the RETRA Servicing Conference in Solihull last summer I gave a live demonstration of surfacemounted IC removed. While many of my poors inhibiting solder (upting) or too social with the result that

summer I gave a live demonstration of surface-mounted IC removal. While many of my peers probably thought this a little foolhardy, I was confident that the job could be done with little difficulty – because of the excellent performance of the soldering/desoldering equipment I would be using. The most up-to-date soldering and desoldering equipment was on show and being demonstrated in the foyer of the hotel where the conference was held. Amongst the equipment there was a new soldering station.

The JBC Advanced soldering station is a third-generation design whose soldering iron uses a new temperature-control system. A single, 50W maximum power unit provides heating for one or other of two types of soldering pencil. One is rated at 10W and has a selection of small tips. The other is rated at 40W and comes with a selection of slightly larger-sized tips. Both are lightweight, the 10W iron weighing 15g while the 40W weighs 25g. But there's more to it than that!

Tip Heating

With the advent of digital technology arranged on very high density PCBs, component removal and replacement presents an accessibility problem. The need is for a very small tip, in the region of 0·2-0·4mm, conical or chisel shaped. If a large, tapered tip that's heated from the rear is used, see Fig. 1(a), there will be heat loss throughout the length of the tip, with inadequate temperature control at the sharp end.

Solder reflow depends on the thermal mass of the tip to provide enough heat. When a tip relies on thermal conduction through its mass, this must be reasonably large if adequate heat is to be generated. It is difficult getting adequate heat conduction to the tip when there's a long taper that ends in a very small tip. As the taper narrows to 0.3mm or so, the cross-section through which the heat travels is reduced. This restricts thermal flow.

If the soldering job consists of a component lead that's connected to a large print land, or a very small component connector with metal tags, it's difficult to maintain the reflow temperature. As the end of the tip cools, because of thermal loading, heat replenishment is required. But with the small cross-section, insufficient heat is delivered to the end. At best you get a 'cold' joint of semi-crystalised solder; at worst the iron may adhere to the PCB as the tip rapidly

cools. There's a trade-off with the temperature setting: either too hot, with the result that burning tarnishes the tip, inhibiting solder 'wetting'; or too cool with the result that the solder at the joint doesn't reflow. You can get round the problem by applying additional liquid flux and having a very small reservoir of solder on the tip, but this calls for experience and skill.

Burning much reduces tip life when an iron is left powered during idle periods – the heat then has plenty of time to travel to the end of the tip. This means high tip costs. The iron can obviously be switched off when not in use, but switching off can be very frustrating for a technician who wants to complete a quick resolder. The reheat time may be 90 seconds – even a minute can seem a long time!

The solution adopted by JBC is to use the tip itself as the heater element, see Fig. 1(b). Tip design can then be tailored to control the heat directly, where and in the quantity required.

A demonstration of the high power that can be provided in this way by a small tip was given by Willow Vale Electronics: a 2p coin was heated and solder was flowed on to it. This is made possible by tight control of the power delivery and thermal flow.

When Darron and I saw this we realised that the JBC Advanced soldering station promises the sort of performance required for delicate work on the tiny circuits used in digital camcorders. The tip also takes just two seconds to reach its working temperature, which can be closely controlled to within a few degrees during constant use. We tested the equipment by soldering tiny connectors on digital PCBs. In the photo opposite the elbowed tip's diameter is 0.3mm and the ruler markings are 0.5mm – this sort of work is always carried out using a binocular microscope.

JBC Model AD2000

Use of the JBC Advanced tip, which incorporates the heater and temperature sensor, enables the heat to be delivered exactly where and as required. The tip heating time has been improved from around 90 seconds to two (see Fig. 2). There is also improved tip temperature control while in use (see Fig. 3). And by delivering the heat directly to the tip, the working temperature can be reduced. Whereas a rear-heated tip power unit would be set to 350/400°C, the JBC unit

Our heading photo shows the JBC AD2000 Advanced soldering station. can be set to just over 300°C for the same task using an 0.3mm tip.

A further advantage, for tip life, is the intelligent soldering iron stand. When the soldering pencil is docked in the stand its presence is sensed and the tip temperature is reduced to about 120°C. This prevents tarnishing and burning of the fine tips, extending their life.

Part of the stand is used for tip changing. The tip is placed in the extractor's V-shaped grove and the pencil-type holder is retracted, leaving the tip. In this position, power is removed. The holder can then be moved to an adjacent tip and pushed on. When the soldering pencil is moved away from this position, power is restored and the new tip quickly heats up. The pencil can be docked in the tip extractor position to 'power off'.

Use

In use I found that there was a very short but noticeable delay when alternately picking up and putting down the soldering pencil. I had to solder some small cables to a connector: each cable had to be positioned then soldered. Although the pencil heats up in two seconds, there was a noticeable 'pause' between picking it up and soldering the cable. It was a very short pause, in fact less than a second. With a continuously heated tip you would dock, use, dock, use, dock, use etc. With the JBC pencil it's a case of dock, pause, use, dock, pause, use etc. This is not a criticism, just something you notice.

For continuous soldering of a through-hole IC there was plenty of heat capacity from joint to joint, with no delay. This despite the fact that the tip is very small, too small for the job by normal standards.

The soldering pencils are well suited to continuous use and occasional use, with their quick heat-up time and enough heat capacity for tuner case lugs. The close temperature control means that the pencils are ideal for high-density PCBs with small, surface-mounted ICs.

Dry-joints at the tiny IC connectors in digital camcorders were resoldered more easily than with a conventional tip, and the heat at the end of a microfine tip will deal with metal tags. A 168 PQFP IC with three legs per mm was successfully removed and a replacement soldered to the PCB. Legto-leg soldering with 0.3mm solder was improved. Where space is tight, we found that the legs can be fluxed and solder then applied, using the tip as a reservoir. I was able to wipe solder two-three legs at a time using the tip as a reservoir

JBC Tips

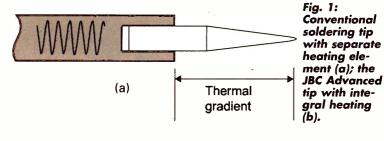
The sizes of the JBC Advanced tips range from 0·3-2·3mm for the 10W pencil, with straight or elbow versions. The smaller tips are not available for the 40W pencil, the sizes ranging from 1-4·8mm. There are two special tips for the 40W pencil, a straight spoon and an elbow spoon: spoon refers to a hollow tip indentation that acts as a reservoir for solder when wipe-soldering the legs of QPF and PLCC ICs.

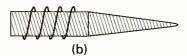
Summary

The advantages of the JBC Advanced Soldering Station are: lower tip temperature; reduced tip burning; longer tip life; improved 'wetting'; less heat reduction from components or the PCB acting as a heatsink. The single power unit will drive either a 10W or 40W soldering pencil.

The system is available from Willow Vale Electronics Ltd., 11 Arkwright Road, Reading, Berks RG2 0LU. Phone no. 01189 876 444, fax 01189 867 188. System AD2000 is available under order code 23800AS at £157. This includes a 10W pencil and two tips.

The 10W pencil type AD2010 is available separately under order code 23800AQ at £29; the 40W pencil type AD2045 is available under order code 23800AR at £36.





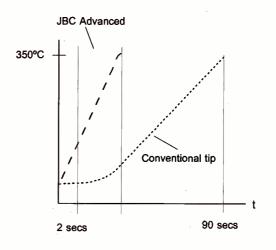


Fig. 2:
Comparison of the heat/time characteristics of a JBC
Advanced tip and a conventional soldering tip.

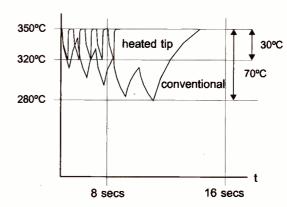
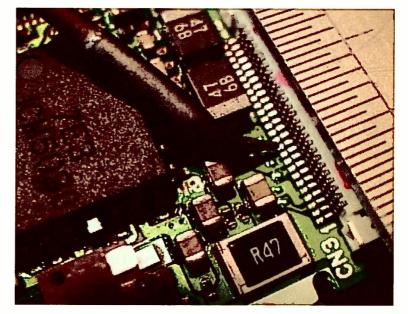
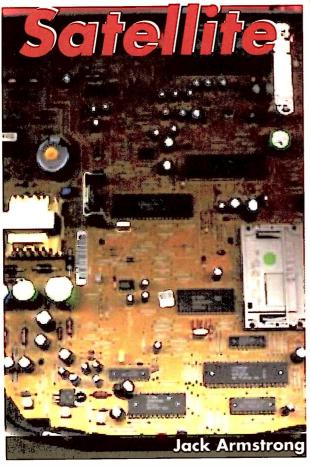


Fig. 3: Comparison of the heat control at the tip with a JBC Advanced and a conventionaltype tip.

Below: Use of an 0.3mm tip with elbow to reflow the soldered connections to a small surface-mounted chip.





Amstrad SRD400

Why do public houses have the oldest systems? Maybe because the Amstrad SRD400 has proved to be a reliable workhorse and publicans know how to be careful with money! Bert Wetherill, who runs the Horse and Hounds, is no stranger to thrift.

"It won't cost more than a tenner?" he said forcefully, "'cause I can get another at the car boot sale on Saturday. Only it would be real nice to have it back for the match tonight. Plus, you don't want the price of your pint to rise, do you?"

He didn't smile either. So I decided to get on with the repair immediately!

The problem seemed to be a low LNB supply. My meter showed that it switched between 10.6V and 13.4V. Of course I wasted half an hour messing with the regulator circuit before I realised that there was a dry (corroded) joint on the big 4,700µF reservoir capacitor. If I'd plugged the TV monitor in I'd have seen the hum bars immediately – but I'm far too clever for that! I had to measure voltages first and confuse myself by assuming that I was measuring smooth DC. I've known other

Workshop

competent repairmen be caught out by supposedly 'low secondary voltages' from power supplies. I always recommend using an oscilloscope to check the outputs from the power supply, since it will show instantly whether a voltage is smooth or has sawtooth spikes on it. One day I'll take my own advice.

Once this had been put right another problem was evident: although the channel number changed when I pressed the 'up' button, the picture didn't. It alternated between just two programmes – one each for horizontal and vertical polarisation. Measurement showed that the tuning voltage was low at only 3V. Replacement of TP504 (2SK301) and IP504 (AN431) cured the problem.

Flashing Lights

"The power went off and now the red light is flashing. I'm afraid to turn it on in case it goes bang!"

Now Jimmy is a timid person at the best of times. He's been a gardener all his life and still prefers gas mantles to electric lights, so his fear was understandable. All modern Grundig-based receivers and BT receivers flash an LED when first connected however. They do this simply to remind you to set the internal clock, in case you decide to use the timer function to record a programme. Even the old Amstrad SRD510 flashes its lights after a power cut if the timer had been set. It never ceases to amaze me how many dealers phone me about this type of "fault". Am I the only person in the world who reads user

I stuck a piece of black tape over the offending LED and handed the receiver back to Jimmy. He doesn't own a VCR, so he won't be setting the timer.

"Thanks, Mr Armstrong. I'll cut your grass, shall I?"

Grundig GRD150

These Grundig receivers apparently had an incredibly low failure rate during the warranty period. They are making up for it now!

When Derek, a local installer, brought me a GRD150 and described the fault as "horizontal line on picture" I wondered whether he meant a hum bar and plugged the

mains lead in at arm's length.

A horrendous buzzing noise came from the power supply, so I pulled the plug out quickly. I didn't need a magnifying glass to see that C201 (47µF, 400V) was bulging.

"Wow" Derek breathed, "it was giving quite good pictures before it cooled down. Just that line across and occasional scrambling. Is it repairable?"

I assured him that it was, and quickly replaced the offending capacitor with one I'd previously taken from a beyond-economicrepair Minerva. The result was perfect pictures and no more buzzing.

Derek paid up with good grace and drove off to fleece his customer.

Early Pace Receivers

A common problem with very old Pace receivers such as the SS9000IRD and its clones is that contact between the internal decoder connector and the main board pin connector can fail. The result can be faint decoder messages and intermittent operation. This is almost certainly the cause of the trouble if the decoder messages on the TV screen shift when the receiver is tapped. A quick but temporary fix is to spray a little WD40 on to the connector and work it up and down a few times. Do this with the receiver unplugged. But beware: an old Pace receiver may destroy its power supply when you plug it back in. The cause of this is degradation of the electrolytic capacitors in the power supply - as a result of heat over a number of years. For this reason it's best to deal with the problem in the workshop, and to replace the capacitors (you'll find them in Relkit 2 - phone 01270 753 311 for details) before the receiver is plugged in for test.

With these 60-channel models the decoder must be selected and stored in the channel menu for each scrambled channel – unlike later models, they don't recognise a scrambled channel automatically. So the symptom "no decoder messages on some channels" usually means that the factory reset sequence has been pressed or there has been a mains brown-out. Reprogram each channel to read "decoder INT" and "AV INT".

If you get a similar problem with

the later PRD and MSS series receivers, check whether the contrast value has been set at less than 4 in the installation menu.

I am often asked whether an enhanced LNB can be used. This shifts the frequency of all channels 250MHz higher to bring the Astra 1D channels within the tuner's range. If the receiver can be tuned high enough, it will receive all the available channels - but each channel will have to be individually tuned in 250MHz higher than its listed frequency. As 60-channel receivers won't tune high enough, most Astra 1B chanels will be lost. Most 90-channel receivers will tune high enough to obtain CNN International, but only a few make it as high as Sky Sports 3.

As a rule of thumb: 60-channel receivers won't tune high enough; 90-channel receivers might if they are fitted with the Hitachi BF9 tuner, not if they are fitted with the later Sharp tuner. If a replacement tuner kit has been fitted (this lies on its side) the tuning range will usual-

ly be adequate.

Early PRD receivers might tune high enough. In my experience they will definitely do so if a small modification is carried out beneath the tuner. A different microcontroller IC can be fitted to provide a menu

option for an enhanced or standard LNB. PRD receivers with this IC and all later models can be used with an enhanced LNB. Upgrade kits are available.

So the answer is to try the receiver with an enhanced LNB. If the receiver won't tune high enough, it might be possible to modify it in the workshop. If it will tune high enough, you can probably sell the customer a new LNB plus installation. Some owners will prefer this to buying a complete new system. Always ask if you can upgrade a receiver that's brought in for repair. The work is often so minor that it can be done at little extra cost.

If all else fails, you can use an enhanced LNB in conjunction with a Global ADX-Plus channel expander. This unit has an internal switch to select between shifting the frequency band up (standard LNB) or down (enhanced LNB) by 500MHz.

Pace PRD800

This unit arrived by carrier. I do contract work for a chain of public houses, and receivers often arrive unannounced! The VideoCrypt decoder message bars on screen were brilliant white, without any text, though the decoder worked perfectly.

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 replaced the decoder's graphics generator chip U27 (type TCE-VCT01), but this made no difference. A helpful young man at Pace told me that the decoder messages are added to the video signal in U19 (4053). I found that pin 1 of this chip was permanently high at 12V. The IC was faulty, a replacement restoring normal operation. Even the lads at Pace were surprised, as the fault had not been reported before.

By the way, if you use Pace's friendly help line and subsequently find the cause of your fault, please take the trouble to fax them back with details of the original symptoms and your cure. It helps everyone.

Test Case 431

Most of the repairs carried out in the Test Case workshop are for our rental customers. The rental sets are mostly basic models which are hired out at rock-bottom prices, often as a package with a VCR. Despite our low prices, the customers expect first-class service - and they get it. Loss of a rental contract is regarded as a major disaster. So when Mrs Harrison rang up to say that her set was displaying a greenish picture Doc Colin was dispatched pronto to put things right.

The set concerned was a Tatung Model T21TD60. It uses the D series chassis, a simple and straightforward design first introduced about five years ago. Colin found that the picture was very much on the yellowish-green side. He advanced the setting of the blue background potentiometer on the tube base panel, and reduced the green potentiometer's setting. This restored

good colour.

A week went by, the rain stopped, then Mrs Harrison was back on the phone. The picture was drifting towards yellow once

more - could we call again? Of course!

This time Doc Colin brought the set back to the workshop for attention, leaving a loan set in its place. Because of summer holidays, the workshop staff was rather depleted. So it was that the job came to be assigned to Cathode Ray. He hoped that another tweak of the presets would be all that was required, but despite the fact that the picture lacked blue content the blue background potentiometer RV927 was almost at maximum setting. The red control RV917 was at near centre while the green control RV937 was about two-thirds advanced.

Perhaps the tube's emission had fallen? A check with the

CRT tester/rejuvenator showed otherwise, so it was now time for some real diagnosis! Ray started by measuring the voltages at the tube's cathodes. He found that the blue voltage was higher than the others. That would account for the lack of blue. When Ray set all three background controls to their mid-points the display was even worse: the screen became very yellow, and the blue cathode voltage was way above that of the red and green cathodes. There's no point in quoting a reading here, because it depends on picture content: Ray was using the workshop test pattern. From this commendable start, the diagnostic process went steadily down hill . .

Ray interchanged the BF869 R and B output transistors. This made no difference to the symptom. He unsoldered the $4.7k\Omega$ background potentiometers and measured their resistance. They were all close to the correct value. Then he moved over to the main chassis, where the big TDA8361 jungle chip IC503 carries out colour decoding. He noticed that three BC547 transistors, TR301/2/3, are connected to its RGB outputs as buffers for the text and OSD signals. Could they be the cause of the problem? It didn't take long to disconnect their emitters from the board. It took even less time to see that this had no effect on the symptom. Ray reconnected the transistors and thought again.

He carried out scope checks at IC503's RGB output pins 20/19/18. With a colour-bar input the waveforms looked fine. There was a difference in their DC levels, but this didn't seem to be enough to cause such a large disparity between the blue display and the others. Was the IC to blame? Or had some other part failed? For the solution, turn to page 65.

Digital Satellite TV

Hugh Cocks on reception problems, upgrades and setting up for digital satellite TV

Nokia 9600 Software Upgrade

The Nokia 9600 digital receiver caters for both scrambled and unscrambled MPEG-2 DVB signals, but won't be able to decode the Sky Digital transmissions from 28.2°E unless an external conditional access module and card are made available by Sky (they are located inside the Sky digibox). As with most things in the digital and computer world these days, software upgrades that give the receiver more functions are available.

The current software version is CI (Common Interface) 2.3, though receivers often come with version 2.1 loaded. To confuse matters, version 2.2 was never officially released, though a Scandinavian customer of ours is convinced that his new 9600 at home is loaded with this software! The 9600 helpfully displays the version it has inside during the self-test procedure at switch on.

Improvements

The latest software version allows favourite channel editing, which was not available with version 2.1. The 4:3 and 16:9 picture dimensions change also works. If you have an internet connection facility, go to www.nokia.com where the link to the mediamaster pages will be found, or enter

www.nokia.com/products/multimedia/sw2info.html

The 9200 free-to-air only model (no conditional access module or card slot) also has an upgrade available, but I haven't a receiver to try it on. The upgrade is from FTA 1.0 to FTA 2.0 – the same internet page gives information on this model as well.

Table 1: Free-to-air services at 13°E.

Table 1. Tiec-to-dir scrylocs at 10 m.								
Service	Frequency	Polarisation						
RAI (Italy) Mediaset	11-804GHz	vertical						
(Italian commercial)	11-919GHz	vertical						
NTV (Russia)	11-938GHz	horizontal						
Fashion TV	12-245GHz	horizontal						
NBC Europe	11-021GHz	vertical (see text)						
Hungary	12-149GHz	vertical						
Travel TV	12-188GHz	vertical						
	•							

It's possible to do the upgrade directly over the internet via a PC – connect a serial null modem cable between the PC's RS232 socket and the Mediamaster's socket. You first have to download the serial download server software, plus the new mediamaster software, and store it on the computer's hard disc. Full information is available at the Nokia web pages mentioned above.

Off-air Procedure

The upgrade is also available over the air from the 1°W satellite position. This is easier to do provided you have access to the 1°W Nordic satellite grouping. When looking for this satellite, it's approximately due south in the UK. An 80cm dish should provide enough signal. Key in 11·174GHz horizontal polarisation and adjust the dish for the maximum red-bar display in the receiver's search menu.

Once the channel search has been done, store the NRK (Norway) International signal as channel 1 on the receiver's channel listing. It's at 11·174GHz horizontal, symbol rate 22,500 and FEC 2/3. At the time of writing this signal is unscrambled, because of a complication with subscriptions, but if it is scrambled this won't affect the upgrade process and the NRK INTERNATIONAL identification will be present to confirm the channel. Make sure that enough signal strength is present, and if possible that there won't be a heavy downpour of rain to attenuate the signal during the upgrade process!

Next, go to the installation menu and select the SOFT-WARE UPGRADE option. Press the remote control unit's OK button. The receiver then checks to see if an upgrade is available. If there is, it will come back with an on-screen message of confirmation and will ask whether you wish to proceed. Press OK again and the upgrade starts!

The screen will go blank and the display will first display SELF TEST followed by OTA (over the air) UPGRADE. Within a minute or so the OTA disappears and UPGRADE starts to flash rapidly. The whole process takes around seventy minutes: the square block display to the right of the alphanumeric display will increase in height during the process. It's very important to ensure that the signal and power aren't likely to go off during this time!

When the seventy minutes are up the receiver will be ready for use - once it has gone through the self-test

once again. Interestingly, the channels previously stored in the memory as a list are still present.

Free-to-air Services

Eutelsat at 13°E has a number of non-scrambled services available, including Italian, Russian and the Fashion TV package – even Thailand TV!

Try entering the frequencies listed in Table 1. Enter all symbol rates as 22,500 and the FEC as 2/3. If no results are seen, enter these parameters in the advanced channel search menu. The receiver should then automatically adjust its receiving characteristics to those of the incoming signal. I found this facility a great help recently when trying to locate NBC Europe's digital transmission now that the analogue one has ceased. I keyed in 11·010GHz, vertical polarisation, symbol rate 22,500 and FEC 2/3. Within a short time NBC was found – with actual characteristics 11·021GHz, symbol rate 6,110 and FEC 3/4.

Note that the red signal-strength bar display at the bottom of both channel search menus seems to read the tuner's AGC. As NBC is a very low symbol-rate (and hence bandwidth) signal, the display reads between poor and medium though the received picture is fine. A signal like RAI at 11-804GHz or even an analogue signal reading such as BBC World at 11-618GHz produces a much higher red-bar display.

A good future upgrade feature would be to indicate, prior to searching, whether a digital QPSK signal is present at the intended search frequency – the red-bar signal display happily deflects with an analogue signal present, and much time can be wasted searching for non-existent signals. Once the receiver has started its search procedure, which can take several minutes, it can't be stopped manually.

If you've internet access a good source of digital signal information is www.satcodx.com – it's updated daily and also tells you whether the signal is scrambled.

Swedish Reception

SVT has a Europe-wide service, called SVT Europa, via Sirius 2 at 5°E. This satellite's horizontally-polarised signals can be received throughout Europe using a dish of no more than 80cm. You need a universal LNB, as the signals are in the 11·7-12·5GHz band. The satellite's vertically-polarised signals cover only Scandinavia at high power, though the UK is within the 'fringe-area' of the beam as far as DX interest is concerned. Yet a third footprint covers NE Europe.

The SVT Europa service is encrypted, so a smart card and 'common interface module' (otherwise known as a conditional access module or CAM) are required. One of our customers wanted the service, so we obtained for him a Nokia Mediamaster Model 9602S. There are, at the time of writing, three models in this range – the 9600, 9602 and 9610. The latter has a telephone modem (for pay-per-view options) and an SCSI socket (for connection to a CD-ROM player). The 9602 has only the modem socket, while the 9600 has only the SCSI one. We didn't require either of these options however.

When you come out of standby the front panel display shows the software programming version that's loaded. This particular one had version 2.0. You can download more up-to-date versions from Intelsat at 1°W, see above. There's also a lot of unofficial software for this model (and the 9500 series), but I've no experience of it.

Subscription

TVX Connova (see later) supplies both the viewing card



The Nokia 9600 digital satellite receiver.

and the CAM for the SVT Europa service, for which the customer can apply by fax. They turned up within a couple of days by express delivery. The contract application form is in Swedish, and is therefore best left for the customer to fill in! TVX Connova handles a number of subscription TV services throughout Europe.

Installation

The front of the Nokia receiver has a slot, slightly larger than a standard smart card one, where you slot in the CAM. This is a 'PCMCIA'-style device that's identical in size and connection to the Psion Gold card modem used with laptop computers. The viewing card slots into the CAM – it sticks out from the front panel in the conventional way.

There's no UHF modulator, but three scart sockets are fitted, one each for TV and video and one labelled 'sat'. If an analogue receiver is switched on (scart pin 8 going high) its signal is routed to the video and satellite scart sockets. The front panel, somewhat confusingly, says 'sat'. Normally the digital station name and channel number are shown.

Inserting the CAM proved to be a bit difficult, as not much is left exposed at the front of the receiver for the final hard push into the multiway connector inside. If this turns out to be a problem, it would be best to take the lid off the box. A diagram shows clearly which way up the CAM goes into the receiver and which way the card slots into the CAM (unusually, contacts upwards).

Picture break-up and loss

As the quality of a digital signal decreases, the errors increase and the correction circuitry has to work harder. When it can no longer cope and overloads, mosaic squares appear in the picture. These are MPEG macroblocks that are held in the frame DRAM and haven't, because of the signal errors, been updated. If the errors increase, the picture will freeze and then be completely lost.

An MPEG macroblock is the digital signal segment used by the decoder for movement estimation and compensation.

Locating the Satellite

Fortunately Sirius 2 transmits Cyprus TV in analogue form at 12·265GHz with horizontal polarisation. So you can use an analogue receiver to find this. I used a current Pace receiver, set the LNB selection to 'universal' and the band to 'high' in the tuning menu. Other receivers may just display the IF, which is 1,665MHz with the 22kHz tone on. This is important: if the LNB doesn't see a tone it will select only the low 10·7-11·7GHz band and there will be lots of fruitless searching. Cyprus TV has the identification PIK at the top of

the screen, which helps, and colourful pictures of Cyprus are shown when programmes are not being transmitted.

Setting Up

Once the dish has been aligned the Nokia box can be connected. This is fairly conventional, and a guided installation menu is provided. A universal LNB is the default setting, and Sirius 2 is satellite option 4 (though in practice this could be left on the Eutelsat or Astra name with no problem).

The Swedish TV parameters are entered in the 'antenna adjustment' menu. The frequency is 12.380GHz, with horizontal polarisation, a symbol rate of 27,500 and FEC 3/4. These can be left in 'auto' if you wish.

The red-bar display at the bottom of the screen should indicate between 'medium' and 'good'. If the display shows 'low' when the Swedish frequency has been keyed in, check the dish alignment. This is only an AGC reading. If the Cyprus TV analogue frequency is keyed in the red bar will again deflect. The display could be used as a dish alignment check: key in both frequencies and see if the signal-bar deflects. If you enter a frequency below 11.7GHz there should be no deflection as the satellite doesn't transmit in this range.

Once you are happy with the signal strength, press the OK button to start the channel search, indicated at the bottom of the screen. The receiver will start its search and, after a short time, should indicate that it has found SVT and also BET on Jazz – this is an unencrypted US jazz channel transmitted with SVT. Swedish radio international will be displayed in the radio listings.

The receiver is now ready to show pictures. Without the CAM and card, Swedish TV will be displayed as a name on the screen and on the front panel and there'll be a "No CA module" on-screen message. You will be able to receive the jazz station and Swedish radio however.

There's a small rectangular box to the right of the station name at the front of the receiver. It increases in height to become a square when a good-quality, low error-rate digital signal is being received. In practice reception is possible with a rectangular-shaped box!

Other Stations

Other stations can be found at the same time in the search, listed after SVT. You can start a second search and enter different parameters – it won't result in loss of the original stations. An editing menu enables the station order to be altered and unwanted ones deleted.

Information on and parameters for digital services are available on a per satellite basis at web site www.satco.dx.

Further information on subscribing to Swedish TV can be obtained from TVX Connova, Box 304, 59124 Motala, Sweden. Telephone no. 00 46 141 56060, fax 00 46 141 56061. E-mail tvx@connova.se. There's an internet site at www.connova se.

Dutch Problems

The Dutch digital package via Astra had a slight frequency change around in early August. Most viewers wouldn't have noticed, as over-the-air information told receivers how to retune themselves – provided they could detect the new frequencies. This has led to a problem with some DIY installations in our neck of the

Several calls came from perplexed Dutchmen who had lost Netherlands 1, 2 and 3, the main channels, while RTL4, 5 and some others were still present. Just to confuse matters, the channel/programme identification was

still at the bottom of the blank screen.

I knew that Netherlands 1, 2 and 3 had previously been transmitted via Astra 1F in the 12·1-12·5GHz band with vertical polarisation. What I needed was quick information on possible new frequencies. This was obtained from what's commonly known as the Satco DX internet site – www.satcodx.com. It lists satellites on a channel/frequency basis and immediately told me that Netherlands 1, 2 and 3 plus some other channels had moved to Astra 1G, at just above 11·5GHz, and were now horizontally polarised.

Astra 1G's horizontally-polarised signals are available here in Portugal, but are at a much lower level than its vertically polarised signals. Horizontal Astra signals in the 11.7-12.5GHz band are not available here.

With this information it was easy to deal with the problem. The dishes at the DIY installations weren't accurately aligned. Before the change, a keen satellite viewer watching the receiver's on-screen signal-strength display (some receivers even produce an audio tone that increases with signal strength) could point the dish in more or less the right direction and get the signals. Now, spot-on alignment is required and the LNB's skew angle must be exactly correct.

Skew Angle

As the vertically-polarised signals are much stronger, the LNB skew angle is critical. If, with an analogue signal, there's breakthrough of the vertically polarised signal you get a slightly inferior picture with the odd sparklie or two. But with a digital signal the result can be no picture at all or, at best, the picture being degraded, with jerky movements and a lot of pixel/square blocks on the screen.

Another effect, mentioned a lot less, is audio break up. The audio often doesn't go off quietly: it produces a nasty, loud unstable squeal – loud enough to wake up anyone asleep in front of the telly!

A simple check for LNB skew alignment where the vertical and horizontal signals are of widely different strengths is to select the weaker polarisation and then, with an in-line satellite peaker, turn the LNB for the lowest display/lowest audio note – the exact position is easily found.

Some universal LNBs have different horizontal/vertical skew settings at the low-band (10·7-11·7GHz) and high-band (11·7-12·75GHz) frequencies. This is probably because the wide range of microwave wavelengths in this 2GHz block of signals rotate slightly differently as they propagate down the LNB's feed tube prior to being picked up by the 90°-spaced low-noise amplifier probes. Some makes appear to be more prone to this effect than others!

LNB Switching Problem

This was a new installation for the reception of Dutch digital TV. The complaint was no signal, though the dish produced good results with Astra analogue signals and the universal LNB had been changed.

The 22kHz switching tone from the receiver, which was of Far East origin, appeared to be OK in level but there was a very long run of coaxial cable to the dish. I fitted a 22kHz Global tone generator in the coaxial feed, adjacent to the receiver. This increased the tone level and the LNB then switched to high band perfectly.

Since the dutchman didn't want to receive the Astra analogue signals, the simplest and cheapest solution was to leave the added generator in circuit – with instructions that its switch must not be put in the off position.

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Confessions of a Lecturer

Phasor describes what it is like to be on the podium as a manufacturer's training officer

raining is an essential part of most people's working lives. This is especially the case with a job like electronic servicing, where the technology keeps changing. For the past twenty five years I've been conducting seminars for service engineers, covering in particular TV, VCRs and CD players.

Types of Seminar

There are three types of training seminar: those that are free, held at a hotel during the working day; those that are held in the evening and are also free; and those for which a modest charge is made – they might be held during the day or in the evening.

Each has its particular type of trainee. The free all-day ones are attended by engineers whose employers can afford to let them go for the day, or self-employed engineers who decide to take the opportunity of a day away from the whingeing public. Amongst the day-time trainees we occasionally find youths told by their employers to attend in the hope that they may learn something.

The evening free sessions are attended more by the self-employed who cannot afford the possibility of losing custom, and by the employees of the more financially cautious retailers — basically by engineers who are interested enough in what they do to want to learn more, in their own time. Finally, the ones who come along to the evening or day sessions for which a fee is charged are the really keen ones,

who are undaunted by the cost and time required to gain new knowledge.

A Typical Day Session

Here's how a typical day session might go. It's due to start at 09.30 hours at the Hotel Splendide, Gungemouth. I arrive at 08.30 to find that the room I've hired for the day is still full of the remnants of last night's after sales conference binge, a scene of some devastation.

While I am still trying to find the hotel manager, the first trainees arrive at 08.45. They have bulging briefcases, a dazzling array of ballpoints in their top pockets, and a barrage of questions to ask before I've even put up the projection screen and discovered that the projector's lamp has burnt out.

After six or seven journeys to the car to get equipment, course notes, giveaways and the slides and cribcards, I'm perspiring profusely. I need to find the lavatory quickly, and am trying to answer several hostile engineers demanding to know why our latest chassis is so unreliable. I finally retort that it "gives you fellows something to do" and flee to the toilets.

A start like this is usually the precursor to a very fraught day. But I begin well and am into the stuff that Sales have told me to say first. This is heard in silence, and the disbelief on the trainees' faces is my signal to get on with the technical stuff as quickly as possible.

By 10.30 the temperature in the room has risen some ten degrees and

the first break is due. There's not been too much in the way of barracking, soft-fruit throwing or anyone passing out. My explanation of the finer points of a switch-mode power supply has gone down well, and today's crowd seem eager to absorb the information.

In the semi-darkness however a small knot of engineers has been scanning the course notes to look for mistakes. They think they've found one or two, and declare their findings loudly as I'm about to down my first half litre of cold orange juice. Why do people come to lectures when they know it already?

We restart with an assault on the use of a phase-locked loop for tuning, and I immediately fall foul of those who want to know the precise contents of the integrated circuit that contains the programmable divider and comparator. With this out of the way, I'm running ten minutes behind schedule and decide to skim over surface acoustic-wave filters and balanced-input IF amplifier/demodulator chips. No doubt I will pay for this at some point during the hours to come.

Three at the back are now talking audibly and incessantly about a rival brand that does things differently and, in their view, rather better. I make a mental note to put these characters down at the first opportunity. This comes whilst dealing with the raster correction circuitry when, without mentioning their apparently favourite brand by name, I criticise its engineering in this part of the chassis. The ruse works, but I've



Why do people come to lectures when they know it all already?

made three implacable enemies and need never bother to apply for a job with their favoured manufacturer.

Lunch Time

Lunch time arrives and I am now half an hour behind schedule. The trainees stampede for the toilets, then the restaurant, and after that the bar. At five minutes to two the lecture room is still empty and I have to resort to prising them away from their pints.

We start off again. Field output stages, line scan generators, after-hours sync and audio fall one by one. My knot of three are silent. Until the tea break, when they launch their assault on the design of the latest teletext decoder, something I intend to discuss in the last part of the session.

I am cornered by these paragons of engineering virtue. Their leader, a tall, bald and very precisely-spoken man of about forty, drives his criticisms home by stabbing the space between us with a yellow Biro whose cap has been badly chewed. Knowing that this is the result of one of his habits, I totally disrupt his flow with the comment "I say, your dog has an odd appetite, hasn't he?" He regards the chewed pen darkly and, totally deflated, steers his cohorts away to refill their tea cups.

Last Lap

It's three forty five and the last lap is about to start. I've galloped through some of the more mundane circuitry and come, at last, to the final bit—the teletext decoder. Crossing from the analogue to the digital domain has its moments of terror for some.

and I can see unease on a few faces as I describe the data stream retrieved from the slicer circuit and the structure of each row of text.

The concept of a graphics ROM seems to be beyond a good many, and the talk is of pigeon holes and numbered boxes, the number of the box being derived from its horizontal and vertical co-ordinates. The orienteering devotees nod their heads knowingly and smile at the mention of maps. Others look dazed and lost. I change my analogies and all come on board. Whew!

End of Session

It's 16.30 and the session comes to an end. The last questions are asked, and a few stragglers manage to leave before it's time for me to carry what's left of the course notes, goodies and equipment back to the car.

I make a last check on the room to ensure that I've left nothing behind but dirty cups and hot air. The bill has to be signed at reception, which always takes at least half an hour. I wait as they sort out a gentleman who wants to change his room for one on the ground floor because he's afraid of lifts and his heart is afraid of stairs.

With the car loaded up ready for the journey home, and the bill paid, I visit the gents before my 150-mile drive. As bad luck would have it, two of my trainees have been having a jar at the bar before going home. They trap me with "just a little point we are not quite clear about". Nor am I, but never mind. I do my best to get round it.

At five thirty the rush hour has

started and I head out into a succession of traffic jams before joining the M25 and the biggest jam of them all.

Smiles

There have been many humourous moments during the training sessions I've conducted over the years. I was once told that a group of engineers employed by a well-known retail group wouldn't repair a certain receiver because it had digital circuitry in it. Their union had told them to boycott any sets with ultrasonic remote control until they'd received training on the subject.

After I'd provided the training required I asked the service manager what was wrong with the receiver at the centre of the trouble. "It has a faulty on/off switch" was the reply. Oh well, I suppose a switch could be classified as digital! I often wonder how those militant engineers would respond to today's domestic electronic equipment.

I was once asked to give a talk to a group of dealers. It was to be an evening event. The idea was to outline, in simple terms, the advantages of a low component count, greater integration and an accelerated soak test before packaging the receivers.

Half way through I was interrupted by a fellow who had enjoyed a good measure of my firm's hospitality that evening. "I got a workshop full o' they sets an' 'em all faulty" he alleged. I asked him how many were defective. "Over two hundred" he replied, "I got 'em all lined up along the walls!"

Another dealer immediately stood up and said "if you've got that many

I'll take some off you, dead or alive!" The model was on limited availability at the time, supplies being allocated on an account size basis. The guy who made the claim was later found to be a freeloader who was not even an account holder.

On one other notable occasion I invited twenty five engineers to a daytime talk on a new chassis. They told all their mates across several counties, and 108 turned up to hear me. The hotel manager had a panic attack and spent the morning telephoning his reserve staff to get them to come in and cope with the catering.

Digital TV

Training appears to have slipped into calm waters for the present. The advent of digital TV doesn't seem to have produced the big increase one might have expected. But traditional analogue technology will remain with us for a long time yet, and of course this takes in timebases and power supplies which aren't going to alter to any great extent.

Much of the excitement at present relates to the coming together of digital TV and the internet. The action here could mostly be in the software field. Future training is bound to be affected by this changing technology. Maybe classes of students will sit in front of internetconnected TV sets in their own homes. They'll do it in their own time - and make their own tea!

Evening Meetings

Evening seminars are in some ways more relaxed affairs. The lecturer can be sure that those who come in their own time are bound to be keen. With an 18.30 kick-off, it's possible to be through by 22.00 and actually packed ready to depart - either home to bed or your hotel - by 23.00.

Recent company clamp-downs on expenditure have had me using a swish hotel for the seminar, thereby maintaining the quality image, then retiring to a boarding house some miles away for an overnight stay. After a couple of nights of nylon sheets and plastic lampshades singed by over-size bulbs I make the effort to go home if at all possible.

Subjects have to be dealt with in a

more condensed manner at an evening meeting, what you cannot put over in the time available being printed in the course notes. The trainees are very eager, and the quality of the questions and level of understanding tends to be higher than those with daytime sessions. Being bombarded with questions on and off the lecture stage is something to which you have to become accustomed.

In Conclusion

Training lectures are very rewarding. For the lecturer there's the build-up of mutual respect between yourself and your trainees. It is surprising what a wealth of engineering talent there is 'out there'. For trainees there is the opportunity to meet someone from a major manufacturer, ask questions that may have been nagging for some time, and establish a link with a source of information and knowledge

Despite the occasional idiot, failprojector bulbs, catering arrangements that go wrong and the sheer hard work involved, training is a worthwhile occupation.

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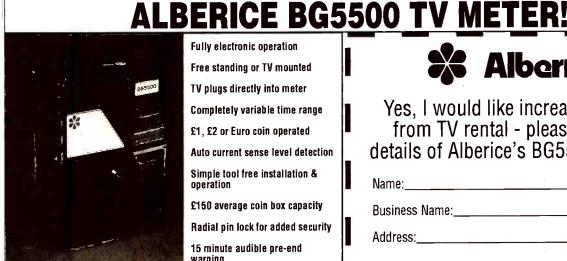
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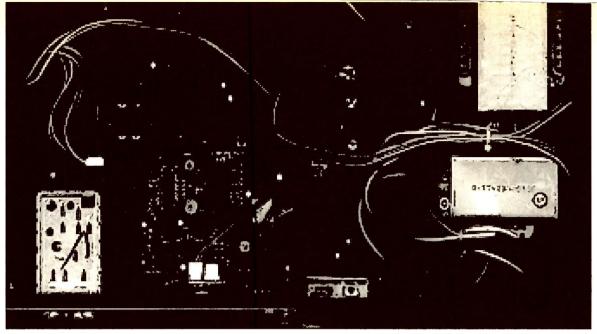


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Satellite Notebook

Shorted LNB F Socket

The owner of an old Alba satellite receiver complained that it was dead. It was fed from a shared dish system via a magic switch. The only other active receiver, a Pace PRD800, also failed to produce any signals, though the display was alight. The Alba receiver's mains fuse had blown: its non-switch-mode mains transformer's thermal fuse was also open-circuit. A bad sign if ever there was one!

The PRD800 receiver didn't provide an LNB supply because R543 (1Ω , located beside the tuner assembly) was open-circuit, obviously because of excessive current flow. Time to head for the dish.

The LNB's vertically-polarised output read short-circuit, though the horizontally-polarised output read OK. I naturally thought that the LNB was to blame. But the cause of the trouble was revealed when its F plug was removed. A piece of swarf from what looked like the F plug's thread was touching both the inner and the outer coaxial conductors. There was no sign that the plug had been removed in recent times, so why the short had suddenly occurred remains a mystery.

Replacement of R543 in the Pace receiver restored normal operation. But replacement of the thermal fuse in the Alba set lead to a rapidly roasting transformer. Fortunately the owner bought a new receiver from us!

I've noticed recently that some F plugs have a thread which is rather coarse in comparison with the finer one that most connectors have. They usually screw up all right though you can encounter

some resistance, which calls for the use of a small spanner for the final tightening. If I come across this situation I undo the connector again to see if any loose swarf is visible. Nothing has been found so far! H.C.

LNB Fault

The owner of a fixed installation for Eutelsat at 13°E reported an odd fault. When it was very hot BBC World, Euronews, RAI and some other channels disappeared. Several channels, including Eurosport, Onyx and Spanish TV, remained.

The missing signals were all vertically polarised, and a replacement LNB restored normal reception. The faulty LNB, a Continental Microwave model, would switch between polarisations but, when it was hot, there would be no vertically-polarised signals at all – just no output. As soon as the temperature fell, the signals came back. It's the first time I've come across a problem like this: normally a faulty LNB is stuck on one polarisation or produces little or no output at all. H.C.

No Horizontal Signals

A Pace PRD800 installation produced no horizontal signals from Astra. The vertical ones were OK, though Sky Movies Screen 1 was marred by some white sparklies that couldn't be tuned out. I initially suspected an LNB problem, but it transpired that a room extension had recently been carried out. The builder, "who knew a thing or two about satellite TV", had extended the IF cable from the dish.

When I traced the path of the IF

cable back through a loaded bookshelf I found that it went into a Belling-Lee coaxial wall socket via a nasty brand of coaxial plug with a large locking screw to secure the inner conductor of the cable. Whether the large diameter of the screwhead is deliberately used to assist impedance matching across the terrestrial TV band is doubtful: at the satellite IF band it's definitely a source of trouble!

I removed the plug and the wall socket, which had dubious DC coupling to provide the LNB power, and replaced them with two F plugs and a back-to-back socket. This restored normal signals with no more sparklies on Screen 1. A voltage drop at the plug and socket contact had prevented the higher-voltage horizontal channels from being received, while the coaxial plug's large screw had helped notch out some of Screen 1's IF signal.

The cosmetic appearance was maintained by fixing the back-to-back connector in the plastic cover of the original wall socket and using a hot-glue gun to fix the cover over the hole – it was previously secured by a screw that went into the wall socket assembly.

H.C.

Matsui OP10

There was intermittent picture loss with both clear and encrypted channels. The picture would flash back overloaded, then return to normal. The cause was C53 ($10\mu F$, 50V) on the decoder panel.

Various decoder problems have been encountered with these units - decoding only when cold and loss of the on-screen messages are

Reports from Hugh Cocks Chris Watton Adrian Spriddell and Nick Beer common. The cause is glue. On resonator XT2, around pins 1 and 2 of U1, and below U4 on the underside of the PCB where about half a tube of glue holds a $1k\Omega$ resistor in place.

You can get this glue off by spraying it with freezer and prodding it with a meter probe. Remove XT2, clean the area around it, then refit it. Replace C45 (1µF, 50V) with a 105°C type.

Most of the electrolytic capacitors fall in value, especially those in the decoder and the power supply.

The BT Model SVS250 uses the same chassis. C.W.

Amstrad SRD510

The customer complained that there was no remote control operation, but the receiver was actually dead. After replacing the usual culprits, R602/3 (both 47k Ω), C612 (220 μ F, 25V) and C611 (1 μ F, 50V), the power supply was back in operation. But there were lines on the picture – it looked like cochannel interference. The cause

was lack of 12V supply smoothing: C305 (470 μ F, 16V) had fallen in value to 140 μ F. A.S.

Philips STU3601/Grundig GRD300

There was no audio response – apart from an odd click or two and that vague feeling of DC through the speakers you sometimes get when working on a dead amplifier. Scope checks at pins 42 and 43 of IC1 displayed only a thin line with occasional random spikes: at FM input pin 24 there was 200mV of something – maybe a carrier, maybe noise.

As luck would have it I'd just been fitting some heatshrink sleeving to a dimmer rack and the gas torch was still cooling on the bench. In an inspired moment I decided to treat the suspect chip with a shot of white-hot air. Never have I been so glad to hear an American voice, as the CNN commentator burst forth from my workshop speakers. A blast of freezer shut him up again, and a new chip (STV0030) cured the

fault. Fortunately there's plenty of space around it, so replacement is not too difficult. **A.S.**

Pace PRD900

After repairing a power supply fault I found that there was no VideoCrypt operation – no unscrambling and no decoder messages. The cause was traced to the SP973T8 video ADC chip U20. As with all Pace parts, it's worth shopping around for the cheapest source – with so many differently badged versions, prices can vary substantially.

The power supply fault had resulted in poor regulation, with the outputs over thirty per cent high. **N.B.**

Pace PRD900

This unit couldn't be brought out of standby when you tried to start it at the front panel, but was OK when operated with the remote control unit. Loss of power on/off operation was caused by a break in the print at J13, which sits just in front of the card reader. N.B.

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Philips G90AE Chassis

This set was dead though there was some power supply activity – there was an HT output but it was low at 50V. With a dummy load connected and the input to the set via a variac, the HT was correct at 95V with an input of 120V AC. As the input was increased towards 220V the HT gradually fell. Cold DC checks on the secondary side of the power supply revealed that D6653 (BAS32) was short-circuit. **P.B.**

Grundig G1000 Chassis

If the set is dead with the power supply making a clicking sound, check whether D301 (BA157) is short-circuit. It's the rectifier for the 26V supply derived from the line output transformer. **P.B.**

Mitsubishi CT25B3STX (Euro 12 Chassis)

Excessive HT (it should be 145V) is often the cause when the field IC fails. Replacing C906 (47 μ F, 50V 105°) in the chopper transistor's base drive circuit usually solves the problem – but not this time!

The next step is to check the values of R961, R972 and R960 in the HT sensing network and replace C905, C909, C906 and C920. In the past this has solved 90 per cent of power supply faults. Again, not this time.

TV Fault Finding

To check whether the fault is on the primary or secondary side of the power supply, scope the output waveform at pin 3 of the TEA5170 chip IC950. Use a variac to reduce the mains input so that the voltage at TP91 (145V) falls below 140V. The pulses should widen as the voltage falls below 140V, and narrow if the voltage rises above 145V.

On this occasion the pulses were at their narrowest by the time 145V was reached. They couldn't narrow further even when the voltage rose above 145V.

This suggested a fault on the primary side of the circuit. D907 (RD3.0), which is connected in parallel with C906, was found to be short-circuit. **P.B.**

Philips G90AE Chassis

"No sync, TDA2579 replaced" it said on the job card. When I looked at the weak, broken up display on the screen a video problem appeared to be more likely. Checks around the TDA5850 video switching chip showed that the normal 1.5V peak-to-peak input waveform was present at pin 8 but only 0.5V peak-to-peak emerged at pin 5. A new TDA5850 chip cured the problem. **P.B.**

Grundig P37-440 (CUC4401 Chassis)

If the set is dead with only low output voltages from the power supply, replace C633 (100μF, 25V). **P.B.**

Ferguson TX91 Chassis

If you cannot gain access to the tuning menu by pressing the tuning button on the remote control unit, try this: switch the set to standby and turn the mains switch off; wait till the standby light goes out, then turn the mains switch on while holding down the remote control

unit's standby button. The lock menu will appear, and you can then remove the lock. **P.B.**

Mitsubishi CT25A2STX (Euro 12 Chassis)

Here's a question for you. What's the cause of the following symptoms: excessive width with bowed verticals; no on-screen menus; and the picture is shifted to one side?

The answer is a low-amplitude H SYNC feedback pulse from the line output stage. D559 (1N4148) in the clipper network was found to be short-circuit.

Dry-joints at the pins of the line output transformer also required attention – they could well have been the cause of the diode's failure. **P.B.**

Panasonic Alpha 1W Chassis

This set was dead apart from the fact that the channel numbers lit up and changed. There were no squealing noises from the power supply. Quick checks confirmed that there was 330V across the mains bridge rectifier's reservoir capacitor and that the $560k\Omega$ startup resistor R803 was OK. The only other likely cause was the STR54041M chopper chip. When you replace it, always replace C808 (10μF, 63V) as well. It's the reservoir capacitor for the -4V supply at pin 1. After doing this the set was back in action again. M.M.

Thorn CT5122T

I was told that the customer's children had been playing with a high-powered water pistol and that some water had got into the set. It hadn't occurred to them to unplug the set!

Close inspection showed that there was slight corrosion around the memory and text chips. I removed the board and cleaned the affected areas with a liberal dose of video head cleaner and a toothbrush. After drying the PCB thoroughly, followed by reassembly, I was relieved to find that the set came on. But the memory had become corrupted, with the loss of all tuning and RGB or EXT video on some channels. Reprogramming cured this. M.M.

Crown CRP14 (SM1 Mono Chassis)

This set was dead. I found that the 5N90 chopper FET was short-circuit and the $5\cdot 6\Omega$, 5W surge limiter resistor R101 open-circuit. The TDA4605 chopper control chip IC101 had also failed, and the associated resistors R108 (220k Ω) and R109 (330k Ω) were open-circuit. Once these items had been replaced the set sprang back to life. M.M.

Mitsubishi CT14MV1B

This TV/VCR unit, a Philips clone, was dead. I found that the mains bridge rectifier diodes D6313-6 and the 2Ω surge limiter resistor R3337 had failed because the chopper FET Tr7330 had gone short-circuit. Diodes D6332 and D6337 had also gone short-circuit. These items were replaced, along with the MC44603 chopper control chip IC7310, but the unit still failed to start up. R3338 (39 Ω fusible), in the drive to the FET's gate, was open-circuit. All was well once this item had been replaced. M.M.

JVC AV28F1EG

This German set was sent to me by another dealer "because it needed a field chip". The symptom was flyback lines at the top of the picture. There was a very simple cause: the field output chip's pins were dryjointed. Resoldering them, also the pins of the two regulators in the power supply, put matters right. M.M.

JVC AV25SD4

When this set was switched on the green light showed but there was no picture or sound. Another dealer had resoldered the pins of the line output transformer. But he'd missed the connection to the line output transistor's collector. It often becomes dry-jointed in this and other JVC models. Resoldering this one pin and its rivet restored normal operation. M.M.

Akura CX24 (Nikkai TLG0909 Chassis)

Text data lines covered most of this set's screen. The cause of the fault was in the field output stage, where

C310 (4·7 μ F, 250V) had failed. **C.W.**

Hitachi CTP2568

This set would sometimes refuse to come out of standby. When it did it worked well. To cut a long story short, the cause of the problem turned out to be the 1-2V memory back-up cell. You will find it on the mains input panel, to the left as you look in at the back. Curiously, the set didn't loose its channel memory. C.W.

Tatung 140 Chassis

The pictures were very streaky when captions were being displayed, with dark bands the full width of the screen. This looked like video output stage trouble, so I dobed a 10µF capacitor across the 200V supply on the CRT's base panel. This cleared the fault but when, instead, the reservoir capacitor for the 200V supply was replaced the fault was back. Its cause turned out to be the BA159 rectifier diode D403. C.W.

JVC C2155EM

This multi-standard set was very reluctant to come out of standby and had to be plugged in for a few hours before it would start. Two 220µF capacitors in the standby supply, C13 and C33, were found to be low in value. Replacements restored normal starting. C.W.

GoldStar CIS4441 (PC04X Chassis)

If there's flat-out brightness, the picture appearing briefly with loss of brightness control when the set is switched off and on, replace the three $680k\Omega$ resistors on the tube base panel. C.W.

Toshiba 145R7B

One of these 14in. sets had very low, distorted sound. I found that the audio mute transistor Q680 was conducting slightly, hence the distortion. A rather unusual muting circuit is used in this chassis, with a link to the RGB drives via three 1N4148 diodes D201-3. One of these had a 200Ω leak. Because of the unusual circuitry, I don't think I could have sorted out the fault without a circuit diagram. M.Dr.

Tatung 190 Chassis

If the mains fuse or the surge limiting resistor is faulty and you cannot find the cause using a multimeter, you will probably find that R812 (33k Ω) in the snubber network connected to the collector of the chop-

per transistor is too close to the heatsink. In this condition it will tend to flash across. **M.Dr.**

Philips G90 Chassis

Intermittently from cold this set would lock up with no sound and wouldn't change channels. In addition error code F7 would be displayed on the screen. The manual says that this indicates a teletext fault. Some scope checks showed that there were line-frequency pulses on the text 8V supply. The cause of the problem was C2843 (220µF, 25V) which had dried up. M.Dr.

Hinari CT4 (Nikkai TLG0101 Chassis)

This set's picture was smeared to one side, as if the first anode control had been set far too low. When I checked the voltages at the collectors of the RGB output transistors I found that they were low at only about 100V. The supply to these transistors comes via L501 ($10\mu H$), which had 200V at one end and 100V at the other. A replacement, obtained from a scrap set, cured the fault. **M.Dr.**

Saisho CT144R

This set had an intermittent fault. When it was present there was a three-inch band of noise bars across the screen with a crackle on the sound. The cause was traced to dryjointed chassis-bonding lugs at the regulator's heatsink. When these had been resoldered a tap test showed that all was well. **B.L.**

Ferguson TX98 Chassis

Circuit protector ICP1 was opencircuit for no reason that could be detected. So we fitted a replacement and left the set on soak test. Shortly after this there was a firework display from the line output transformer. Would a replacement transformer reveal that other faults were present? Fortunately all was well. **B.L.**

Mitsubishi CT28AV1BS (EE3 Chassis)

This TV/satellite receiver wouldn't power up: it just flashed pretty green and red LEDs. Some voltage checks showed that there was only 7V instead of about 11.5V at the cathode of D952 on the secondary side of the chopper circuit. Its 1,000µF, 16V reservoir capacitor C955 had dried up. A replacement rated at 105°C cured the fault. **B.L.**

Ferguson ICC7 Chassis

At switch on all this set produced

was a short squeal. The HT voltage was OK, but there was no 24V supply. Surge-limiter resistor RP62 (0·1 Ω) was open-circuit and a resistance check showed that there was a short-circuit across the supply. The culprit was the TDA8178 field output chip IF01. Fortunately all was well once IF01 and RP62 had been replaced. **B.L.**

Panasonic Z4 Chassis

This set had a dead power supply. IC801 had gone short-circuit, taking R802 with it. When these two items had been replaced the set still didn't want to know: it just sat there flicking its standby LED.

Voltage checks around IC801 revealed that pin 2 was at 0V. This led me to transistor Q801, which was short-circuit collector-to-emitter. Normal service was resumed once this transistor had been replaced. **B.L.**

Ferguson ICC9 Chassis

This set's screen would frequently become bright red: the protection circuit would then switch it to standby.

The CRT and its base socket were eliminated by disconnecting the red cathode's feed resistor RB31. I then discovered that the cathode drive was only 15V instead of the more usual 140V.

Since the red drive input to the TEA5101 RGB output chip was almost double the 3.5V it should have been, I decided to check the video circuitry on the main PCB. The culprit turned out to be the BC858B emitter-follower transistor TV71. It was going open-circuit intermittently. R.F.

Hitachi C2146TN

This set might remain totally dead or the EHT might rustle up then die. Occasionally the set would work. For this sort of thing check for dry-joints at the 8V regulator IC951 and the 5V regulator IC952. If you don't find any, resolder IC901, the line driver transistor Q701 and its transformer. Soldering all these items cured this set.

For intermittent standby operation resolder IC950. G.R.

Panasonic TX25T2

Severe field instability and line pairing is a common fault with these sets. It happens when the filter/snubber resistor R469 associated with the field scan coils goes open-circuit. The value seems to vary. We had two sets in with this fault recently. In one R469 was 150Ω , in

the other it was 470Ω . It goes opencircuit because of dry-joints at the scan coil plug/socket.

To check for this fault, connect a 220Ω resistor across the field scan coils to see if the symptom clears. G.R.

Ferguson IKC2 Chassis

After fitting a new on/off switch we found that the set tripped, with the HT pulsing to 112V. A fault in the protection circuit seemed likely. Replacing transistors TV01, TV02 and TV17 cured the fault. G.R.

Toshiba 216T9B

There was excessive height. Close examination of the field timebase section of the PCB drew my attention to C303 (2·2µF, 63V) which looked decidedly poorly. It's the field ramp generator capacitor, which is connected to pin 31 of IC501. A replacement cured the fault. G.R.

Sony KVM16TU

The customer's complaint was that on the odd occasion this set would not start up – he was convinced that the on/off switch was the culprit. When the fault appeared we quickly established that the mains rectifier was working, so the switch was OK. When we checked the start-up resistor R602 we found that it had risen in value from $560k\Omega$ to $660k\Omega$. But the basic cause of the fault was the BC637 current-limiting transistor Q601, which was short-circuit. It's connected in series with R602. M.J.C.

Hitachi C2118T (G7PS Mk 2 Chassis)

Intermittent field collapse was the complaint with this set. So I replaced the LA7835 field output chip IC601 and the 100µF flyback boost capacitor C603. A nice quick one I thought. Half an hour later there was field collapse again. A check with the scope showed that drive was present at pin 1 of IC601, and a quick blast of freezer on it restored the field scan. Time for some voltage checks, which I should have carried out in the first place.

The supply at pin 7 was high at over 30V, while the HT voltage was 128V instead of 112V.

In fact the cause of the trouble was R909 in the power supply. It had increased in value from $39k\Omega$ to $45k\Omega$. As a result the HT voltage was just below the level at which ZD903 (P6KE130A) would short across. M.J.C.

Mitsubishi CT2125TX

There was no picture though the on-screen graphics could be called up and the sound was present. I spent some time on a wild goose chase in the video and text circuitry, then decided to check that the receiver's supply lines were all present and correct. The 5V regulated supply to the control, VIP and CCT chips turned out to be missing. Z951, a 630mA circuit protector on the power supply panel, was opencircuit. No reason for its failure could be found. **K.E.**

Ferguson ICC8 Chassis

The picture was mainly red and green, with the blue content evident only on highlights. The tube's voltages seemed to be about right, and drive waveform checks didn't reveal anything seriously amiss. Perhaps the TEA5101A RGB output chip was faulty? Before fitting a replacement I decided to check the values of the resistors in the output stage feedback circuits. This led me to RT64 which had risen in value.

We've now had the same fault on two more occasions. **K.E.**

Samsung Cl348Z (P50 Chassis)

Intermittent field roll was the customer's complaint. After checking that his signal was OK we took the set back to the workshop, put it on the soak test bench, and waited for the fault to appear. Sure enough the field unlocked momentarily. But when we took the back off the set the fault cleared. So we set about checking the components in the field sync circuit. Coupling capacitor C351 (0.47µF, 50V) turned out to be leaky. **K.E.**

Mitsubishi CT2525TX

There was a strange moiré-type patterning over the whole picture, also slightly reduced height and colour saturation. A sharp tap on the side of the cabinet seemed to restore normal operation, so I felt that the cause of the problem was probably to do with dry-joints. Close examination of the main PCB revealed some very suspect-looking joints in the power supply section, but the cause of the trouble turned out to be the 12V regulator chip IC902. **K.E.**

Matsui 20R1 (Grundig G1000 Chassis)

The customer complained that there was "no operation". In fact the set was tripping. Some checks showed

that there was a short across the HT rail, but disconnecting the line output transistor made no difference. Disconnecting pin 4 of the line output transformer did however. This pin is connected to the collector of the output transistor, so we were definitely in the right area. The culprit turned out to be the BY133 efficiency diode D304. P.G.

Sony KVD2912

Intermittent crackling on Nicam and loss of the picture were the complaints with this set. The sound problem took a bit of time to show up. Its cause was traced to bad joints in the IF can, particularly at the video tank coil and the AFC coil. When it eventually occurred we traced the cause of the loss of picture to a bad crimp at the heater supply plug on the CRT base plate.

Decca D25NEE5 (Tatung E Series Chassis)

The power LED came on but the set refused to start. On investigation I found that the power supply was running, with all the LT rails

intact and 150V present at the line output transformer. But there was no drive at the base of the line output transistor. There was drive on the primary side of the driver transformer T401, but its secondary side appeared to be open-circuit.

When I removed the transformer I saw that the ends of the windings had never been tinned during manufacture. As a result they had become dry-jointed. Resoldering cured the problem. P.G.

Mitsubishi Euro 12 Chassis

The customer complained that there was an intermittent field fault, the symptoms being lack of height and foldover. In fact when the symptoms did eventually appear the cause was obviously low output from the power supply - the HT line was at only 87V. The voltages were correct in standby however.

Ouick checks while the set was in the fault condition revealed that the set-HT control was inoperative and that there was no supply at pin 2 of the TEA5170 master regulator chip IC950. This supply comes from the collector of the power

switch-1 transistor O951, which was switched off. This led us to the power switch-2 transistor Q952. whose collector should be at 0V when the set is working. In fact there was a rather excessive 29V here, which returned to normal in standby. The cause of the trouble turned out to be an invisible hairline crack in the print between the base of Q952 and the junction of R956/7. The confusing 29V came from the sound switch-1 transistor O954 and its bias resistor. The base of this transistor should also go low when Q952 switches on. P.G.

GoldStar CIT9172 (PC11A Chassis)

The cause of very intermittent loss of the picture, the sound remaining OK, was eventually traced to the TDA8214A timebase generator/ field output chip IC401. When the tinplate screen beneath the PCB was removed, the IC was seen to be badly dry-jointed. In fact it had not been inserted far enough into the board during manufacture. The bad joints were sensitive to heat, not vibration. P.G.

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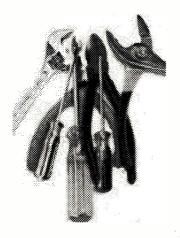
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John Edwards' Casebook

JVC AV21H1EK

"It don't work since I connected my old Rogers amplifier to it" the old gent said, once we'd reached the sitting room where the set lived, "all's I got was this smell of burning, then it packed up." It seemed obvious to me that the audio output IC had probably been damaged, but before I could utter a word his wife started pumping at the on/off switch.

"There" she said, "listen." Not unexpectedly, the set issued a faint squeak then returned to the relative safety of the standby mode, whereupon she started to thump the top of the set with vigour while drawing my attention, with pointed finger, to the blank screen. "See" she said, "nuffin."

I switched the set off and removed the back cover. Then I disconnected plug Q at the top of the large, vertically-mounted PCB, thereby removing the 28V supply to the audio output stage. When I switched the set on again it came to life with a perfect picture, but no sound of course.

"Nice one" he blurted out, "didn't take long. Knew it weren't anything much. What does I owe ya?"

"Nothing" I said, "unless you want sound as well." After agreeing a price, in truth after a lot of haggling, next day I fitted a new TA8216H audio chip — in the workshop. The original one had a pin hole through its case. When I returned with the set I explained that the external speaker sockets were for speakers only. But I'm not sure that he got the message.

Fisher FVHP725

When mains power was applied the loading motor whirred continuously and the clock flashed zeros. Pressing the power button made no difference: there was still no channel indication or light from the power-on LED.

I thought I was in for a 'nasty', but decided to investigate the mode motor assembly. I removed it, carried out thorough degreasing, cleaned it and applied fresh lubricant. When I'd refitted it the machine powered up normally. A new forward/rewind idler completed the repair.

Sony KV2092 (XE4 Chassis)

The fault symptom could best be described as very fine ragged edges to the picture content. The slightest movement of the field output IC's heatsink would instigate or stop the effect. I carried out scope checks at the pins of the IC while the symptom was present, but there was no interference other than a very low 2-4mV peak-

to-peak HF 'noise' at the earth pin. When I resoldered the heatsink to PCB mounting lugs the fault cleared.

Ferguson TX10 Chassis

I don't see many of these old-timers nowadays. Those I do come across have usually seen better days as far as the tube is concerned. This one produced a nice, clear picture however, so I decided to tackle the no red in the text mode problem. The obvious thing to do was to replace the TDA3560 colour decoder chip, which in fact cured the fault.

I was less keen about agreeing to a three-month guarantee on such an old set. My experience is that in the customer's mind a repair guarantee tends to cover everything in the cabinet, no matter what's written on the invoice.

Goodmans 2043 (GoldStar PC04A Chassis)

This set's power supply was working but there was no 106V output at the cathode of the HT rectifier diode D803 and thus no line output stage operation. One leg of the fusible resistor FR803 (4.7 Ω), which is in series with the rectifier, was badly dry-jointed. Resoldering was all that was needed to bring the set back to life.

JVC HRD540

The deck was jammed, with the loading motor struggling fruitlessly to shift the half-loaded mechanism and jammed carriage tray. I unplugged the machine and removed the carriage. After placing it in the eject position I put it to one side. I then rotated the loading motor by hand until the hole in the main cam aligned with the hole in the chassis, at approximately the twelve o'clock position. As I did so I saw that the tape guides and half-loading arm returned to their stop positions.

The mechanism seemed to be quite free and there weren't any tight spots. So I refitted the carriage and powered up. Numerous tests – running through all the modes, including eject, after inserting a tape – proved that all was now well.

Saisho CM2080T

This set wasn't completely dead: the power supply produced an HT output of about 33V. A check on the 2SD1555 line output transistor Q402 showed that it was leaky. Once this and the STR50103A chopper chip IC501 had been replaced the set worked normally. But as a precaution I also replaced the two $330k\Omega$ start-up resistors R502 and R503.

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Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price
HA13001 HA13002	650p 200p	LA2800 LA3120	350p 200p	LA7096 LA7113	200p 275p	LF353 LF355	48p 60p	MC3302 MC3401	50p 45p	SAB3029 SAB3035	525p 275p	STK3102 II STK3106	530p 2500p	STK5478 STK5479	380p 300p	STR16006 STR17006	500p 500p	TA7281 TA7282	200p 160p
HA13006 HA13007	400p 300p	LA3150 LA3160	200p 120p	LA7116 LA7123	125p 1300p	LF357 LF398	70p 300p	MC3423P MC3488AP	100p 250p	SAB3036 SAB3037	725p 700p	STK3122 III STK3152 II	725p 900p	STK5481 STK5482	470p 285p	STR20005 STR20012	450p 450p	TA7210	200p
HA13108 HA13117	280p 175p	LA3161 LA3210	40p 65p	LA7210 LA7212	60p 150p	LH2426S LM301	600p 26p	MC34063AP MN1220T		SAB3042 SAB3064	825p 130p	STK3156 STK4017	500p 400p	STK5483 STK5486	440p 450p	STR20015 STR30110	450p 330p	TA7283 TA7284P	200p 400p
HA13118 HA13119	140p 140p	LA3226 LA3246	60p 75p	LA7214 LA7220	150p 125p	LM311 LM319	35p 165p	MN1226 MN1228	450p 600p	SAB3209 SAB3210	225p 250p	STK4019 STK4021	480p 380p	STK5487 STK5488	525p 480p	STR30115 STR30120	275p 400p	TA7288 TA7291P	220p 200p
HA13127 HA13128	350p 400p	LA3300 LA3301	140p 110p	LA7222 LA7224	110p 150p	LM324 LM335Z	30p 120p		1300p 70p	SAB6456 SAB8048	125p 225p	STK4024 II STK4025	550p 530p	STK5490 STK5632	450p 450p	STR30123 STR30125	450p	TA7292P TA7294P	325p 450p
HA13130 HA13135	450p 500p	LA3361 LA3365	100p 70p	LA7225 LA7292	250p 275p	LM339 LM348	35p 50p	MN3004	600p 2000p	SAB8051A SDA2003		STK4026 STK4028	480p 550p	STK5720 STK5725	400p 450p	STR30130 STR40090	550p 250p 350p	TA7299 TA7302P	200p 75p
HA13139	600p 1150p	LA3370 LA3373	70p 70p	LA7294 LA7295	200p 160p	LM358 LM380	45p 80p	MN3011 MN3101	4000p 110p	SDA2004 SDA2005	325p 700p		1050p 925p	STK5730 STK6316	450p 300p	STR40115 STR41090	600p 330p	TA7303 TA7307	70p 100p
HA13151 HA13403	875p 400p	LA3375 LA3376	300p 80p	LA7297 LA7305A	120p 350p	LM381 LM382	150p 130p	MN3102 MN3207	110p 375p	SDA2007 SDA2008	300p 400p	STK4036 STK4038	470p 680p	STK6324B STK6327	500p 1200p	STR43111 STR44115	950p 475p	TA7310	100p
HA13406W HA13408	400p 350p	LA3380 LA3390	300p 250p	LA7308 LA7311	70p 200p	LM386 LM387	60p 100p	MN3208 MN6030B	950p 350p	SDA2112 SDA2120	450p 200p	STK4040 II STK4042 II	650p 800p	STK6328A STK6431	800p 850p	STR45111 STR50020	550p 350p	TA7312 TA7313	120p 70p
HA13412 HA13426	600p 500p	LA3400 LA3401	250p 90p	LA7320 LA7323	120p 325p	LM389N LM393	105p 45p	MN6163A MTA001M	700p 600p	SDA2131 SDA2208	225p 450p	STK4044 STK4046	950p 950p	STK6607 STK6722	400p 725p	STR50092 STR50103A	550p	TA7314 TA7315	175p 200p
HA13432 HA13441	400p 450p	LA3410 LA3430	150p 135p	LA7330 LA7331	350p 250p	LM431 LM710	50p 45p	NE555 NE556	20p 40p	SDA4212 SDA5241	775p 725p	STK4048 STK4050 II	1280p 1600p	STK6732 STK6822	1000p 900p	STR50113 STR50115	500p 500p	TA7317P TA7320P	120p 200p
HA17524 KA2102	250p 100p	LA3600 LA3605	60p 100p	LA7332 LA7340	225p 300p	LM723 LM741DIL	40p 18p	NE558 NE565	80p 110p	SDA5243-2 SDA5343	450p 1450p	STK4060 STK4065	510p 650p	STK6922 STK6932	1000p 525p	STR51041 STR50213	500p 500p	TA7322 TA7323	130p 80p
KA2130 KA2131	150p 110p	LA3607 LA4030	125p 180p	LA7376 LA7391	150p 550p	LM741MET LM747	45p 55p	NE567 NE571	115p 290p	SDA5640 SDA5642	200p 450p	STK4101 STK4111	500p 500p	STK6962 STK6972	275p 490p	STR53041 STR54041	400p 320p	TA7234 TA7325	75p 90p
KA2206 KA2209	150p 125p	LA4031 LA4032	140p 140p	LA7520 LA7530	200p 200p	LM1017 LM1035N	200p 350p	NE592 NE5532P	85p 140p	SGSF444 SGFS465	500p 500p	STK4112 STK4121	500p 480p	STK6981B STK6982	600p	STR55041 STR56041	450p 550p	TA7326 TA7328	200p 110p
KA2210 KA2212	230p 65p	LA4051 LA4100	160p 85p	LA7535 LA7545	175p 160p	LM1040N LM1203	650p 225p	SAA1000 SAA1004	350p 650p	SLA4031 SLA7020M	750p 450p	STK4122 STK4131	560p 480p	STK6982H STK7216	600p 420p	STR58041 STR59041	250p 300p	TA7330P TA7331P	80p 80p
KA2213 KA2214	130p 100p	LA4101 LA4102	80p 100p	LA7550 LA7555	275p 150p	LM1203AN LM1875T	225p 330p	SAA1005 SAA1006	325p 300p	STA301A STA341M	200p 180p	STK4132 II STK4133 II	600p 750p	STK7217 STK7225	400p 500p	STR60001 STR80145	525p 475p	TA7333	100p
KA2224 KA2244	50p 75p	LA4110 LA4120	120p 270p	LA7620 LA7680	500p 675p	LM1881N LM1886	375p 250p	SAA1008 SAA1010	450p 400p	STA401A STA403A	220p 270p	STK4141 II STK4142	420p 530p	STK7226 STK7251	600p 500p	STR81145 STR90120	375p 425p	TA7335 TA7336	85p 180p
KA2261 KA2263	100p 100p	LA4138 LA4140	105p 60p	LA7681 LA7710	650p 250p	LM1889 LM1894N	300p 200p	SAA1024 SAA1025	250p 250p	STA405A STA431A	280p 250p	STK4147 II STK4151	1450p 680p	STK7253 STK7308	450p 350p	STRD1206 STRD1406	500p 600p	TA7337P TA7339P	175p 175p
KA2264 KA2284	100p 75p	LA4142 LA4145	65p 65p	LA7800 LA7801	90p 100p	LM1895N LM2901N	275p 35p	SAA1026 SAA1027	400p 400p	STA432A STA434A	220p 270p	STK4152 STK4161	650p 650p	STK7309 STK7310	400p 470p	STRD1706 STRD1806	360p 360p	TA7341 TA7342P	250p 70p
KA2309 KA2401 KA2412	175p 150p	LA4160 LA4162	100p 110p	LA7802 LA7806	300p 260p	LM2902N LM2903N	40p 40p	SAA1029 SAA1042 SAA1043P	150p 325p	STA435A STA441C	270p 220p	STK4162 STK4164 II	550p 1175p	STK7348 STK7356	400p 425p	STRD1816 STRD1906	350p 550p	TA7343 TA7347P	120p 120p
KA2912	225p 125p	LA4178 LA4180	150p 150p	LA7808 LA 7820	250p 100p	LM3900 LM3909 LM3911N	40p 100p	SAA1044	675p 400p	STA451C STA456C	280p 240p	STK4171 STK4172 II	900p 680p	STK7358 STK7402	440p 560p	STRD3035 STRD4412	300p 500p	TA7348P TA7349P	125p 175p
KA2913A KA2914A KA22427	175p 200p 100p	LA4182 LA4190 LA4192	180p 300p	LA7823 LA7824 LA7830	200p 130p	LM3914	200p 160p	SAA1056 SAA1057	300p 375p	STA471 STA901M	210p 280p	STK4181 STK4182 II	680p 750p	STK7404 STK7406	600p 650p	STRD4420 STRD4512	550p 400p	TA7354P TA7357	65p 340p
KIA6213S KIA6210AH	60p 400p	LA4200 LA4201	140p 130p 120p	LA7831 LA7832	90p 85p 130p	LM3915 LM3916 LM8363	160p 270p 320p	SAA1058 SAA1060	225p 375p 250p	STK0025 STK0029	420p 1000p	STK4191 STK4192	700p 700p	STK7408 STK7410	675p 1500p	STRD5441 STRD5541	475p 450p	TA7358 TA7359P	85p 90p
KIA6281H KIA6283K	250p 150p	LA4260 LA4261	230p 300p	LA7835 LA7837	150p 150p	LM8560 LM13600	175p 150p	SAA1061 SAA1062 SAA1063	250p 250p 250p	STK0039 STK0040 STK0049	600p 520p 510p	STK4211 II STK4211 V STK4221 II	1000p 800p 1200p	STK7458 STK7554 STK7561	1250p 600p 650p	STRD6008 STRD6009E STRD6018	575p 450p 450p	TA7361 TA7362	125p
KIA6299H KIA7227CP	210p 200p	LA4265 LA4270	125p 300p	LA7838 LA7850	200p 225p	LM13700 LM18293	125p 500p	SAA1064 SAA1070	275p 550p	STK0050 STK0059	440p 620p	STK4231 II STK4241	1050p 1050p	STK7562 STK7563	1000p 800p	STRD6602 STRD6601	475p 650p	TA7364P	175p
KIA7313 L149V	45p 300p	LA4282 LA4420	350p 140p	LA7851 LA7910	200p 150p	M491BB1 M494B1	800p 700p	SAA1073 SAA1075	325p 350p	STK0060 STK0070	820p 1100p	STK4241 V STK4272	1250p 500p	STK7573 STK7576	400p 1500p	STRM6545 STRM6546	900p 900p	TA7366P TA7368P TA7373F	65p 35p
L165V L200	250p 200p	LA4422 LM4425A	130p 200p	LA7913 LA7930	90p 350p	M5265P M50115P	200p 320p	SAA1086 SAA1089	175p 325p	STK0080 STK011	1000p 330p	STK4273 STK4301	550p 500p	STK7703 STK8050	1000p 1600p	STRM6549 STRS5741	500p 800p	TA7374	150p 175p
L272 L272M	200p 110p	LA4430 LA4440	130p 200p	LA7940 LA7953	200p 300p	M50117P M50119P	500p 525p	SAA1101 SAA1124	700p 200p	STK015 STK016	440p 760p	STK4311 STK4332	650p 365p	STK8250 STK8260	500p 1200p	STRS5941 STRS6307	750p 600p	TA7376P TA7378P	100p 60p
L290B L291B	225p 300p	LA4445 LA4446	200p 170p	LA9200 LB1205	300p 170p	M50422P M50461	750p 350p	SAA1130 SAA1250	550p 280p	STK025 STK050	650p 1600p	STK4352 STK4362	500p 450p	STK8280 STK73405 II		STRS6308 STRS6309	600p 600p	TA7401 TA7402P	250p 200p
L292 L293B L293C	750p 225p	LA4460 LA4461 LA4466	120p 120p 225p	LB1216 LB1258	150p 100p	M50784 M50786	300p 500p	SAA1251 SAA1271	380p 400p	STK077 STK078	520p 1800p	STK4372 STK4392	600p 500p	STK73410 STK7340 II	350p 500p	STRS6708	1000p 575p	TA7403 TA7404	325p 150p
L293D L293E	325p 225p 250p	LA4470 LA4475	300p 225p	LB1268 LB1274 LB1290	70p 85p 120p	M50790 M51014L M51143AL	600p 120p 110p	SAA1274 SAA1290 SAA1293	280p 750p 550p	STK080 STK082	550p 2000p	STK4412 STK4432	450p 600p	STK73605 STK73907	375p 700p	TA7054 TA7061	190p 115p	TA7405P TA7411AP	200p 150p
L294 L295	475p 450p	LA4476 LA4480	225p 225p 225p	LB1292 LB1405	110p 70p	M51161 M51161 M51161P	300p 250p	SAA1294 SAA1300	800p 200p	STK084 STK085 STK086	600p 900p 1000p	STK4773 STK4793 STK4803	820p 800p 1000p	STK78617 STR370 STR371	2400p 300p 400p	TA7062 TA7066 TA7075P	200p 120p 300p	TA7415P TA7417AP	350p 225p
L297 L298	525p 400p	LA4485 LA4495	300p 250p	LB1407 LB1409	130p 200p	M51162P M51164AL	250p 80p	SAA1310 SAA1350	200p 275p	STK0100 STK0100II	900p 1200p	STK4813 STK4833	800p 850p	STR380 STR381	350p 390p	TA7089 TA7102P	300p 500p	TA7521P TA7607	350p 200p
L465A L482	525p	LA4496 LA4498	250p 275p	LB1412 LB1415	300p 100p	M51166P M51182L	300p	SAA1351 SAA1900S	750p 475p	STK420 STK430	400p 500p	STK4843	720p 1700p	STR383 STR384	410p 350p	TA7119 TA7120	150p 55p	TA7608 TA7609	360p
L497B L702B	525p 400p	LA4500 LA4505	200p 220p	LB1416 LB1426	85p 125p	M51191L M51231P	85p 200p	SAA3004 SAA3006P	400p 225p	STK433 STK435	400p 375p	STK4863	700p 1100p	STR440 STR441	800p 950p	TA7124 TA7130P	250p 85p	TA7611 TA7612	210p 300p
L702N L2720	325p 150p	LA4508 LA4510	200p 100p	LB1450 LB1615	110p 270p	M51308SP M51310AP	550p 900p	SAA3007P SAA3008P	130p 200p	STK436 STK437	430p 600p	STK4893 STK4913	1000p 900p	STR442 STR450A	1600p 700p	TA7137 TA7140	60p 100p	TA7613AP TA7614	90p 170p
L2722 L4960	175p 325p	LA4520 LA4550	170p 200p	LB1620 LB1622	210p 220p	M51316P M51320	300p 200p	SAA3010P SAA3027P	300p 375p	STK439 STK441	500p 680p	STK5314 STK5315	475p 500p	STR451 STR452	800p 600p	TA7141 TA7150P	825p 250p	TA7616 TA7621	300p 300p
L6203 L6210	600p 250p	LA4555 LA4557	120p 150p	LB1630 LB1639	80p 300p	M51356P M51358P	400p 150p	SAA3049P SAA4700	550p 425p	STK443 STK457	700p 470p	STK5322 STK5323	500p 600p	STR453 STR454	500p 1300p	TA7157 TA7172P	100p 150p	TA7622 TA7628	420p 110p
L6221AS L6506 LA1130	300p 300p	LA4558 LA4570 LA4571	125p 130p	LB1640 LB1641 LB1642	150p 75p	M51365P M51366P	350p 360p	SAA5000 SAA5010	200p 220p	STK459 STK460	560p 660p	STK5324 STK5325	450p 370p	STR455 STR456	550p 470p	TA7193 TA7200	320p 200p	TA7629 TA7630	220p 200p
LA1135	240p 120p	LA4581	175p 175p	LB1645	150p 100p	M51381P M51384AP	200p 750p	SAA5012 SAA5020	400p 350p	STK461 STK463	600p 950p	STK5326 STK5330	750p 850p	STR457 STR470	600p 400p	TA7207	1200p 150p	TA7632 TA7640	400p
LA1145 LA1150 LA1170	200p 150p 90p	LA4597 LA4620 LA4630	125p 400p 325p	LB1648 LB1649 LB3500	200p 190p 125p	M51387P M51392P M51393AP	600p 300p 350p	SAA5030 SAA5040A SAA5040B	440p 280p 400p	STK465 STK501 STK561	900p 550p 450p	STK5331 STK5332 STK5333	300p 180p 650p	STR1096 STR1195 STR1229	275p 350p 325p	TA7208 TA7210 TA7214	125p 200p 220p	TA7641 TA7644BP	90p 140p 480p
LA1177 LA1180	130p 75p	LA4700 LA4705	350p 400p	LC4966 LC7011	65p 500p	M51395AP M51395AP M51397AP	450p 425p	SAA5040B SAA5041 SAA5042	550p 425p	STK563 STK583	415p 500p	STK5335 STK5336	350p 350p 350p	STR2005 STR2012	400p 400p	TA7217 TA7220	145p 220p	TA76545P TA7658	65p
LA1185 LA1186	150p 35p	LA5005 LA5112	90p 200p	LC7060 LC7120	600p	M51436P M51496P	350p	SAA5050 SAA5051	650p 400p	STK760 STK770	600p 400p	STK5336 STK5337 STK5338	500p 295p	STR2013 STR2015	300p 550p	TA7222 TA7223	90p 210p	TA7659P	100p 400p
LA1201 LA1205	75p 75p	LA5511 LA5512	50p 50p	LC7130 LC7131	300p 260p	M51533 M51544	300p 150p	SAA5052 SAA5054	500p 500p	STK772 STK772B	650p	STK5339 STK5340	400p 350p	STR2024 STR2105	575p	TA7225 TA7226	300p 290p	TA7660P TA7666P	325p 100p
LA1207 LA1210	120p 140p	LA5522 LA5523	45p 150p	LC7132 LC7137	400p 450p	M51848 M54523P	150p 200p	SAA5230 SAA5231	850p 170p	STK780 STK795	575p 450p	STK5342 STK5343	245p 380p	STR2124 STR3105	675p 525p	TA7227 TA7230	700p 100p	TA7668 TA7672	100p 400p
LA1222 LA1230	80p 130p	LA5524 LA5527	80p 150p	LC7181 LC7185	350p 350p	M54563P M58484	200p 500p	SAA5240PA SAA5243PE	600p 360p	STK1039 STK1040	460p 640p	STK5353 STK5361	400p 375p	STR3113 STR3115	225p 400p	TA7232 TA7233	95p 120p	TA7676AP TA7679	450p 475p
LA1235 LA1240	130p 80p	LA5530 LA5531	65p 65p	LC7191 LC7207	300p 275p	M51516 M51518	260p 200p	SAA5244AP SAA5246AP	950p 380p	STK1049 STK1050	700p 650p	STK5362 STK5372	400p 260p	STR3123 STR3125	400p 480p	TA7237 TA7238	300p 400p	TA7680AP TA7681AP	200p 425p
LA1245 LA1260	110p 75p	LA5537 LA5655	45p 175p	LC7215 LC7217	160p 350p	M51995P M51977P	250p 300p	SAA5246P SAA5250P	750p 750p	STK1060 STK1070	700p 850p	STK5373 STK5391	375p 375p	STR3130 STR3135	500p 250p	TA7240 TA7241	160p 165p	TA7687AP TA7688	100p 150p
LA1261 LA1265 LA1266	75p 125p 130p	LA5658 LA5665	225p 250p	LC7218 LC7230	250p 700p	M52307P M54646AP	900p 400p	SAA5351 SAA7000	375p 550p	STK1080 STK2025	940p 620p	STK5392 STK5421	500p 450p	STR3212 STR3214	275p 275p	TA7242 TA7243	190p 320p	TA 7698 TA 7699	400p 600p
LA1266 LA1267 LA1354	130p 150p 225p	LA5667 LA5700 LA6339	200p 300p 35p	LC7267 LC7351 LC7364	550p 200p 200p	MB3708 MB3712 MB3713	275p 600p 130p	SAA7020 SAA7210P	600p 1300p 550p	STK2028 STK2029	500p 480p	STK5422 STK5431 STK5434	375p 550p	STR3215 STR3315 STR40904	275p 275p	TA7245 TA7245BPO	225p 200p	TA7705 TA7709P	300p 150p
LA1363 LA1364	90p 200p	LA6355 LA6510	50p 150p	LC7432 LC7522	200p 425p 350p	MB3714 MB3715	225p 250p	SAA7220PA SAA7274P SAA7280P	600p 1450p	STK2030 STK2038 STK2048	1000p 700p 950p	STK5434 STK5436 STK5441	570p 500p 400p	STR4090A STR4142 STR4211	650p 450p 315p	TA7248P TA7250B TA7251BP	575p 325p 325p	TA7719P TA7727P	200p 125p
LA1365 LA1368	120p 220p	LA6515 LA6520	150p 175p	LC7535 LC7537AN	300p 400p	MB3713 MB3722 MB3730	200p 900p	SAA9050 SAA9057	450p 475p	STK2058IV STK2101	1600p 1050p	STK5441 STK5443 STK5446	575p 350p	STR4512 STR5015	400p 500p	TA7256P TA7259P	225p 225p 225p	TA7750 TA7757	200p 200p
LA1369 LA1385	200p 170p	LA6531 LA7007	250p 400p	LC7537AIN LC7537N LC7560	450p 750p	MB3731 MB3732	220p 240p	SAB0600 SAB0601	600p 525p	STK2110 STK2125	550p 580p	STK5451 STK5461	390p 500p	STR5100 STR5214	550p 475p	TA7262P TA7263P	400p 325p	TA7769 TA7772P	130p 150p
LA1503 LA1805	120p 175p	LA7011 LA7016	220p 45p	LC7565 LC7582E	300p	MB3735 MB3756	400p 160p	SAB0602 SAB1009BP	625p 225p	STK2129 STK2139	750p 675p	STK5462 STK5464	500p 300p	STR5315 STR5412	575p 280p	TA7265AP TA7267	300p 220p	TA7784 TA7792P	250p 250p
LA1810 LA1851	130p 300p	LA7018 LA7019	100p 130p	LC7800 LC7815H	175p 175p	MB3759 MB3771	200p 110p	SAB1016 SAB1046P	600p 350p	STK2155 STK2230	900p 470p	STK5466 STK5467	500p	STR6020 STR7001	270p 600p	TA7267BP TA7269	120p 260p	TA7796P	75p
LA2000 LA2001	150p 200p	LA7033 LA7042	400p 280p	LC7818 LC7820	280p 325p	MB3773 MB8719	110p 360p	SAB2015P SAB2016P	525p 150p	STK2240 STK2250	740p 650p	STK5468 STK5471	300p 900p	STR9005 STR9012	400p 300p	TA7270 TA7271	170p 220p	TA8101N TA8105N	230p 140p
LA2101 LA2110	270p 150p	LA7046 LA7051	300p 130p	LC7821N LC7822N	250p 160p	MC1391 MC1455	120p 45p	SAB2022P SAB3012	525p 675p	STK3041 STK3042	370p 375p	STK5472 STK5473	375p 480p	STR10006 STR11006	450p 325p	TA7272 TA7273	260p 300p	TA8110AP TA8119P	110p 70p
LA2200 LA2205	190p 150p	LA7053 LA7054	130p 350p	LC7881B LC7881M	135p 325p	MC1488 MC1489	35p 35p	SAB3013 SAB3017	200p 320p	STK3044 STK3062	950p 500p	STK5474 STK5476	500p 350p	STR12006 STR13006	450p 500p	TA7274 TA7279P	210p 325p	TA8122AN TA8127N	250p 100p
LA2211	350p	LA7060	150p	LF347	110p	MC1496	65p_	SAB3021	450p	STK3082	550p	STK5477	450p	STR15006	500p	TA7280	190p	TA8132AN	200p

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Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part Pr	ice Pa	rt	Price	Part	Price	Part	Price
TA8164P TA8184P TA8189P	100p 350p 130p	TDA1180 TDA1185A TDA1190	120p 190p 80p	TDA2760 TDA2780 TDA2791	400p 600p 275p	TDA4661 TDA4670 TDA4680	225p 475p 350p	TDA8391 TDA8395 TDA8405	675p 360p 550p	UPC1004C UPC1009 UPC1018	130p 950p 170p	2SA773 5 2SA777 3	Op 2S 5p 2S	A1177 A1179 A1182 A1184	25p 20p 20p 120p	2SB561 2SB562 2SB564 2SB566	30p 20p 15p 90p	2SC738 2SC739 2SC761 2SC762	15p 150p 110p 150p
TA8200AH TA8201AK TA8205	325p 300p 220p	TDA1200B TDA1220 TDA1235	80p 50p 300p	TDA2795 TDA2822M TDA2824	150p 60p 85p	TDA4685 TDA4700A TDA4714C	350p	TDA8415 TDA8416 TDA8417	650p 625p 550p	UPC1020 UPC1023 UPC1024H 2	200p 60p 75p	2SA781 15 2SA786 2	Op 2S 5p 2S	A1185 A1186	200p 500p	2SB596 2SB598	50p 30p	2SC783 2SC790	85p 50p
TA8207K TA8210 TA8211AH	175p 260p 200p	TDA1236 TDA1251 TDA1270	240p 150p 150p	TDA2840 TDA3047 TDA3048	200p 100p 130p	TDA4716C TDA4718A TDA4725	450p 250p 750p	TDA8421 TDA8425 TDA8432	300p 500p 550p	UPC1025 UPC1026 UPC1028	230p 95p 90p	2SA798 3 2SA812 1	Op 2S 5p 2S	A1198 A1201 A1202	40p 40p 25p	2SB600 2SB601 2SB605	500p 60p 25p	2SC792 2SC805 2SC828	380p 225p 20p
TA8214K TA8215 TA8216H	260p 300p 300p	TDA1327 TDA1405 TDA1410	200p 50p 220p	TDA3082 TDA3083 TDA3190	200p 200p 100p	TDA4800 TDA4810 TDA4814A	300p 500p	TDA8433 TDA8440 TDA8442	600p 300p 200p	UPC1031H UPC1032 UPC1035C	150p 60p 110p	2SA816 7 2SA817 2	Op 2S	A1204 A1206 A1207	225p 60p 25p	2SB631 2SB632 2SB633	40p 45p 80p	2SC829 2SC839 2SC867	15p 20p 900p
TA8217P TA8220AH TA8221AH	120p 500p 600p	TDA1412 TDA1506 TDA1508	35p 275p 175p	TDA3301B TDA3310 TDA3410	1600p 120p 150p	TDA4850 TDA4851 TDA4852	475p 325p 325p	TDA8443 TDA8444 TDA8451	350p 200p 325p	UPC1043C UPC1158H UPC1161	125p 70p 110p	2SA836 2 2SA837 20	Op 2S Op 2S	A1208 A1209 A1210	70p 100p 120p	2SB641 2SB647 2SB648	12p 20p 45p	2SC870 2SC897 2SC900B	100p 175p 30p
TA8225H TA8225L TA8227	475p 475p 250p	TDA 1510 TDA 1512 TDA 1514A	170p 140p 325p	TDA3420 TDA3501 TDA3502	200p 300p 360p	TDA4860 TDA4866 TDA4881	200p 275p 200p	TDA8452 TDA8453 TDA8461	200p 350p 950p	UPC1167 UPC1170 UPC1173	125p 150p 200p	2SA841 2	20p 2S	A1215 A1216 A1217	600p 550p 100p	2SB649 2SB673 2SB676	35p 100p 85p	2SC930 2SC936 2SC941	15p 300p 15p
TA8229K TA8400P TA8410K	200p 200p 200p 200p	TDA1515A TDA1516Q TDA1517	200p 350p 150p	TDA3502 TDA3504 TDA3505 TDA3506	300p 275p 260p	TDA4935 TDA4940 TDA4942	300p 200p 200p	TDA8490 TDA8540 TDA8702	225p 250p 275p	UPC1176C UPC1178H UPC1180C	120p 250p 200p	2SA847 2 2SA854 3	5p 2S 0p 2S	A1220 A1221 A1222	75p 70p 50p	2SB688 2SB703 2SB705	90p 90p 200p	2SC944 2SC945 2SC950	140p 10p 40p
TA8410P TA8432	200p 200p	TDA1519 TDA1519A	200p 200p	TDA3507 TDA3510	450p 200p	TDA4944 TDA4950 TDA5030A	175p 100p	TDA8703 TDA8708 TDA8730	500p 600p 225p	UPC185H2 UPC1186 UPC1187	400p 80p 150p	2SA872 2 2SA872A 5	5p 2S 0p 2S	A1226 A1227 A1232	25p 250p 180p	2SB707 2SB716 2SB718	200p 20p 60p	2SC959 2SC980 2SC982	225p 40p 20p
TA8605N TA8606N TA8607P	350p 350p 320p	TDA1520 TDA1521 TDA1522	275p 210p 110p	TDA3520 TDA3530 TDA3540	250p 250p 200p	TDA5140A TDA5330T	200p 300p	TDA8732 TDA8735 TDA8740	300p 175p 625p	UPC1188H UPC1191 UPC1197	350p 300p 140p	2SA884 10 2SA885 3	0p 2S 5p 2S	A1237 A1238 A1239	25p 30p 30p	2SB727 2SB733 2SB734	100p 75p 35p	2SC983 2SC1000 2SC1001	120p 20p 950p
TA8611AN TA8615N TA8628N	250p 480p 350p	TDA1524 TDA1526 TDA1534	200p 225p 2000p	TDA3541 TDA3560 TDA3561	175p 260p 300p	TDA5331T TDA5332T TDA5500	200p 150p 400p	TDA8741 TDA88081	550p 325p	UPC1198H UPC1210 UPC1215V	200p 150p 125p	2SA887 2 2SA893 1	20p 2S 5p 2S	A1240 A1242 A1244	45p 80p 120p	2SB737 2SB739 2SB744	20p 22p 55p	2SC1008 2SC1010 2SC1012	20p 225p 75p
TA8631 TA8632N TA8644N	500p 550p 425p	TDA 1540 TDA 1541 TDA 1542	420p 500p 250p	TDA3561A TDA3562 TDA3562TF	300p 260p 300p	TDA5600 TDA5660P TDA5700	450p 250p 200p	TDA88091 TDA9045 TDA9080	300p 400p	UPC1222 UPC1225H UPC1227V	130p 220p 225p	2SA899 4 2SA900 4	10p 2S 15p 2S	A1245 A1246 A1248	55p 80p 35p	2SB750 2SB753 2SB754	60p 100p 80p	2SC1013 2SC1014 2SC1030	170p 140p 150p
TA8646 TA8653N TA8659AN	375p 1500p 900p	TDA1543 TDA1552Q TDA1553AC		TDA3563 TDA3564 TDA3565	350p 325p 220p	TDA5701 TDA5708 TDA5709	200p 275p 375p	TDA91020 TDA9403 TDA9500	130p 750p	UPC1228HA UPC1230	45p 200p	2SA907 65 2SA909 50	0p 2S	A1249 A1252 A1253	100p 20p 30p	2SB764 2SB765 2SB772	30p 70p 25p	2SC1046 2SC1047 2SC1050	250p 20p 280p
TA8690N TA8691N TA8701AN	700p 450p 275p	TDA1555Q TDA1557Q TDA1558Q	375p 300p 300p	TDA3566 TDA3567 TDA3569	280p 350p 300p	TDA5800 TDA5820 TDA5832	850p 370p 125p	TDA9503 TDA9513 TDA9800	550p 225p 225p	UPC1237HA UPC1238 UPC1241H	120p 150p	2SA913 10 2SA914 9	00p 2S 00p 2S	A1256 A1257	30p 30p 70p	2SB774 2SB775 2SB776	50p 100p 110p	2SC1051 2SC1061 2SC1069	250p 85p 175p
TA8718N TA8720 TA8739P	550p 525p 450p	TDA1560Q TDA1571 TDA1572	675p 300p 175p	TDA3570 TDA3580 TDA3586	375p 300p 750p	TDA5850 TDA5930 TDA61000	175p 225p 150p	TDA9821 TEA0652 TEA0653T	200p 150p 80p	UPC1242H UPC1245V UPC1270H	150p 130p 250p	2SA916 3 2SA921 4	30p 25 10p 25	A1258 A1261 A1262	150p 110p	2SB788 2SB791 2SB794	35p 130p 40p	2SC1070 2SC1079 2SC1080	65p 300p 225p
TA8872N TAA550 TBA120S	450p 25p 40p	TDA1574 TDA1576 TDA1578A	125p 170p 210p	TDA3590 TDA3591 TDA3592A	250p 360p 300p	TDA61010 TDA61110 TDA6200	225p 750p	TEA0655 TEA0665 TEA1002	300p 300p 650p	UPC1274V UPC1277 UPC1278	250p 240p 240p	2SA933 3 2SA934 3	30p 2S	A1263 A1264 A1265	280p 280p 200p	2SB795 2SB810	45p 15p 160p	2SC1096 2SC1098 2SC1106	40p 120p 180p
TBA396 TBA520 TBA530	70p 120p 100p	TDA1579 TDA1589 TDA1591	130p 275p 275p	TDA3601Q TDA3602 TDA3611	375p 225p 450p	TDA6600- TDA6610- TDA6612-	2 1100p 2 900p	TEA1007 TEA1009 TEA1015F		UPC1288V UPC1297CA UPC1298	320p	2SA937 2 2SA939 14	20p 29	A1283 A1284 A1286	50p 60p 60p	2SB816 2SB817 2SB819	175p 60p	2SC1114 2SC1115	415p 280p
TBA540 TBA560 TBA800	90p 90p 40p	TDA1596 TDA1598 TDA1600	200p 160p 200p	TDA3640 TDA3645 TDA3651	350p 400p 200p	TDA7000 TDA7010T TDA7020T	175p	TEA1017 TEA1019 TEA1024	280p 130p 150p	UPC1313H A UPC1316C UPC1318	70p 300p	2SA942 6 2SA949 7	30p 29 70p 29	A1289 A1290 A1293	50p 150p 110p	2SB822 2SB824 2SB825	40p 60p 135p	2SC1116 2SC1124 2SC1161	290p 270p 110p
TBA810AS TBA820 TBA820M	40p 55p 35p	TDA1602A TDA1670A TDA1675	400p 200p 200p	TDA3652 TDA3652-TX TDA3653	500p 10800p 85p	TDA7021T TDA7050 TDA7052	200p 100p 120p	TEA 1035 TEA 1039 TEA 1045	200p 150p 300p	UPC1330HA UPC1335V UPC1350	320p 115p	2SA951 6 2SA952 3	30p 25	A1294 A1295 A1301	450p 500p 260p	2SB826 2SB827 2SB828	75p 200p 200p	2SC1162 2SC1164 2SC1165	30p 600p 750p
TBA920 TBA950 TBA990	100p 100p 60p	TDA1701 TDA1771 TDA1870A	500p 200p 200p	TDA3654 TDA3654Q TDA3710	80p 85p 300p	TDA7053 TDA7056 TDA70570	200p 200p	TEA1060 TEA1061 TEA1062	225p 175p 250p	UPC1352C UPC1360C UPC1362C	450p 200p 250p	2SA954 3	30p 29 35p 29	A1302 A1303 A1304	300p 400p 110p	2SB829 2SB835 2SB857	200p 75p 80p	2SC1166 2SC1170 2SC1172	100p 180p 150p
TC5020 TC5081AP TC5082P	200p 80p 170p	TDA1872A TDA1904 TDA1905	275p 80p 80p	TDA3720 TDA3724 TDA3725	175p 300p 300p	TDA7072 TDA7077 TDA7211	100p 175p 100p	TEA1064 TEA1067 TEA1068	250p 150p 350p	UPC1363 UPC1363C UPC1364C	190p 300p 350p	2SA963 12	2 0p 29	A1306 A1307 A1309	110p 100p 50p	2SB861 2SB863 2SB865	110p 220p 25p	2SC1173 2SC1195 2SC1212	33p 210p 35p
TC5092P TC5090A TC9125BP TC9130P	230p 410p 150p	TDA1908A TDA1910 TDA1940	90p 160p 180p	TDA3730 TDA3740 TDA3750	400p 400p 400p	TDA7220 TDA7222 TDA72304	65p 100p	TEA1080F TEA1087 TEA1101	170p 40p 425p	UPC1365 UPC1366C UPC1370C	250p 130p 300p	2SA966 2 2SA968 5	25p 25 55p 25	A1315 A1317 A1318	100p 30p 20p	2SB882 2SB885 2SB891	180p 45p 35p	2SC1213 2SC1214 2SC1215	10p 15p 25p
TC9134 TC9135P	750p 125p	TDA 1941 TDA 1950 TDA 2002	300p 175p	TDA3755 TDA3760 TDA3765V	425p 350p 225p	TDA7231A TDA7233 TDA7240		TEA1330 TEA1511 TEA2000	65p 150p 500p	UPC1373 UPC1377C	85p 200p 1000p	2SA979 3 2SA984 2	35p 29 25p 29	A1319 A1320 A1321	25p 45p 80p	2SB892 2SB895 2SB908	25p 60p 70p	2SC1216 2SC1222 2SC1226	200p 15p 75p
TC9137P TC9138AP TC9142	500p 150p 320p	TDA2003 TDA2004	50p 65p 150p	TDA3771 TDA3780	460p 400p	TDA7241 TDA7245	250p 225p 400p	TEA2018A TEA2018A TEA2019	80p	UPC1379C UPC1382 UPC1384	170p 110p 425p	2SA988 2 2SA991 3	25p 29 30p 29	A1327 A1329 A1346	130p 200p 20p	2SB926 2SB941 2SB950	30p 60p 180p	2SC1237 2SC1247A 2SC1252	250p 35p 850p
TC9143 TC9145 TC9148	300p 150p 200p	TDA2005 TDA2006 TDA2007	150p 70p 120p	TDA3791 TDA3800 TDA3803A	200p 250p 500p 200p	TDA7250 TDA7255 TDA7256 TDA7262	400p 400p 400p 325p	TEA2025E TEA2028 TEA2028E	75p 325p	UPC1387C UPC1394 UPC1397	250p 120p 350p	2SA993 5 2SA995 6	50p 29 50p 29	A1348 A1352 A1353	45p 100p 100p	2SB951 2SB953 2SB975	190p 90p 100p	2SC1278 2SC1279 2SC1308K	110p 30p 350p
TC9149 TC9150 TC9151P	225p 425p 425p	TDA2008 TDA2009 TDA2010	100p 160p 150p	TDA3810 TDA3825 TDA3827	150p 110p	TDA7272 TDA7273 TDA7274	170p 80p 45p	TEA20290 TEA20290	650p	UPC1403CA UPC1406HA UPC1420CA	650p	2SA1005 2 2SA1006 9	25p 29 90p 29	A1356 A1357 A1358	100p 65p 130p	2SB985 2SB986 2SB1009	30p 40p 110p	2SC1312 2SC1318 2SC1325	40p 10p 400p
TC9152 TC9153 TC9154AP	425p 300p 225p	TDA2020 TDA2030 TDA2030H	120p 80p 100p	TDA3840 TDA3842 TDA3843	200p 200p 200p 225p	TDA7275 TDA7282 TDA7284	75p 50p 100p	TEA2037 TEA2114 TEA2117	200p 200p 200p 450p	UPC1423CA UPC1423CA UPC1470	650p	2SA1009 20 2SA1010 22	25p 25	A1359 A1360 A1362	45p 45p 25p	2SB1010 2SB1012 2SB1015	25p 55p 60p	2SC1327 2SC1328 2SC1342	20p 15p 15p
TC9156 TC9158P TC9162	300p 450p 275p	TDA2040 TDA2048 TDA2051V	140p 600p 450p	TDA3845 TDA3856 TDA3857	300p 200p	TDA7302 TDA7310	450p 800p	TEA2130 TEA2164	350p 160p 225p	UPC1474HA UPC1484CA UPC1488H	75p	2SA1012 8 2SA1013 10	85p 29 00p 29	SA1370 SA1371 SA1376	50p 100p 30p	2SB1016 2SB1017 2SB1018	130p 40p 130p	2SC1343 2SC1345 2SC1346	200p 15p 100p
TC9163 TC9164 TC9167P	375p 400p 100p	TDA2052V TDA2054M TDA2107	250p	TDA3950 TDA4001 TDA4050	225p 250p 150p	TDA7313 TDA7318 TDA73304		TEA2260 TEA2261 TEA2262	185p 275p	UPC1498H UPC1505C	500p 400p	2SA1016 3 2SA1018 10	30p 29 00p 29	SA 1380 SA 1381 SA 1382	75p 100p 120p	2SB1020 2SB1039 2SB1066	120p 65p 40p	2SC1358 2SC1359 2SC1360	270p 15p 70p
TC9172P TC9174P TC9176P	300p 325p 500p	TDA2151 TDA2170	325p 375p 1300p	TDA4052 TDA4060 TDA4092	500p 500p 250p	TDA7350 TDA7359 TDA7360	300p 300p 700p	TEA37170 TEA37180 TEA5030	175p 135p	UPC1513HA UPC1514CA UPC1515CA	200p 250p	2SA1021 3 2SA1023 6	35p 29 60p 29	SA1385 SA1386 SA1387	180p 400p 75p	2SB1068 2SB1077 2SB1098	160p 180p 80p	2SC1364 2SC1368 2SC1382	25p 75p 40p
TC9177P TCA9940 TCEP100	225p 100p 100p	TDA2220 TDA2270 TDA2320	200p 250p 80p	TDA4100 TDA4173A TDA4180	145p	TDA7361 TDA7370\ TDA7374\	/ 350p	TEA5040 TEA5101 TEA5110	175p	UPC1520CA UPC1521HA UPC1536C	120p 550p	2SA 1029 2SA 1036	BOp 29 BOp 29	SA1396 SA1399 SA1400	120p 25p 150p	2SB1099 2SB1109 2SB1123	75p 40p 50p	2SC1383 2SC1384 2SC1393	25p 20p 20p
TD62308A TD62382 TD62506	200p 200p	TDA2501 TDA2502 TDA2503	300p 175p 200p	TDA4190 TDA4200 TDA4210	180p 300p 160p	TDA7770 TDA8114 TDA8115	140p 225p 200p	TEA5114 TEA5115 TEA5116	220p 220p	2SA329 2SA467 2SA473	75p 40p 29p	2SA1038 2SA1048	40p 29 25p 29	SA1423 SA1428	30p 35p	2SB1133 2SB1134	50p 65p 60p	2SC1394 2SC1398 2SC1399	15p 55p 100p
TD62705 TD6304AP TD6306P	350p	TDA2504 TDA2505 TDA2506	200p 220p 400p	TDA4260 TDA4280 TDA4282	250p 320p 360p	TDA8116 TDA81200 TDA8124	250p	TEA5170 TEA5500 TEA5501	200p 325p 225p	2SA483 2SA484 2SA489	90p 80p 50p	2SA1052 2SA1060 12	15p 29 20p 29	SA1441 SA1442 SA1443	110p 110p 130p	2SB1135 2SB1140 2SB1143 2SB1151	45p 40p 75p	2SC1400 2SC1403 2SC1407	50p 500p 50p
TD6350P TD6359P TDA1001	200p 300p 200p	TDA2507 TDA2507T TDA2510	450p 450p 450p	TDA4283T TDA4290 TDA4400	450p 125p 175p	TDA8134 TDA8135 TDA8136	225p 225p 225p	TEA5550 TEA5560 TEA5570	150p 130p 85p	2SA490 2SA493 2SA495	45p 25p 40p	2SA1069 15 2SA1073 3	50p 29 75p 29	A1450 A1459 A1462	30p 40p 25p	2SB1162 2SB1163	400p 370p 50p	2SC1417 2SC1419 2SC1419 2SC1426	150p 50p 700p
TDA 1002 TDA 1003 TDA 1005A		TDA2514A TDA2515 TDA2530	500p 450p 300p	TDA4420 TDA4421 TDA4426	120p 300p 170p	TDA8137 TDA8138 TDA8138	200p 200p 130p	TEA5580 TEA5581 TEA5591	165p 200p 200p	2SA496 2SA505 2SA509	30p 120p 35p	2SA1077 30 2SA1080 12	00p 29 25p 29	SA1469 SA1475 SA1488	100p 95p 150p	2SB1168 2SB1182 2SB1185 2SB1202	40p 50p 45p	2SC1429 2SC1431 2SC1444	50p 400p 275p
TDA1010A TDA1011 TDA1012	75p 120p	TDA2532 TDA2540 TDA2541	100p 150p 70p	TDA4427 TDA4431 TDA4433	200p 150p 100p	TDA81381 TDA8139 TDA8140	200p 200p	TEA5620 TEA5630 TEA5640I		2SA537 2SA539 2SA544	170p 20p 650p	2SA1082 2SA1083	80p 29 20p 29	SA1489 SA1490 SA1491	300p 225p 300p	2SB1203 2SB1204	45p 45p	2SC1445 2SC1446	350p 55p 70p
TDA1013A TDA1015 TDA1016	110p 85p 140p	TDA2542 TDA2543 TDA2544	110p 210p 200p	TDA4437 TDA4439 TDA4440	125p 220p 180p	TDA8143 TDA8145 TDA8146	160p 120p 200p	TEA5701 TEA6000 TEA6100	650p 400p 350p	2SA550 2SA562 2SA564	150p 30p 15p	2SA1085 2SA1091 16	75p 29 00p 29	SA1492 SA1493 SA1494	260p 500p 450p	2SB1205 2SB1223 2SB1243	40p 60p 40p	2SC1447 2SC1449 2SC1450	120p 200p
TDA1020 TDA1022 TDA1023	110p 330p 130p	TDA2545 TDA2546A TDA2548	120p 200p 200p	TDA4442 TDA4443 TDA4445	240p 250p 220p	TDA8160 TDA8170 TDA8172	125p 170p 200p	TEA6200 TEA6300 TEA6310	225p 500p 425p	2SA571 2SA603 2SA606	650p 100p 200p	2SA1094 19 2SA1095 36	90p 29	SA1516 SA1519 SA1523	280p 20p 45p	2SB1274 2SB1282 2SB1318	40p 300p 40p	2SC1454 2SC1470 2SC1472	250p 120p 40p
TDA1024 TDA1025 TDA1028	150p 320p 175p	TDA2549 TDA2555 TDA2556	300p 175p 230p	TDA4450 TDA4452 TDA4453	225p 250p 275p	TDA8173 TDA8174 TDA8175	175p 200p 300p	TEA6414 TEA6415 TEA6420	360p	2SA608 2SA614 2SA628	15p 150p 20p	2SA1102 13 2SA1103 13	30p 29 30p 29	SA1535 SA1538 SA1540	175p 55p 50p	2SB1375 2SB1382 2SB1468	45p 350p 100p	2SC1473 2SC1474 2SC1501	15p 45p 70p
TDA1029 TDA1035 TDA1038	200p 160p 500p	TDA2557 TDA2558 TDA2574V	225p 400p 350p	TDA4480 TDA4481 TDA4482	280p 215p 200p	TDA8178 TDA81798 TDA8185	650p 750p 180p	TEA8172 TL431 TL494	125p 45p 100p	2SA634 2SA636 2SA639	50p 50p 60p	2SA1105 29 2SA1106 10	50p 29 60p 29	SA1598 SA1599 SA1600	220p 220p 250p	2SC182 2SC372 2SC380	75p 25p 10p	2SC1505 2SC1507 2SC1509	55p 45p 35p
TDA1041E TDA1041P TDA1044	250p	TDA2575A TDA2577A TDA2578A	100p 200p 200p	TDA4500 TDA4501 TDA4502	300p 280p 400p	TDA8190 TDA8191 TDA8192	200p 425p 200p	TLO61 TLO64 TLO71	40p 80p 38p	2SA640 2SA642 2SA643	60p 50p 25p	2SA1112 19 2SA1115	50p 29 30p 29	SA1601 SA1625 SA1626	200p 40p 90p	2SC388A 2SC394 2SC403	25p 60p 25p	2SC1514 2SC1515 2SC1520	35p 60p 45p
TDA1047 TDA1048 TDA1053	200p 200p 300p	TDA2579A TDA2582	210p 130p 170p	TDA4503 TDA4505A TDA4505E	325p 300p 275p	TDA8196 TDA8205 TDA8213	120p 1250p 175p	TLO74 TLO83 TLO84	80p 55p 70p	2SA673 2SA677 2SA678	15p 35p 26p	2SA1120 2SA1123 2SA1124	40p 25 40p 25 60p 25	SA1640 SA1652 SA1667	100p 70p 175p	2SC454 2SC458 2SC460	15p 10p 10p	2SC1541 2SC1545 2SC1567	110p 120p 40p
TDA 1053 TDA 1054 TDA 1057 TDA 1059E	180p 60p	TDA2591 TDA2591Q	110p 150p 80p	TDA4505K TDA4505M TDA4510	450p 1000p 200p	TDA8214I TDA8215I TDA8217	3 225p	TMP47C-43 TPU2732 TPU2735	84N 1250p 800p 500p	2SA683 2SA684 2SA699	25p 25p 100p	2SA1127 2SA1133 1: 2SA1135 1:	50p 2 20p 2 30p 2	SA1668 SA1671 SA1673	180p 310p 425p	2SC461 2SC495 2SC496	15p 45p 25p	2SC1568 2SC1569 2SC1570	35p 55p 40p
TDA1060 TDA1062 TDA1068	140p 140p 140p 75p	TDA2594 TDA2595	300p 200p 400p	TDA4532 TDA4555 TDA4556	200p 275p 370p	TDA8303 TDA8304 TDA8305	250p 400p 500p	UC3524 UC3842N UC3843	100p	2SA705 2SA706 2SA708	70p 140p 50p	2SA1141 20 2SA1142 10	00p 2 00p 2 15p 2	SA1680 SA1706 SB175	40p 25p 45p	2SC497 2SC515 2SC535	85p 100p 30p	2SC1571 2SC1573 2SC1576	50p 25p 550p
TDA1072 TDA1074 TDA1077	150p 280p 250p	TDA2611A TDA2616		TDA4557 TDA4560 TDA4565	200p 270p 150p	TDA8340 TDA8341 TDA8349	150p 250p	UC3844 UPC20C UPC554	70p 220p 130p	2SA711 2SA715	280p 50p 50p	2SA1145 2SA1146 26 2SA1151	40p 2: 00p 2: 30p 2:	SB324 SB337 SB474	40p 150p 250p	2SC536 2SC605 2SC619	20p 100p 100p	2SC1580 2SC1583 2SC1586	600p 25p 540p
TDA1082 TDA1083 TDA1085	275p 275p 95p 170p	TDA2640 TDA2653A	350p 350p 200p	TDA4566 TDA4568 TDA4570	250p 225p 200p	TDA7350 TDA8351	275p 200p N3 800p	UPC555 UPC556H UPC571	60p	2SA720 2SA725	20p 80p 20p	2SA1152 19 2SA1153 2SA1154	50p 2: 30p 2: 22p 2:	SB492 SB511 SB525	80p 55p 65p	2SC641 2SC644 2SC647	80p 10p 300p	2SC1617 2SC1619 2SC1623	340p 170p 50p
TDA 1087 TDA 1092	60p 100p	TDA2658 TDA2670	300p 150p	TDA4580 TDA4600	400p 200p	TDA83614 TDA8362A	N3 900p N 1200p S 1200p	UPC574 UPC5750 UPC577	60p	2SA733 2SA740	15p 90p 450p	2SA1156 2SA1162	90p 2: 30p 2:	SB527 SB531 SB536	130p 400p 80p	2SC681 2SC683 2SC708	250p 35p 100p	2SC1624 2SC1626 2SC1627	60p 55p 15p
TDA1097 TDA1151 TDA1154	475p 40p 50p	TDA2710-1 TDA2721	200p	TDA4600II TDA4601 TDA4605	160p 120p 190p 370p	TDA8362N TDA8366N TDA8372	2 1500p	UPC592 UPC595 UPC596	95p 190p 190p	2SA747A 2SA748	425p 60p 200p	2SA1169 5	00p 2:	SB537 SB544 SB546	90p 22p 45p	2SC710 2SC711 2SC730	15p 15p 350p	2SC1628 2SC1634 2SC1667	75p 50p 450p
TDA1170 TDA1170 TDA1175	85p 85p 175p	TDA2740	200p 300p 200p	TDA4610 TDA4650 TDA4660	370p 300p 200p	TDA8380 TDA8385 TDA8390	275p	UPC1001 UPC1004	220p	2SA769 2SA770	80p 200p	2SA1174	25p 2	SB549 SB560	50p 25p	L 2SC732	40p 40p	2SC1669 2SC1674	100p 15p

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	2SC1789	100p	2SC2320	10p	2SC2792	220p	2SC3307	600p	2SC388A	25p	2SD381	50p	2SD950	300p	2SD1396	120p	2SD1843	70p		
Section Prop. Section	2SC1810	250p	2SC2328A	50p	2SC2808	40p	2SC3310	125p	2SC3884A	200p	2SD386	70p	2SD957A	520p	2SD1398	120p	2SD1847	275p	2SK414	550p
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Second	2SC1829		2SC2331	50p	2SC2825	900p	2SC3328		2SC3892A	250p	2SD402	120p	2SD973	60p	2SD1405	80p	2SD1857	75p		
	2SC1834	50p	2SC2334	80p	2SC2827	130p	2SC3331	25p	2SC3895	325p	2SD415	55p	2SD982	90p	2SD1407	60p	2SD1863	35p		
	2SC1844	50p	2SC2336A	125p	2SC2834	280p	2SC3345	100p	2SC3897	400p	2SD426	150p	2SD986	120p	2SD1409	170p	2SD1877	175p	2SK531	350p
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Section Column	2SC1870	700p	2SC2365	280p	2SC2879	3200p	2SC3376	300p	2SC3953	50p	2SD525	50p	2SD1024	850p	2SD1426	135p	2SD1887	225p	2SK552	250p
	2SC1875	220p	2SC2371	25p	2SC2883	60p	2SC3378	120p	2SC3964	100p	2SD545	18p	2SD1030	75p	2SD1428	180p	2SD1895	225p	2SK555	320p
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	2SC1895	500p	2SC2389	45p	2SC2909	60p	2SC3383	80p	2SC3975	210p	2SD554	225p	2SD1046	200p	2SD1432	400p	2SD1913	50p	2SK559	600p
	2SC1906	15p	2SC2408	120p	2SC2911	80p	2SC3397	20p	2SC3996	600p	2SD556	225p	2SD1051	130p	2SD1438	60p	2SD1930	50p		
Section Sect	2SC1909		2SC2440	200p	2SC2921	650p	2SC3400		2SC3998	800p	2SD560		2SD1060		2SD1441	220p		60p		70p
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\$\frac{1}{2} \text{SCMM2}	2SC1921			55p		550p	2SC3405			325p					2SD1446	300p				
	2SC1923	10p	2SC2492	50p	2SC2934	75p	2SC3416	30p	2SC4043	45p	2SD600	30p	2SD1069	150p	2SD1451	200p	2SD1978	50p	2SK719	300p
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2501986 456 250200 256	2SC1946	1500p	2SC2491	200p	2SC2987	250p	2SC3425		2SC4123	230p		10p	2SD1128	200p	2SD1468	40p	2SD2011	60p		
22-198 10	2SC1953	45p	2SC2500	25p	2SC2995	60p	2SC3447	130p	2SC4125	275p	2SD638	15p	2SD1135	75p	2SD1494	150p	2SD2018	65p	2SK786	200p
250199 1906 250239 1906 250230 1906 250240 2502	2SC1959	10p	2SC2503	600p	2SC3001	1400p	2SC3457	125p	2SC4138	200p	2SD640	350p	2SD1140	40p	2SD1497	230p	2SD2061	100p		
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	2SC1971	400p	2SC2534	150p	2SC3026	450p	2SC3468	70p	2SC4199	400p	2SD669	35p	2SD1159	65p	2SD1509	100p	2SD2151	175p		
25C1988 300 25C784 300 25C393 800 25C	2SC1973	150p	2SC2538	100p	2SC3037	125p	2SC3482	275p	2SC4231	250p	2SD676	250p	2SD1163A	220p	2SD1519	250p	2SD2331	250p	2SK812	150p
\$25.188	2SC1980	30p	2SC2542	300p	2SC3039	80p	2SC3502	50p	2SC4236	450p	2SD718	85p	2SD1168	270p	2SD1525	450p	2SD2340	225p		
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28C2023 100	2SC2003	20p	2SC2553	200p	2SC3071	25p	2SC3514	170p	2SC4304	225p	2SD741	120p	2SD1192	90p	2SD1555	150p	2SJ103	75p	2SK952	275p
25C2023 180p 25C2883 200p 25C3975 150p 25C3928 45p 25C3828 270p 25C3938 270p 25C39													2SD1197							
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Section Sect	2SC2037	50p	2SC2577	110p	2SC3101	750p	2SC3552	270p	2SC4429	275p	2SD772	200p	2SD1213	220p	2SD1577	250p	2SJ162	680p		
28CZ028	2SC2055	150p	2SC2579	110p	2SC3114	40p	2SC3577	275p	2SC4466	325p	2SD774	30p	2SD1223	75p	2SD1589	60p	2SJ182	150p	2SK1081	700p
25C2081 75p 25C2888 600p 25C3122 50p 25C3895 270p 25C4817 25p 25C3897 75p 25C4817 25p 25C3897	2SC2060	40p	2SC2581	225p	2SC3117	120p	2SC3591	200p	2SC4468	250p	2SD784	650p	2SD1227	40p	2SD1591	310p	2SJ307	175p		
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2SC22085 100p 2SC2281 70p 2SC23157 30p 2SC3153 175p 2SC3308 65p 2SC4145 550p 2SD785 140p 2SC22092 100p 2SC22292 100p 2SC22292 100p 2SC22293 100p 2SC22293 100p 2SC23157 200p 2SC3315 200p 2SC33157 2SC331	2SC2075	60p	2SC2603	10p	2SC3151	175p	2SC3606	100p	2SC4542	400p	2SD792	400p	2SD1246	20p	2SD1632	320p	2SK68	100p		
28C2099 100p 28C2828 190p 28C3685 280p 28C3686 280p 28C3686 280p 28C3686 280p 28C3686 280p 28C3689 28C3689 280p 28C3689 2	2SC2085	100p	2SC2611	30p	2SC3153	175p	2SC3608	65p	2SC4744	350p	2SD795A	140p	2SD1251	180p	2SD1647	40p	2SK97	200p	2SK1217	700p
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25CQ199 25CQ99 25CQ99 25CQ99 25CQ99 25CQ368 25CQ 25CQ369 25CQ368 2							2SC3642	225p		200p						150p			2SK1296	350p
2SC2120	2SC2099	2500p	2SC2631	20p	2SC3164	270p	2SC3659	600p	2SC4769	220p	2SD819	300p	2SD1266	180p	2SD1663	350p	2SK118	50p	2SK1317	900p
2SC2131	2SC2120	10p	2SC2634	10p	2SC3170	300p	2SC3675	100p	2SC4820	225p	2SD821	550p	2SD1271	55p	2SD1667	120p	2SK133	650p		
28C2163 40p 28C2853 100p 28C3189 70p 28C3686 450p 28C4924 250p 28C985 50p 28C186 50p 28C186 25p 28K188 40p 28C1868 28C186 2	2SC2131	550p	2SC2637	120p	2SC3175	150p	2SC3679	140p	2SC4891	800p	2SD826	30p	2SD1272	200p	2SD1669	85p	2SK152	40p	2SK1342	500p
28C2166 80p 28C2854 180p 28C2855 50p 28C3180 175p 28C3868 50p 28C3867 300p 28C8872 300p 28C8882																				
2SC2188	2SC2166	80p	2SC2654	180p	2SC3180	175p	2SC3687	300p	2SC4927	500p	2SD836A	50p	2SD1275	50p	2SD1683	45p	2SK168	40p	2SK1357	350p
2SC2229	2SC2188	70p	2SC2656	550p	2SC3182	120p	2SC3692	150p	2SC5003	350p	2SD838	500p	2SD1277	190p	2SD1706	325p	2SK184	35p	2SK1377	150p
2SC2221 650p 2SC2871 100p 2SC3209 120p 2SC3747 120p 2SC3747 300p 2SC5188 300p 2SC5881 250p 2SC1881 270p 2SC3747 120p 2SC3747 300p 2SC5188 300p 2SC5881 270p 2SC3748 250p 2SC1881 370p 2SC3748 300p 2SC5881 270p 2SC3748 300p 2SC5881 270p 2SC3748 300p 2SC5888 27p 2SC3748 300p 2SC5888 300p	2SC2209	50p	2SC2665	200p	2SC3199	40p	2SC3717	120p	2SC5048	300p	2SD844	200p	2SD1288	175p	2SD1708	375p	2SK193	40p		250p
28C2223 15p 28C2828 70p 28C3211 220p 28C348 100p 28C5148 300p 28D863 23p 28D1293 70p 28D1793 275p 28C1714 170p 28C1818 300p 28D864 200p 28D1293 300p 28D1293 300p 28D1793 28D1792	2SC2221	650p	2SC2671	100p	2SC3209	120p	2SC3746	100p	2SC5086	250p	2SD856	48p	2SD1291	280p	2SD1718	275p	2SK197	140p	2SK1461	220p
28C2238 80p 28C2688 27p 28C3212 260p 28C3752 250p 28C5149 300p 28D866 220p 28D866 220p 28D866 28D8666 28D8666 28D866 28D8666 28D8666 28D8666 28D8666 28D8666 28D86																				
2SC2235 60p 2SC2894 3500p 2SC2795 40p 2SC23742 30p 2SC3782 75p 2SD188 350p 2SD867 140p 2SD1306 45p 2SD1740 125p 2SK240 140p 2SK1537 400p 2SC2237 540p 2SC2705 250p 2SC2244 45p 2SC2787 100p 2SD199 195p 2SD867 260p 2SD1309 140p 2SD1766 275p 2SK246 30p 2SK1547 400p 2SC2238 45p 2SC2710 50p 2SC3259 350p 2SC3788 60p 2SD200 180p 2SD868 260p 2SD1309 140p 2SD1766 275p 2SK246 30p 2SK1646 30p 2SK2238 45p 2SC2710 50p 2SC3259 350p 2SC3788 60p 2SD200 180p 2SD868 150p 2SD870 140p 2SD1760 60p 2SK300 25p 2SK2038 295p 2SC2258 30p 2SC2714 20p 2SC3261 230p 2SC3789 75p 2SD213 250p 2SD871 260p 2SD871 260p 2SD1313 100p 2SD1761 60p 2SK303 40p 2SK2039 750p	2SC2230	80p	2SC2688	27p	2SC3212	260p	2SC3752	250p	2SC5149	300p	2SD864	200p	2SD1297	300p	2SD1732	250p	2SK216	200p	2SK1507	300p
25C2235 240 25C2705 25C2346 49p 25C3478 300p 25D198 140p 25D868 250p 25D1748 90p 2	2SC2235	60p	2SC2694	3500p	2SC3242	30p	2SC3782	75p	2SD188	350p	2SD866A	140p	2SD1306	45p	2SD1740	125p	2SK240	140p		
25C2240 15p 25C2712 20p 25C3260 220p 25C3780 75p 25D201 260p 25D3731 165p 25D1731 65p 25p 25D1731 65p 25p 25D1731 65p 25p 25p 25p 25p 25p 25p 25p 25p 25p 2	2SC2237	540p	2SC2706	250p	2SC3246	50p	2SC3787	100p	2SD199	195p	2SD868	260p	2SD1309	140p	2SD1756	275p	2SK246	30p		900p
2SC2258 30p 2SC2714 20p 2SC3261 230p 2SC3790 120p 2SD379 120p 2SD213 250p 2SD871 260p 2SD1313 1000p 2SD1761 60p 2SK303 40p 2SK2039 750p	2SC2240	15p	2SC2712	20p	2SC3260	220p	2SC3789	75p	2SD201	260p	2SD870	140p	2SD1311	65p	2SD1760	80p	2SK301	40p	2SK2038	295p
	2SC2258 2SC2259	30p 60p	2SC2714 2SC2716	20p	2SC3261 2SC3262	230p 280p	2SC3790 2SC3795	120p 140p	2SD213 2SD234	250p	2SD871 2SD879	260p 60p					2SK303 2SK304	40p 25p		750p 225p

	REPLACI	EMENT VIDEO	O HEADS	
Model Price			Model Price NVFS 100 4500p	Model Price TLS1100 3100p
AKAI VS105, 112, 115, 116, 120, 125, 126, 201, 202, 205, 220, 240, 244, 245, 247, 248,	VHSAN3 800p VHSAY3 1200p VHSBH1, VHSCH1 2100p	3V32, 8942, HR7655 1800p	NVFS1 4200p N.E.C.	VHR120, 130, 14, 141, 143G, 14SP, 151, 15, 16, 171, 220, 23, 244, 274, VHR310,
250, 301, 303, 304, VSP8, VSP82 850p	VHSBP1 850p VHSBY3 2600p	HRD180, 190, 230, 610, 3V59, FV12L, FV20B, 26, 30, 32, 33, VC141L 1600p HRD370, HRD430, HRD470, 3V58, FV13H	N9011, 9012, 9013E, 9014E, 9014G, 9015, 9016, 901A, 902A, 9033, N9034, 9040,	330, 4100, 4105, 4200, 430, 4300, 4400, 4500, 5080, 5100, VHR5200, 5600, 6850, 7100, 7200, 7250,
VP7100, VS9300, VS9500 650p VP7200, VS9700, VS9800 900p VS1 900p	VHSEH2, VHSDH2 1600p VHSEY1, VHSEY2 1400p	1800p HRD530, HRD700, HRD840, HRD870,	9053, 9054, 9055, 9056, 9063, 9065, 9066, 906, 9077, N9096, DX1000, 1600, PX1200 850p	7300, 8070, 8100, 8101, 8200, VHR7800, 7810, 8000SP, 8801SP, VHRD4400, 4410,
VS2 900p VS3 900p	VHSFS1, VHSFS2 1300p VHSFG2, VHSFG4, VHSF63, VHSFB3 1300p	HRD910, FV14T, FV57H 2300p GRC1, GRC2, 3 V41 2800p BR9060, HRD330, 337, 440, 441, 637, 641,	N911A, 914C, 915A, 916A, 917, 9110, 9120 2400p PVC600, 740, 744, 754, 763E, 764,	4500, 4600, VHRD4610, 6700, 4800 3100p TLS2000 4250p
VSP1 900p VS33,35, 37, 38, 38EOG MKII, 53, 55, 66,	VHSTJ1, VHSTJ2, VHSTJ3, VHSWJ3, VHSYJ2 700p	660, 670, 720, 730, 740, 820 HRFC100, SR3300MS, FV44L 1600p	PV2300, 2400, 760, 794, 770, 774 1650p	VHR5300, VHR6500, VHR7400 4500p VHR3500EX 4500p
765, 766, 767, 768, 865, 867, VSF30, 33, 4, 400, 410, 420, 430, 440, 441, 450, 455, 480, 490, 497,	VHSVH4, VHSWH1, VHSXH1, VHSYH2 1600p VHSWJI VHSXJ3 700p	HRD950, HRD960, HRD980, FV46 4500p HRS5000, HRS5500, 5800, 9000,	N380, N381, N830, N831, N832, N833, N834, N835, N836 550p 82611AH1 (FOR MODEL DX3000),	VHR16, 235, 335E, 4150, 4160, 4350, 7250, 7260, 8250 1950p VTC3000 1400p
VSG51, 54, 55, VXS450, VXS470 1600p	GRUNDIG VS410, 415, 435, 450, 456, 460, 500, 505,	FV395.BRS600, SRS368E 5550p FV22L 1400p FV42 2600p	DX4000, N9610, NS7000 2400p N895 1800p	SHARP VC390, VC393, VC496 2750p
VS512, VS515, VS516 2250p VS462, 465, 467, 467EOG2, VSF12, 15EK, 15EOH, 300, 301, 310,	510, 520, 521, 530, 546 1600p BARCELONA, MVS5400, 440, 500, 600, SE5100, 6100, 6110, 9100	VR182LV, VR202LV 1950p FV67HV, FV68TX, FV77 3800p	N9052, N9530, DX2000 3400p VCP1 1700p PVC2300, 2400, 740, 744, 760,	VC779 1800p VC789, VC790 2900p
VSF320, 330, 340, 350, VSG30, 33, 34, 35 VS11, VS12 2300p 1000p	TVR4500, 4510, 5510, VS400, 440, 441, 500, 505, 510, 518, 600, 610,	R2000 SERIES 4500p FV61LV, FV62LV, FV67HV FV42L £101.00p	764 1400p DS6000 3500p	VC200, 220, 300, 381, 383, 384, 385, 386, 387, 388, 471, 477, 481, 482, VC483, 486, 3300, 8381, 9100, 9300, 9400, 9500, 9600,
VS6, VS8, VS9 2400p VSX9 2250p	VS5180, VS6190, 700, 900, 901, 902, 9091, GV200, 201, 2092, SE2100, 5110 1400p	VP160L, VR172L 1950p HRJ200, HRJ205 3300p	VH3, VH555, VH600, VH700, VH844, VH900,	9700 850p VC108, 208, 382, 402, 405, 408, 500, 550,
VSA1100, 1110, 650, VSF500, 510, 550, 560, 580, 590, 600, 650, VSG60, 64, 65, VSG70, 73, 74, 75,	MADRID, SE5140, VS540, VS5480 3000p	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK 7100p HRJ300, HRJ305, HRJ315,	VH1000 (ALL MODELS) 1100p VH1, VH2A 700p D1000, D1100 1600p	571, 573, 581, 582, 583, VC5W20E, 600, 651, 674, 681, 684, 6V3, 750, 780, 781, 683, 684, 402,
VSX560, 580 3600p VS155, VS165 2300p	VS120 2300p	HRJ316EG,HRJ318E 3750p HRJ615, HRJ715, HRJ815 9200p HRJ400, HRJ405, HRJ407MS, HRJ41	D1000X, D1500X, D4500, VPCD100, D1200, D2000X, D5000 1600p	VC500, 571, 573, 580, 584, 600, 682, 693, 700, 772, 7810, 782, 7822, VC783, 8481,
VS20, 22, 23, 24, 25, 26, 27, 422, 425, 426, 427, 485, VSF10, 11, 180, 190 VSF200, 210, 220, 221, 222, 230, 240, 260,	VS680, GV280 4600p VS160, VS740 4400p VS170 4600p	OEK, HRJ415, HRJ416 4500p	VR6460, VR6520, 64VR60, VR6420 725p VR6711 4 HEAD 1800p	8581, VCA10, 100, 102, 103, 1031, 103, 104, 105, 106, VCA111, 113, 116, 131, 140, 202, 203,
261, 262, 265, 270, 275, 280, VSF290, 510, 550, VSG20, 204, 205, 206,	MVS660, SE6160, VERONA, VS660, VS6690 3500p	VX500E, 800A, 810A, 820, 80A, 770B, 773B 1200 p	VR6440 2500p VR6441, VR6540, VR6541, VR6640,	211, 234, 244, 254, 255, 30, 35, VCA40, VCB311N, 320, VCD801, 802, VCM73, VCT212, 310, 410, VCT510, 72, VCT1314,
VSG21, 211, 212, 215, VSG217EOG , 23, 24, 25, 405, 411, 415, 417, VSP 100, 100EM, 110,	GRUNDIG MVS710, 720, 910, SE7120, 9120, VS710,	VCRL3, VX730, VX750 1450p VX735, VX755, VX990 1500p VX735A, VX765, VX850 1750p	VR6642 1300p DV761, VR512, 522, 5229, 63SB7, VR6760, VR6761, VR6762, VR63SB7 7172	VCTS313 850 p VC6000, 6200, 6300, 7300,
VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSX400 1250p VSR9 1300p	MV2105, 2115, SE2120 1700P	VX600 1100p VX900 2650p	7200p VR6920 2750p 41DV2, 4SB11BVR412, 415, 6485, 6490,	7700, 7750, 8000, 8300 1800p VC793 3000p VC473, VC785, VC786 1600p
VS 109, VS603, VS606, VS607 2500p VS75 2500p	HINARI VXL2, 3, 4, 20, 25, 35 1000p	MITSUBISHI HS303, HS304, HS320, HS700 HS306, HS318, HS710 1100p	6880 1600 p VR6948 4850 p	VC699, VCA501, VCA602 2400p VC585, VC685 2400p
VS965, VC967 3450p VSF400, 410, 420, 430, 440, 441, 450, 45S, 480, 490, 497, VSX450,	VXL6 1200p VXL7 1300p	HS307 1900p HS319 1900p	20DV1, 20DV2, 20RW7, 21DVI, 21DV2, 21DV3, 2SB01, 02, 11, 12, 30DV2, 31DVI, 31DV2, 31DV3, 3SB02, 03, 05, 11, 12, 13,	VFH815 2800p VC800, VCH851, VCH852,
470 2850p VSG20, 204, 204, 205, 206, 20, 21, 211,	VXL8, 9, 10, 11, 19, 90, VCR34H, VTV 100, 200 1100p	HS400 2800p HS349, HSE27, 31, 32, HSB27,	68SB4, 71SB4, 86SBI, 91SB2, 92SB2, DV186, 190, 291, 292, 468, 471, VR201,	VCH882 2700p VCH80, VCH81, VFH815 2800p VCA33, VCA36, VCA43, VCA44, VCA46,
212, 215, 217, 225, 23, 24, 25, VSP100, 110, 88, VSR100, 110, VSX400 1300p	HITACHI VT11, 14, 15, 16, 30, 33, 34, 330, 340, 503, 640, 5030, VTP10, 30 850p	31, 32, HSM33, 34, 35, 37G HS411 2400p HSE30, HSB30 1600p	202, 203, 2115, 212, 213, 223, 231, 232, 302, 303, 305, 311, 312, VR313, 3210, 3219, 322, 3229, 323, 501, 6180, 6182,	VCA49 1500p VCA55, VCA63 1800p
VSG415, VSG415EA, VSG425 VS75, VSA77 VSF1000, VSF1010, VSF1030 2800p 2700p 5800p	VT7, VT17, VT18, VT19 1600p VT35, VT350, VT38, VT39 1800p	HS338 1600p HSE10, HSE11, HSE20, HSE21, HSE41,	6185, 6290, 6291, VR6293, 6362, 6367, 6467, 6468, 6470 4600p VR3260, 6349, 6442, 663, 6448, 6449,	VC570 2800p SONY DSR-19R FOR SL-T 9ME 3100p
ALBA VDR3000, VCR4000, VCR5000, VCR6000	125, 128, 220, 225, 400, 405, VT410, 413, 414, 415, 416, 418, 510, 515,	HSB10, HSB20 1500p HS300, HS301, HS302, HS310, HS273, HS550Q 1000p	6542, 6643 1250 p VR601 1800 p	DSR-21 R FOR SLC 8-C9 2600p
VTV10 1000p	VTM625, 626, 725, 210, 211, 215, 726,	HS200 550 p HS337, HS347 1000 p	49SB6, VR6548, VR6648, VR6843 2750p	SLF1E2 PIN, SLC24PS, 33E, 34, 44PS, SLF11, 30PF, 35, 60PS, SLK85, SLT20ME, 30ME, SL100 1500p
VCR7000, 7800, 8000, 8800 1100p AMSTRAD VCR4500, VCR5200, VCR9000,	921 1100p VT3000 550p	HSB12, HSE12, HSE22, HSM16G, 18, 23, 25, 30, MX1 HS411EZ, HS411GZ 1700p	SAISHO VR100, 605, 705, 805, 905, 1000, 1100, 1200, 1600 1200p	DSR-43R FOR SLC7 RANGE, SL5000, SL5100, SL3000 1 PIN, SLC6E, SL36ES,
TVR1 900p VCR7000 1000p		HSB11, HSB21 1600p HSB52, HSE50, 52G, HSM36, 50, 54, 55, 57, 58, 60 3100p	VR3300X, VR3600X, VR3650X, VR3800 1400p VR3200, VR3500 1400p	SL37E 1300p SL3000, SL8000, SL8080, SLC5E, SLT7ME 1600p
VCR1000, 2000, 6000, 61000, 62000, 8600, 8602, 8700, 9005, DD8900, DD8904, TVR4 1100p	8030, 8040, 8100, 8300, 8500 VT8700, 9000, 9300, 9500, 9700,	HSE51 2600p HS410 3000p	VR2000, VR3300, VR3600 1400p VR2500 2650p	SLV201, SLV202 1500p SLK95, SLT50ME 2900p
TVR2, TVR3, VCR4600, VCR4600 MKII, VCR400 1100p VCR8800, VCR8804, VCR9340 2100p	VT8, 9, 56, 57, 570, 575, 576, 580, 585,	HS412, HS421GZ 3100p HS5300, HS5424, HS5600 2500p HSM20, HSM55 1900p	VRS5000X, VX6000A, VXL12X 1500p SALORA 6500, 6600 1600p	SLV275, SLV373VB, SLV410, SLV412, SLV427, SLV474 DSR49R, SLHF100P,
VCR8603, VCR8604, VCR8704, VCR8714 1350p	VT65 1800p VT130, 135, 138, 145, 250, 255, 258, 420,	HSM40 2350p HSM59, HSM68E 6050p NV300, 322, 332, 333, 340, 390, 2000,	SV7300, SV8200, SV8300, SV9200 1500p	SLHF100UB 3000p SLV656, SLV715, 725, 727, 757, SLV777, SLV815, SLV825 4100p
VCR9140, VCR9142 2550p VCR9340 3650p VCR9244 3450p	VT438, 535, 536, VTL30, 301, VTM630, 635, 636 1400p	2010, 3000, 7000, 7200.7500, NV7800, 7850, 8170, 8200, 8400, 8600, 8610, 8620	SV7400, SV8400 1600p SV8100 1200p SV900, SV9900 3450p	SLV353UB 2100p CCDF340E, CCDF500E, CCDV90E,
UF020, 22, VCR3000, 3002, 9500 1750r	V152, V160, V161E, V162E, V163, V164,	625p NV777, NV330 1150p NV8050, NV8051 2500p	SV601, SV611, SV6910 1500p SV800, SV810 2800p	CCDV95E, CCDSP5E 4800p SLV801, SLV802 2500p SLV310, SLV315, SLV325,
FISHER FVHP420, 510, 520, 530, 615, 618, 620, 622, 710, 711, 715, 716, 720,	(4 HEAD) 1900p VT530 1400p VT522, VTM212, 620, 622, 720, 722, 822,	NATIONAL PANASONIC AG1000, 1050, NV250, 260, 280, 450,	\$V6700, \$V8710, \$V8750	SLV335 1200p SLV210, SLV212, SLV270, SLV273, SLV285, SLV300 950p
FVHP721, 722, 730, 830, 905, 906, 907, 908, 910, 911, 915, 916, 918,	922, 925 1300p VT660E 2600p	460, 465, 470, 480, 650 1100p AG6010, AG6015 2000p AG6840 2000p	SV88110, SV8910 2650p 823N, SV8920 3500p	SLV125, 213, 225, 252, 255, 262, 280, SLVX1, 20, 3 1150p
FVHP5000, 5001, 5005, 5050, 5075 1100p VBS3500, 7100, 7500, 7600, 9900, VBR330	VITEAU EAS EAS EAS VITUSED SES	NV100, NV200, NV370, NV380, NV630 675p	SV8600, SV8700 1550p SV8420 2400p	SLV363, SLV416, SLVX50, SLVX55 2000p SLVX75, SLVX90, SLVX95 3000p
VBS7000, VBS7100, VBS9000 2000; FVHP500, 711, 715, 721, 722, 730, 830,	VTM598, 640, 645, 646, VTM730, 731, 735, 736, 740, 745, 746.	NVD80, NVH65 2600p AG5150, AG5250, NVF65, NVH75, NVH77 2600p	SV8620 2100p SV9300 2500p SV8830 2200p	SLV282, SLVX30, SLVX35 2025p SLHF100P, SLHF100UB 3400p
5100, FVHD720 1100g FVHP725, FVHP830, FVHP980 2500g	VTF770, 774, 775, 860, 861.	NVF51 4200p NVGI9 2300p NVJ30, NVHJ33, NVL10, 20, NVL21,	SV8720 2250p SV8520 1900p	SLVE7, SLVE8, SLVE9 3600p SLVE90 5150p SLV615, SLV625, SLVE600, SLVE700,
FVHP990 2700 F FVHP975 2400 F FVHD407, FVHD140, FVHP1, FVHP10,	865 4100p VT85, VT86, VT88 2000p	NVG30, 31, 40, 130, NVJ37, 40, 42, NVSD30, 10EE, 11, 2, 30, 35 1000p	SAMSUNG SV8500 1500p SVX301, VB900, 910, VVT510, VT320,	SLVE800 3450p TOSHIBA
FVHP20 1150; FVHD230, FVHP1100, 1200, 130, 1340, 1410, 2000, 200, 210, 300,	VTF180, VTF185, VTF280 8500p VTF350, VTF351 5150p	NVJ35, NVG46 1400p NVM1, NVM3, NVM5 4200p AG2100, AG2200 700p	5600, VX510, 511, 520.616, VX626, 627 717, 614, 619, 629, 710, 712, 720, 730,	V9680 3400p V8600, V8650, V8700 3000p
FVHP310, 410, 420 1800g FVHD250, 270, 370, FVHP1500, FVHP250	V12390E 2130b	NV430, NV431, NV433, NVSD2, NVSD22, NVSD25, NVSD3 800p NV730, NV730F, NV770	970, 971, 972, SV716, 717, SVX303, 305, VB510, 520, 610, 616, 617, 619, 620, 626, 627, 629, 710, 971, V1520, 616, 621, 626,	V21, V31, V32, V33, V50, V51, V52, V53, V9600 1100p V55, V57 550p
FVHP132, 1400, 1440, 320, 440, 445 3550;	HR2200, 3300, 3320, 3330, 3350, 3360, 3660, 3750, 3860, 4100	4 HEAD 1150p NV366 1700p	900, 910, 1200p SVX319, VB770, V1710, 730, 731, 735, 750, 751, 770, VB750, VK8220, VX750,	V71, V73, V74, V75, V77, V80, V81, V82, V83, V841V85, V86, V87,
FVHP470S, FVHP475HV 4800; FVHP1250, FVHP430S 1950;	3292, 8900, 8901, 8902, 8903, 8906, 8922, 8928, 3V01, 3V06, 3V22 550p HR3660, 7600, 7610, 7650, 7700, HRD110,	NV21 HQ, NV 180, NVD48 1700p NV7881 1700p NV810, NV8301 1800p	VX7330, VK770, VK8225, VR1730, 1735, XR20 1900p	DV90, 96, 97, NM3, V108, 109,
GOLDSTAR 8000 3HSSDB, GHV121, RQ2011, 2031, 2051 1900;	111, 120, 121, 220, 225,	NV850, NV950 2000p NV870, NV890, NV970 2400p	V11560, VN1560, VN1561, VX1530, VX1560, VX1561, VX1580 2200p PL30LR, PX3031, 31R, 32R, 990, 992, 991,	93. 94 1150p V5470, V5480 1300p V600 2350p
GVH51, GVH122, VCP4000, VCP4100, VCP4200 1100, GHV1232, 1233, 1241, 1242, 1243, 1244,	3V16, 3V233V24, 3V31, 3V35, 3V36, 3V38, 3V39, 3V49 550p	AG6024, NVG33, 46, NVL23, 25, 28, NVJ47, 49, 700PX, NVSD20EE,	PXP30, PXR30, VX 1260, SVX503, SX3230, 3231, 3260, 3261, VK30, 300, 1230, 1260, 1261,	V880MS 2600p
1245, 1246, 1266, 1290, 1291 GHV1295, 1296, 1891, 8210, 8215, 1221,	BR1600, HRD140, 141, 142, 143, 150, 152, 156, 157, 158, 160, 5101 HR\$10, 8947, 8948, 3V42, 3V44, 3V45,	400, 44, 45 NVG10, 11, 12, 14, 16, 120, NV250, 280, 450, 465 1100p	VK30R, 31R, 32R, VXK300, 301, 306, 320, 321, 326, 336 1900p	V500G, V509G 2500p V9680 2900p V300G, V301, V305, V306,
1240, 1241, 1247, 1248, 2145 VCP400, VCP4130, 4300, 4301, 4305, 4306, 4310, 4311, 4315, 4316.	3V46, 3V47, 3V52, 3V54, 3V55, 3V56, 3V57 900p	NVG18 1400p NVG20, 21, 22, 25, 28, 200,	S11230, 1240, SVX600, SX1230, 1231, 1260, 1261, 7120, 7121, 7220, SX7221, 7230, 7301 1900p	V309G 2550p V61, V63 1200p V110, V120, V130, V140, V210, V211,
VCP4320, 4321, 4325, 4326 900 C211, GHV1392P, 1393P, 19OOP, 1290,	HRD527, 540, 550, 560, 590, 770,	NVD48 1200p NVG50, NVG300 1600p NVG45 1100p	SANYO VTC5000, 5400, 600, 6000, 6010, 6500,	V212, V220, V221, V222
1291PQ, 12931Q, 1295P, GSE1295PQ, GSE1296, 1297, 1891, 1910, 20005, 2000, GSEC200,	HRDX20, HRDX22, 8950, 8951, 3V64, 3V65, FV10, FVII, FV20, FV21, FV26 900p	NVH70 2400p NV688 1650p	VPR5000, VTC 1500, VTCM 10, 11, 20, 21 VTCM25, VTC2000, 5100, 5150, 5300, 5400,	V711, V880 2700p VCPB1E, VCP2C2 1000p V65, V66, V6 950p
GSEC205, 211, 2301, GSEG2301, GSEQ12, 204, 20, 22, P416P, P500P QUISY22, QUISY24, RC205P, RG11P,	HRD565, HRD566, 3V48 1800p HRD725, HRD755, 3V43, 3V53 1800p	AG6800, AH6810, AG6820 2100p AG6100, AG6200, AG6300 2100p	VTC5350, 5370, VTCNX10, VTCNX15, 20, 30, VPR5800 1800p	V312, V322, V412 2600p V91G 4600p
RG20, RG2001, RQ20, RQ204HP, RQ241, VCP100P,	8930, 8931, 8933, 8940, 3V29, 3V30 550p	NVG7, NVG9, NV230 700p NV780 2000p NVG 15, NVG400 2600p	VTC5500, 5550, 9100, 9300, 9350, 9355, 9455, 9500 1700p VHR1110, VHR1150, VHR1300, VHR1700,	V609, V610V610B, V610UK, V611, V659F, V660, V660F V312, V403T, V413G 2200p 9200p
GSEG10 1300; GHV4400, 4400, GSE-Q404P, QUISY40, RC405P 2350;	3 3V00, 8902, 8903, 8909, 8912, 8922 1000p	NVM7, NVMC20 3800p NVF70 5200p	VHR2300, VHR2370 800p VHR3200, 3270, 3100, 3110, 3150, 3300,	V703W, V813G 4000p V95G 8000p
GSEQ121, RQ2011, RQ2031, RQ2051 1950	FV31, FV41R FV37, FV43H, HRD860 2000p BR7000E, BR7000S, BR7030.	NVJ45, NVJ47 1200p NVSD40 1050p NVF75, NVF77 4300p	VHR1500, VHR2500, VHR3330 1500p VHR2700 2450p	GRANDATA LTD
G.E.C. 4000H, 4001H, 4002H V4001H, V4004, V4100 1200	BR7030/40H, BR7040 2100p HR7200, 7300, 7350, 2650,	NVF55 2800p NVFS200, NVFS88, NVSF90,	VHR7900 3000p VHR5700, VHR7700E,	TEL: 0181-900 2329
V4005H 1500	HRD455 1600p HRD520 1400p	NVHD90, NVHD 100, NV HD 101, NVHF 100 2300p	VHR150E, 153, 154, 1501R, 240, 250, 251, 27, 350, 474, 5350E, 7500, VHR7530,	FAX: 0181-903 6126
CSI, DS2 1600 VHSAH1 1100	HRD300, 400, 580, 600, 620, 640, 650 1500p	NVSD1 1000p AG7330, AG7350, AG7355,	7540, 8500SP, 8800, VHRD5350E, 5450E, 6550 1800p TLS1000P, TLS1001P,	TAIX. UTG1=305 UTZ0
VHSAH3 2400	* 1000p			NE DA DEC

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Model Price	Model Price	Model Price	Model Price	Model Price
AKAI VP7100, VS9300, VS9500, VS9700, VS9800	TX3650, VCR3000, VCR3002, VCR9500 75p	406, 407, 4092, 410, GV411, 412, 414, 415, 416, 417, 4192, 4200, 420, 430, 434, 435,	N.E.C. N830, N831, N832, N833 100p	V1710, 730, 750, 970, VX710, 712, 720, 730, 970, 971, 972 100p
120		GV437, 440, 450, 4592, 460, 464, 470, 500,	N895 80p	VX9880 110p
VS1, VS2, VS3, VS5, VS12, VS15, VP88 70p VS10 65p	1 VD37000	501, 5050, 5095, GV5105, 511, 530, 5395, 540, 560, 5695,	PVC2300, PVC2400 180p DX1000, 1600, 1800, 2000, 3000, N9012, 9013,	SX7121 95p
VS10 65p VSX9, VS105, 112, 115, 116, 120, 125, 126,	VBS9000 120p FVHP520, FVHP530, FVHP420 60p	MV4005, 4105, SE4100, 4104, 4120, 5102,	9014, 9016, N9033, 9034, 9053, 9054, 9055,	SANYO VTC5000, 5150, 6000, 6500, VTCM10, 11, 20,
155, 165, 205, 220, VS24, 240, 244, 245, 247, 248, 250, 512, 515.	FVHP615, 618, 620, 622, 710, 711, 715, 720,	5104, 5106, TVR37001 70p	9056, 9066, 9096, 9110, 9120, N9510, 9520, 9530, 9610 80p	21, 30, 31, 50 65p VTC5300, VTC5350, VTC5400,
248, 250, 512, 515, 516 200p	721, 722, 725, 730, FVHP830, 840 60p	VXL2 80p	NATIONAL PANASONIC	VPR5800 80p
VS22, VS23, VS25, VS35, VS37, VS38, VS53,	FVHP905, 906, 907, 908, 910, 911, 915, 916,	VXL7, VXL8, VXL9, VXL10, VXL11, VXL19, VXL90, VCR34, VTV 100,	NV300, NV330PX, NV332, NV333 NV340, NV366 100p	VTC5500 70p VTC9100, VTC9300 140p
VS55, VS66 80p VS4, VS6, VS8, VS9 95p	918 75p VBR330, VBS7500, VBS7600,	200 100p	NV777, NV788 100p	VTC1100, 1300, 1500, VHR1100, 1110, 1150,
VSA77 120p	VBS9900 100p	VXL4, VXL35, VTV300 70p VXL5, VXL6 100p	NV2000, NV2010, NV3000 80p NV7000, NV7200, NV7800 75p	1200, 1300, VHR1500, 2370, MVR220 80p
VSS99 105p	VBS3500 75p FVHD140, FVHD40, FVHD55, FVHP1, FVHP10,	VXL3, VXL20 90p	NV8600, NV8610, NV862 145p	VHR2100, VHR2300, VHR2500, VHR2700 100p
VCR40000 130p	FVHP20 110p	HITACHI	NV230, 250, 280, 430, 431, 433, 450, 460, 465, 470, 650, 730, NV770, 810, 870, 890, 970, AG	VHR3100, 3110, 3150, 3300, 3310, 3400, 3500, 3700,
VCR5000, VCR6000 105p VCR161, VCR222 100p	FVHD230, 250, 270, 370, FVHP1100, 1200, 1250, 130, 132,	VT11, 14, 16, 17, 19, 33, 330, 34, 35, 350, 38, 39, 88, 165, 5030 75p	1000, 1050 85p NV370, NV380, NV480, NV630, NV780,	3800, VHRD500, 700, TLS1000, TLS1001 65p VHR120, 130, 14, 141, 143, 14, 150, 151, 153,
VCR3000X, VCR4000, VCR4000X 75p		VT5000, VT5500, VT18 120p VT7000, VT8000, VT8030, VT8040, VT8300,	NV830, NV850 70p	154, 15, 16, 171, VHR194, 220, 23, 235, 240,
VCR7000, VCR7800, VCR8000, VCR8800 110p	210, 250, 3, 300, 310, 320, 2000, 410, 420, 430, 440, 445, 470,	VT8500, 8700 60p	NV600, NV688, AG6010, AG6015 85p NVG7, 9, 10, 11, 12, 14, 15, 16, 18, 30, 130,	244, 250, 251, 274, 297, 310, 330,VHR335, 390, 4100, 4105, 4150, 4200, 430, 4300, 4350, 474,
AMSTRAD 105p	475, FVSD2905 85p	VT680, VT6500, VT6800, VT9300, VT9500, VT9700, 9900 75p	400, NVH70 50p	VHR4770, 5080, 5100, 5200, 5300, 5350, 5700,
TVR123, VCR4600, VCR4700,	FVHP5000, 5005, 5050, 5075, 5100, 975, 980, 990 95p	VT52, VT57, VT61, VT62, VT63, 64, 65, 85, 86,	NVFV1, NVM10, 3000, 3300, 40, 7, 9000, 9900, NVMS1, 4	6850, 7100, VHR7200 7250, 7260, 7300, 7400, 7500, 7520, 7530, 7530, VHR7540, 7700, 774,
VCR5200 80p	990 95p G.E.C.	640 60p VT3000 120p	NVM 1, NVM3, NVM5 70p	7800, 7810, 8000, 8100, 8200, 8250,
VCR7000 80p VCR1000, 2000, 6000, 6100, 6200, 8600, 8602.	4005 150p	VT100, 110, 111, 113, 115, 118, 120, 125, 128,	PHILIPS VR6460, VR6920 170p	8500,VHR8800, 8801, VHRD4400, 4410, 4500, 4600, VHRD4610, 4710, 4890, 6700 60p
8603, 8604,	V4004 100p V4007 80p	130, 135, 138, VT145, 150, 168, i70, 175, 220, 225, 250, 255,	VR6540 100p	VMD66, VMD68P 80p VTR1000 70p
VCR8700, 8704, 8714, 8800, 8804, 9000, 9005, 9244, 9340.	GOLDSTAR	258, 260, VTL30 60p	VR6442, VR6542 70p VR2025, VR2580 100p	VTC6010 75p
DD8900, DD8904, TVR4 100p	GHV1221, 1232, 1233, 1240, 1241, 1242, 1243,	VM500 VM600 90p J.V.C.	DV186, 190, 286, 291, 292, 468, 471, 562, 571,	SHARP
TX3650, UF20, 22 24, VCR3000, 3002, 4000, 9500 75p	1244, 1245, GHV1246, 1247, 1248, 1250, 1266, 51, 8000,	HR3300, HR3330, HR3360, HR3660,	761, VR201, 202, 203, 211, 2115, 212, 213, 223, 311, 312, 313, 3210, 3219, 322, 32, 29, 323,	VC200, 381, 384, 385, 386, 388, 390, 393, 838, 9100, 9300, 9500, VC9700 80p
VS1004 1 <u>05</u> p	8200, 8210, 8215,	HR4100 130p HR7200, HR7300 50p	535, VR20DV1, 20DV2, 20RW7, 21DV1, 21DV2,	VC7300, VC7700, VC7750, VC7800, VC8000 110p
BLAUPUNKT	VCP4100, VCP4130 80p GHV1290, 1291, 1295, 1296, VCP4000, 4200,	HR7250, HR7600, HR7610, HR7650,	21D, V3, 25BO1, 25BO2, 11, 12, 302, 303, 305, 31DVi, 31DV2, 31D, V3, 3SB11, 3SB12, 3SB13,	VC8300 115p
RTV100 200p RTV200, RTV222, RTV224 90p	4300, 4301,	HR7655 50p HR7700 50p	72SB8, VR30DV2, 35BO2, 35BO3, 635B7, 715B4, 715B5, 715B8, VR865B2, 915B2,	VC300, 387, 471, 473, 481, 482, 483, 486, 488, 496, 8481
RTV202, RTX200 150p	VCP4305, 4306, 4310, 4311, 4315, 4320, 4321, 4325, 4326 120p	HR7700 50p HRD110, 111, 120, 121, 220, 225,	925B3, VR6180, 6182, 6185, 6285,	VC402, 500, 571, 573, 581, 582, 583, 584, 585,
RTV322, RTV248 100p RTV306, 307, 309, 310, 311, 312, 328, 414,	GRANADA	BP5000 60p	6290VR6291, VR6293, 6362, 6367, VR6390, 6391, 6393, 6467, 6468, 6470, 6561,	VCSF3, VC8581 80p VC108, 405, 408, 550, 600, 651, 674, 681, 682,
434, 444, 707 135 p	VHSH1, VHSAH3 100p	HRD140, 141, 143, 150, 152, 157, 158, 160, 190, 250, 257, 310, HRD455, 565, 566, 725,	6570, 6581, 6670, VR6676, 6710, 6760, 6761,	682, 684, 685, 693
RTV211, RTV214 140p RTV324, RTV32565p	VHSVH4, VHSWH1, VHSXH1 60p VHSYH2 50p	755, HRP50 45p HRD170, 171, 180, 210, 21 1, 217, 230, 300,	6762, 6870, 6970, 6975, VR68SB4, 86SBI, 92SB3 75p	VC700, 750, 783, VC6F3, VC6V3 70p VC208, 671, 772, 779, 780, 781, 782, 785, 786,
RTV315, RTV316, RTV319, RTV320,	VHSBH1, VHSCH 1 150p	320, 321, 330, 337, HRD350, 370, 400, 430,	VR445B9, VR445B920, VR445B922, VR6443,	787, 793, 800, VC7810, 7822, VCA100, 102,
RTV317 50p RTV301, RTV333, RTV338, RTV404,	VHSBP1 135p VHSAN3 110p	440, 44 1, 500, 530, 700, 750.950, HRS5000, 5500, 8000, 9000, BR9060, BRS600,	6843, 6843, VR6943 100p VR3260, 6349, 6448, 6449, 6548, 6648,	103, 104, 131, 140, 170, 202, 03, VCA234, 501, 502, 602, 5011, VCB311, 361, VCD801, 802,
RTV424 85p	VHSDS2 125p	605, 920, 925 45p	49SB620, 644869S, 49SB6 110p	VCH851, 852, 882, VCM73, VCT72 65p
FERGUSON	VHSAY3 125p VHSBY3 100p	HRD227, 520, 52 1, 522, 527, 600, 610, 620, 637, 641, 650, 830,	VKR6850, VKR6855 70p VR501 110p	VCA10, 103, 105, 106, 113, 11613, 211, 234, 244, 254, 30, 33, 35, VCA36, 37, 40, 43, 454,
3292, 3V00, 3V01, 3V16, 3v22, 8900, 8901, 8902, 8903, 8904,	VHSEY1, VHSEY2 70p	HRD840, HRDX20, 22, HRJ200, 205, 300, 305,	VKR6800, VKR6810, VKR6820 70p SE4104, VR231, 2310, 2319, 231, 232, 2329,	48, 50, 505, 51, 52, 53, 54, 55, 56, 57, 58, VCA60, 605, 615, 67, 68, 1031, VCB320,
8906, 8909, 8912, 8922 120p	VHSCC1 100p GRANADA	SR330, HRS10 125p HRD840, 550, 560, 580, 590, 640, 660, 670,	237, 23, 241, 2410, 2419, 242, 243, 245, 2469,	VCBS97, VCD805, VCD806, 810, 815, VCH80,
3V23, 8923, 8924, 8929 50p 3V29, 3V30, 8930, 8931, 8933,	VHSDP1, VHSFV2 80p	720, 730, 740, 770, HRD820, 860, 870, 880,	247, 2479, 251, 252, 256, 257, 258, 33, 19, 332, 3329, 333, 337, 339, 3419, 342, 343, 3469, 347.	81, 85, 865, 910, VC51000, VCT212, 310, 410, 610, VCT1314, VCTS312.
8940 65p	VHSTJ1, VHSTJ2 150p VHSTJ3 65p	910, 960, 980, HRDX20, 25, HRJ2 10, HRJ215, 315, 316, 318, 400, 405, 407, 410,	3479, 35, 1, 352, 357, 358, 422, 4229, 432, 437,	313, VC790ET 80p
3V31, 3V32, 8941, 8942 60p 3V35, 3V36, 3V38, 3V39, 3V49, 8943,	VHSWJ1, VHSWJ2 120p	411, 415, 416, 507, HRJ6 10, 615, 715, 97,	442, 4229, 432, 437, 442, 44, 5, 4469, 447, 4479, 451, 452, 457, 458, 459, 512, 522, 5229,	VCC10 70p SONY
8944 60p	VHSXJ3 85p VHSYJ2 80p	HRS4700, 5800, SR3200, SRS368E 60p HRJ600 40p	6379, 642, 647, 722, 7229, 723, 7379, 747,	SLC6, SLJ10, SLT6ME 140p
3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54,	VHSFJ2 140p VHSFS1, VHSFS2 130p	LOGIK	8389, 948, 9489 70p SAISHO	SLC5, SLC7, SLJ7, SLJ9, SLT7ME 140p SLC9, SL8000, SL8080, SLT50 165p
3V55, 3V57, 8945, 8947, 8948 45p	VHSFG1, VHSFG2, VHSFG3,	MATSUI 180p	VR2000, VHL3 90p	SL8000E, SL8080E, SL8200, SL8600 175p
3V58, 3V43, 3V44, 3V59, 3V64, 3V65, 8950, 8951, FV10, FV11, FV12, FV13, FV14, FV20,	VHSFG4, VHSF63 180p	VX600, 730, 735, 750, 755, 765, 850, 6000,	VR3800, 3200, 3300, 3500, 3600, 3650, VRS4400, 5000 75p	SLV255, 125, 213, 225, 262, SLVX1, 20, 3 95p
FV21, FV22, FV26, FV32, FV39, VC141L 45p	MVS400, 440, VS400, 410, 415, 435, 440, 441,	VS888 75p VX1000, VX2000, VX2500, VX3000,	VR3400 100p	TOSHIBA
FV31R 110p	450, 456, 460 55p VS180, 200, 220, 226, 262, 265, 267, 2X40800,	VX6000 80p	SAMSUNG SV716, 717, V1616, V~621, V1626, VX616,	V55, V57 V33, V31, V32, V51, V52, V53, V9600,
FV61L, FV62, FV67, FV68, FV70, FV71, FV72, FV74, FV77	0850, 0880,	WX800 70p	VX617, VX619, X626, VX627, VX629,	V9680 85p
FV43H, FV44L, FV46T, FV57H 125p	1600, 2000, 2080, 2200, 2280, MVS200RC 90p	HS200 200p	VX714 75p VB520, 510, 610, 616, 617, 619, 620, 626, 627,	V61, V63, V65, V66, V67 DV80B, DV80D, V71, 73, 74, 75, 77, 81, 83, 85,
FV37H 80p 3V52 55p	VS150 160p	HS300, 301, 302, 307, 310, 337, 338, 347, 349, 411, 412, 421, 480, HSB10, 20, 30, HSE10, 20,	629, V1510, 520, V1611, 616, 621, 626, VX510, 511, 520, VT320, 5600	86 80p V108, 109, 110, 120, 130, 140, i99, 209, 210,
FV41R, FV42L 100p	VS310, 311, 315, 320, 326, 340, 345, 380, 385, 445	30, 70 80p	VB900, VB910, V1900, V1910 110p	211, 220, 221, 411,V421, 609, 610, 611, 659,
FIDELITY HQS200, VCR1000, 2000, 600, 6000,	VS150 75p LC290N, LC295SN, SVS 180, VS 170 70p	HS303, HS304, HS306, HS307, HS330, HS400,	PX980, 981, 982, SE9001, SV9001, SVX307, 319, 322, VB750, 770, 8220, 8225, V1770, 790,	660, 711, 880 120p V91 G, V95G 115p
6100 180p	VS 160, BARCELONA, FLORENZ, GV4000,	HS318, HS319, HS410 110p	8220, 8225, VK8220, VPX31, VX750, VX770,	V212, 213, 22-2, 3i2, 322, 403, 412, 413, 610,
VCR100 160p VTR1000, VTR1001 100p	4000, 4001, GV4002, 400, 401, 4010, 402, 403, 404, 405,	HSM1000, 16, HSM23, 25, 33, 34, 35, 37, 54, 55, 57, 58, 59, 68 56p	790, 8220, 8225, SE9000, 9001 90p SVX301, 303, 305, SX7301, VB710, 971,	703, 813 50p VCPB1E 110p
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	VT11, 14, 17, 19, 33, 34, 35, 38, 39, 52, 57, 61, 62, 63, 64, 65, 85,		Ferguson	3V39, 3V30, 3V31, 3V32, 3V353V36, 3V38, 3V39, 3V49, 8930,	Take Up Clutch PU 51380
		FF Rew Idler 6886792		8931, 8933, 8940, 8941, 8942, 8943, 8944	
Order Code:		Price 100p	J.V.C.	HR7200, 7600, 7650, 7655, 7300, 7350, 7610	Take Up Clutch
Hitachi Order Code:		Play Idler 6861482 6861481 Price: 180p			PU 53462A PU 51380
		idler	Order Code:	: IDL23	Price: 200p
	414, 424, 434, 444, 478, 707	idler	Philips	DB532, VR6520, 6843, 644	Reel Idler
	GHV1221, 1232, 1240, 1241, 1242, 1243, 1244, 1245, 1246, 1247,	ldler	Sharp	VC600, 651, 681, 682, 684, 685, 693, 699, 700, 783, 6FR, 6V3,	Idler Assembly
	GHV1248, 8000, 8200, 8210, 8215, GVHP51, VCP4100, 4130			6F3	NPLYV0107GEZZ
Grundig	MVS400, 440, VS400, 410, 440VS450, 460	Idler	Order Code:		Price: 615p
National	NV230, 250, 260, 280, 370, 380, NV430, 431, 433, 450, 460, 465,	Idler Arm VXP 0521	Philips	VR6843, 6943, 44SB9, VR44SB920, 44SB922, 6943	Reel Drive Unit
	470, 480, 630, 650, 730, 780, NV810, 830, 850, 870, 890, NVG7, 9, 10, 11, 12, 14, 15, 16, 18, 30, 130, 400, AG1000, AG1050, 1200		Sharp	VC772, 780, 781, 782, 785, 786, VC787, 800, 793, 799, 7810,	ldler
	1500, 1810, AG2100, 2200, NVH65, 70	•		7822, VCA100, 102, 104, VCA131, 140, 170, 202, 203, 234, 50	i, NPLTV0111GEZZ
	VR6460, VR6520, VR6920	Idler Arm 40340162		VCA602, 5011, VCD801, 802, VCH851, 852, VCH882, VCM73,	
Order Code:	IDL08	Price 100p	i	VCT72, VC782MK11	
		Idler 150280	Order Code:		Price: 700p
	VC200, 381, 383, 384, 385, 386, VC388, 390, 393, 3300, 8381,		N.E.C.	N911, 915, 916, 917, 9012, 9013N9014, 9016, 9033, 9034, 905	
0-4 0-4		Idler NIDL0005GEZZ		N9054, 9055, 9056, 9066, 9096, N9110, 9120, 9510, 9520, 953	
Order Code:		Price: 100p		N9610, DX1000, 1600, 2000, DX3000, PX1200	Idler Arm Assembly
Philips Sharp	VR6540 VC300, 387, 402, 471, 473, 477, VC481, 482, 483, 486, 488, 496,	Idler	Order Code:		Price: 270p
	500. 571. 573.	Idler	Philips	DV186, 190, VR211, 2115, 212, 213, 223, 286, 291, 292, 311,	Pressure Roller Assembly
		NIDL0006GEZZ	1	312, 313, 3210, 3219, 322, 3229, 323, 535BO, VR486, 471, 56	
Order Code:	IDL11	Price: 100p		582, 571, 761, 201, 202, VR203, 302, 303, 305, 6180, 6182, 61	
		Reel Idler		6285, 6290, 6291, 6293, VR6362, 6367, 6390, 6391, 6393, 646	
	3V23, 3V29, 3V30, 3V31, 3V323V35, 8923, 8924, 8929, 8930,	B 1441 B1440007		6468, 6470, 6561, 6570, 6581VR6670, 6676, 6710, 6760, 6761	
		Reel idler PU48967 Reel idler PU48967		6762, 6870, 6970, 6975, 86B1, 63SB7, 68SB4, 71SB4, 71SB5,	
Order Code:		Price: 175p		72SB8, 72SB8, 92SB31, 20DV1, 20DV2, 20RW7, 21DV1, 21DV	72,
		Take Up Idler PU 51402	[2SB01, 2SB02, 2SB11, 2SB12, 30DV2, 31DV1, 31DV2, 31DV,	
	8931, 8933, 8940, 8941, 8942, 8943, 8944	10110 Sp 10101 1 0 0 1702		33SB02, 3SB03, 3SB05, 3SB11, 3SB12, 3SB13	
	HR7200, 7600, 7650, 7655, 7300, 7350, 7610, HRD110, 111, 120,	Take Up Idler PU 51402A	Toshiba	V91, V95	Pressure Roller Assembly
	121, 225				PS403-40205
Order Code:	IDL22	Price 100p	Order Code:	PR232	Price: 300p

VXP0433 VXP0463 VXP0521 VXP0581 1430662T15620 NIDL0005GEZZ NIDL0006GEZZ NPLY0107GEZZ

IT15 IT16 IT17 IT18 IT19 IT20 IT21 IT21

<u>Price:</u> 20p each 16p each pack of 5 13p each pack of 10

Packs are for each model

PU51380 PU51402A PU55373 PU55374 VXP0329 VXP0343 VXP0344 VXP0401

IT07 IT08 IT09 IT10 IT11 IT12 IT13 IT14

Sanyo Sharp



Akai

JVC

Goldstar Hitachi M32773 MZ366960J2 VXP0521 6861471 6861482 6886971 PU48697B

IT01

IT02 IT17 IT03 IT04 IT05 IT06

National Panasonic

tnemelaque

Text and research by Eugene Trundle

Workshop Equipment

for testing, diagnosis and repair

1998 is the year in which digital TV finally arrived. As this supplement is being prepared, the new DTV services are coming on stream from satellite and terrestrial transmitters.

It's likely that fault-finding amongst the microprocessors, the microcontrollers, the DRAMs and other memories and the processing chips used in DTV receivers will be based on software rather than hardware: we could be using programs rather than prods, probes and meters. Nevertheless as long as there are picture tubes and highvoltage power supplies there will be a need for conventional test instruments and faultfinding techniques. As long as there are line and field timebases that drive copper/ferrite yokes there will be scan failures, sparks and arcs to deal with; and while chopper power supplies and electrolytic capacitors continue to exist they will fail from time to time. In addition lightning, static spikes, surges and heat will continue to take their toll on electronic equipment.

VCRs and camcorders, regardless of format, present other problems. Until – if – we get away from moving parts, pollution, dirt and wear will take their toll. And the inevitable breakdowns still have to be dealt with.

The new digital transmissions, rugged though they are, require care in the installation and alignment of the dishes, feeders and any distribution systems used.

Many of these needs require the use of specialised test equipment and service aids. In this feature we will look at what's good and what's new.

Oscilloscopes

Hameg is perhaps the best-known manufacturer of oscilloscopes for TV and



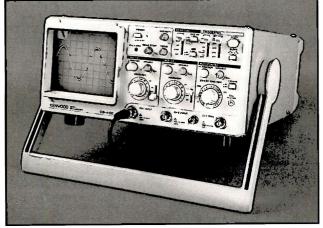
Ozan's Teletest 2 pattern generator in the workshop - with essential reading!

video servicing. Many Hameg models now have a microprocessor-controlled auto-set and memory function. With auto-set the triggering, sweep and Y-gain are automatically set to provide the best waveform display of any signal presented to the instrument. The memory function stores six different user-defined settings. Two new Hameg models, the HM407 and HM1507, incorporate these features: the HM407 is a 40MHz, 100MS/sec analogue/digital scope at £724; Model HM1507, at £1,355, is an analogue/digital type with a 150MHz bandwidth and a 200MS/sec signal sampling speed.

Kenwood has a whole new range of bench-based scopes. The CS5350 is a threetrace 50MHz analogue model with auto setup and automatic measurement of voltage and frequency. Model CS5370 has the same features, functions and appearance, but the bandwidth is increased to 100MHz. The flagship of the Kenwood servicing range, Model DCS8300, is a digital storage scope with 100MHz capability in normal use and 40MHz in the digital storage mode. As well as auto set-up this model offers waveform processing functions such as averaging, peak hold and interpolation.

Grundig has a new digital storage oscilloscope, Model SO100, with a digital and analogue bandwidth of 100MHz. Sampling rates range up to 40MS/sec, with storage depth to 4K. There's an optional software pack, in floppy-disk form, for this instrument. It enables waveforms to be displayed, processed and stored by a PC.

The subject of PC-based waveform



TV reader offer -**Kenwood Oscilloscopes**



www.vanndraper.co.uk Kenwood, Grundig, Kathrein, Hitachi, Fluke

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TV line and frame triggering Calibration output Complete with two probes

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Vann Draper is offering readers of TV magazine special discount on the Kenwood range of high quality oscilloscopes. The CS4125 20MHz 2 channel oscilloscope normally sells for £361.33 but is available for just £319 including vat & delivery. The CS4135 40MHz 2 channel oscilloscope normally sells for £528.75 but is available to TV readers for just £479 including vat & delivery.

Both oscilloscopes are delivered ready to use complete with two X1/X10 probes, mains lead, operating manual and a one year manufacturers warranty.

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Alternatively tel. 0116 2771400, fax 0116 2773945 or email sales@vanndraper.co.uk

Key specifications

Sweep mag

20MHz (CS4135 40MHz) 3dB bandwidth CRT size

CRT voltage Vert sensitivity

Input impedance Time base

150mm rectangular, graticule 8 by 10 divisions Approx 2kV (CS4135 approx 12kV) 1mV-5V/div, 12 ranges, 1-2-5 steps, fine adjust 1Mohm +/-2%, approx 22pF

0.5s - 200ns/div, 20 ranges, 1-2-5 steps, fine adj

CH1, CH2, Alt, Chop, Add, CH2 invert Auto, Norm, Fix, TV frame, TV line Trigger 1kHz squarewave, 1Vpk-pk +/-3% TTL level, dark for positive voltage 7kg (CS4135 7.2kg) Cal signal Z axis input

Weight

300 x 140 x 415mm excluding protrusions

Full data sheets for the above oscilloscopes as well as for other more advanced models are available either by post or from our website at www.vanndraper.co.uk

display brings us to Pico Technology Ltd., whose 'virtual oscilloscope' designs, based on an AD converter, have been further developed. There are now the ADC-40 (8-bit sampling) and ADC-42 (12-bit sampling) types at £64 and £90 respectively; the 12-bit ADC-100 at about £200; and the ADC-200 series, with bandwidth up to 50MHz and 100MS/sec sampling, at £460.

Oscilloscopes don't have to have a CRT to provide the display, nor need they be large, heavy or mains-powered. For use in the field - or in the workshop under some circumstances - Fluke has its ScopeMeter range. These models have an LCD display, dual-trace capability and a digital multimeter.

In its TDS200 range Tektronix has compact, light LCD-readout oscilloscopes bandwidths up to 100MHz.

The ultimate in convenience and portability is perhaps the Pico OsziFOX handheld (pentype) digital storage oscilloscope at £80. It has 6-bit resolution, a sampling rate of 20MS/sec and a built-in 16 x 32-element backlit LCD readout. Display of 'live' or stored data on a PC screen is possible using the cable supplied and DOS/Windows software.

Multimeters

There's no doubt that analogue meters of all types are losing ground fast! We still find

uses for them in first-line field servicing amongst other things, for installing and testing aerials, dishes and their accessories. For these purposes inexpensive yet comprehensive types, such as those in the Altai and Tenma ranges, come into their own. Several of these cost less than £10 - the best sort if you are going to drop one off the roof accidentally or leave one in the microwave.

Fluke can be recomm-

ended for quality and durability in the DMM field. The newly introduced Fluke 70 Series III range has extra-large characters, analogue bar-graph indication and, for really difficult environments, an auto touch-hold feature. Prices range from £120-£150.

Wavetek has lately made an assault on the DMM market with a wide range of handheld instruments at prices from £35 to £142, with features to match.

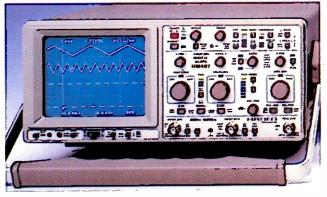
Wavetek, Fluke and others offer pen-type digital multitesters for use in confined spaces. There must be hundreds of different DMMs on the market at present, many designed for specific applications and environments.

The number of hand-held capacitance testers is increasing. There are new offerings this year from AVO, CIE, Konig, Caltek/Philex and Tenma. Prices range from £40 to £227, the latter for the dual-display AVO B131, which measures resistance, capacitance, inductance and Q (at test frequencies of 120Hz and 1kHz) with 1 per cent accuracy.

Safety Testing

Most of what we've looked at so far provides tests to assist with fault diagnosis. The other, and very important, aspect of equipment testing is for safety and compliance with safety legislation.

Megger and Robin both have new hand-



The Hameg HM407 40MHz, 100MS/sec analogue/ digital oscilloscope.

15% off Pico oscilloscopes

Test Equipment has come a long way over the last few years, traditional 'benchtop' instruments such as oscilloscopes are giving way both to smaller hand held units and more recently to PC based instruments. Pico Technology are at the forefront of these developments and are giving you the chance to save 15% off the purchase price of some of the highest quality test equipment available today. You can order either the ADC200 or osziFOX oscilloscopes using the order form below. This offer is valid until the 15 Dec 1998.

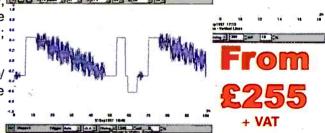
Transform your PC.... Into an oscilloscope, spectrum

analyser and multimeter

The ADC200 range of PC based oscilloscopes offer performance only previously available on the most expensive 'benchtop' scopes. By intergrating several instruments into one unit, the ADC200 is both flexible and cost effective. For video signals the ADC200/50 is an ideal solution, it combines a dual channel 50MS/s digital storage oscilloscope with a 25MHz spectrum analyser. The screen shots of PAL video signals shown opposite were captured using an ADC200/50.

Connection to a PC gives the ADC200 the edge over traditional oscilloscopes: the ability to print and save waveforms is just one example. Advanced trigger modes, such as save to disk on trigger make tracking down those elusive intermittent faults much easier. The ADC200 is supplied with PicoScope for Windows (DOS & Win 3.1, 95/98 and NT) which is powerful, vet simple to use, especially with its comprehensive on line ... help. Installation is easy and no configuration is required; " simply plug into the parallel port and it is ready to go.

There are three models in the ADC200 range: the ADC200/ 20, 200/50 and 200/100 offering a 20, 50 and 100 MS/s scope and a 10, 25 and 50 MHz spectrum analyser respectively.





Once oscilloscopes were heavy and clumsy to handle, but over the years they have got smaller and smaller. The latest development in this field has just arrived: a digital storage oscilloscope in a handy slim housing, scarcely longer than a pencil and about as thick as your thumb.

Despite its small size, its performance can match that of a service oscilloscope. With a sampling rate of up to 20MS/s even signals

function, numeric AC a The low cost of the os makes it ideal for an ultimate in portability.	and DC voltages ca ziFOX, together wi	th the units small size	£68
Order form Broadway House, 149-151 S ■ Tel: 01954 211716 ● F	ax: 01954 2118	80 ● E:mail post@p	icotech.co.uk
Please send me: Www.picotech.com Pleases fax or post to us at the given address Delivery details Name:	osziFOX ADC 200/ 20 ADC 200/ 50 ADC 200/ 100	Qty: @ £68 +P Qty: @ £255 +F Qty: @ £340 +F Qty: @ £425 +F	&P+VAT = £84 P&P+VAT =£302 P&P+VAT =£406
Address:	Card Number Card Number Signature:	Cheque 🗅	Total: £
Post code	G	To qualify for this offe	r quote ref: TEL998



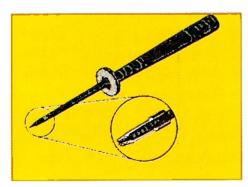


The DC\$8300 digital storage oscilloscope, flagship of the Kenwood servicing range, is available at £2,450 complete with high-performance probes etc.

held insulation/continuity testers, in analogue and digital form, at prices between £100 and £300.

The alternative for appliance safety tests is a PAT (portable appliance tester). The new, comprehensive Megger PAT4DVF has an alphanumeric LCD display and a QWERTY keyboard, which is not the first feature that springs to mind when you think about PATs! It can be used with 110V and 240V equipment and has an RS232 link for use with a computer running the AVO Powersuite software. Its basic specification is: 500V insulation test, reading to $50M\Omega$; earth-bond current up to 25A, reading to 1,999m Ω ; and maximum 3kV AC flash test, reading to 3.5mA. Price is £950. There's a similar product (PAT 2000i) at a similar price in the Seaward range. For those who want to comply with the legislation at a price more in line with repair and servicing costs, the Seaward PAC500 is still available at about £180.

The other important aspect of safety testing is for microwave oven leakage radiation. In this field Celtek's A100 series of leakage monitors stands out. The basic model A100P, which is calibrated to national standards, reads 0-10mW/cm² and costs £140 – or £160 as a kit (A100C) with carry-case, waterbeakers, thermometer etc. An alternative



The Fluke TP80 test probe, with 4mm steel tips, for use with high-density PCBs.

device, available from CPC under order code IN00096, gives visual and audible warnings when the leakage level is above 50mW/cm², has a self-check feature, and comes with a certificate of conformity: price is £94.29 with accessories.

Pattern Generators

Amongst TV pattern and test-card generators, the top-end benchmark Promax GV698 remains unchallenged in terms of price and features, though Grundig now has hardware available to generate 16:9 widescreen images. At the lower end of the market there's the new Burosch TPG1 hand-held test-pattern generator at £174.48: it provides a 'universal test pattern' for overall picture assessment; colour bars; a white raster; RGB bars; a grey scale; a multiburst; and a 1kHz sinewave test tone.

Burosch also has a new computer-monitor pattern generator in hand-held/pocket form, Model CMT-4 at £203.66, to stand against the longer-established Black Star Model MTPG at £165. If a matching PC is available, software-based alternatives like Black Star's 'Testcard' at £29 provide a cheaper alternative.

The Black Star 1410 video monitor tester from Black Star provides a comprehensive range of line and frame frequencies, including 15.625kHz/50Hz for work with projection and conventional TV sets.

Ozan/Teletest continues to produce valuefor-money pattern generators for TV and monitor use, an area in which Sencore also specialises.

Power Supplies

Workshop power supplies find many uses on the bench, especially amongst those who service camcorders, audio or radio products, and those who need to drive VCR decks through their motions while dismantled. A very wide range of units is now available, with analogue and digital V/I readout, voltage ranges up to 60V (Kenwood PAC series), current ranges to 30A (Altai), and in twinand even triple form, the latter from Tenma at £167.

New are the Kenwood P-ranges, with LED display, remote sensing and even, in some versions, remote control.

To simulate a car battery, Altai offers fixedoutput (13·7V) regulated mains converters in current ratings from 3A (at about £15) through 5, 7, 10, 15 and 20A types at up to £164

Audio Servicing

Simulation of car batteries is just one aspect of audio servicing – a reasonable profit can still be made from repairing in-car equipment.

The Ozan Teletest Tone is new in the audio servicing field. It generates four pure sinewaves at up to 12kHz, with four standard levels, plus ITC- and BBC-standard stereoident effects.

Another newcomer is the Tenma LPM6673 laser power meter. Its 633 and 750-820nm response, three power ranges and built-in simulator enable more than CD players to be checked. An identical-looking instrument is available in the form of the Konig LPM5673 – but at a different price! So it's worth checking costs and specifications if you are in the market for a laser-power meter.

There's some new audio test gear from Kenwood: the CS1575D stereo oscilloscope has the ability to display simultaneously two conventional traces plus a Lissajous pattern; the SG series of FM/AM signal generators offers stereo and ranges up to 2GHz; the AG series of audio generators has a variant (253) that boasts a distortion figure of 0.004 per cent.

Those who like daydreaming at the bench might find a range of digital test instruments



The Fluke 12B digital multimeter. Features include capacitance checking to 10,000µF and selectable automatic switching to measure AC or DC.

just introduced by the same company of interest. There are, amongst other things, CD-ROM and DVD encoders and analysers, a DAB OFDM encoder and an IEEE 1394/Firewire bus analyser. I won't quote prices here! They are available from Vann Draper.

Test Discs and Tapes

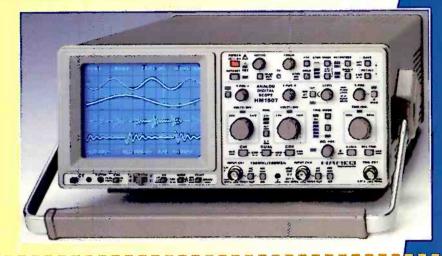
Still with audio, a new range of test CDs is available from Burosch and Hama. It includes a general tester with 96 test-signal components, a laser-beam focus checker, and a Surround-sound set-up/test disc that features – would you believe it? – Tyrannosaurus Rex and the sound of a railway station!

Video test tapes have blossomed this year, with a wide range of products from firms such as Burosch and Nedis at prices below £30 – including a Video-8 stereo version. I

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AD2000 is static free with 230V/55W power supply and has the facility to be used with either the AD2010 (20W) or the AD2045 (50W) power chord. With a range of quick fit solder cartridges [tip/element as: y). Ip sizes from 0.3mm to 4.8mm (16 lips) and temperature control from 100-350°C. This product is a "flust" for the professional engineer.

ORDER CODE: 23800AS

JT6040 an autonomous desolder station with built-ir, hot an generator and electronic temperature and air-flow control. Vacuum pump for securing the IC's. Power: 800W at 230V. Temperature selection: from 150° to 450° C. Air flow regulation: from 6 to 34 l/min.

ORDER CODE: 23800

Trade Prices apply on both products.

For further information on the full range of quality equipment shown above please contact:

The Sale Order Desk at Willow Vale Electronics Limited

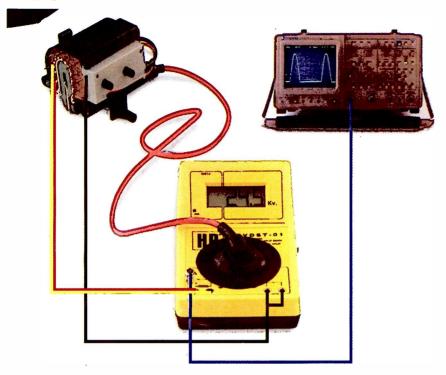
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| Supplement



The HR flyback-transformer tester in use.



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guess that JVC, even Konig, with their three-figure offerings won't sell many alignment tapes in future!

TV Test Gear

In the run-up to DTV there hasn't been much new TV test gear on offer. One item I have found to be very effective - in fact better than everything else I've tried - is the HR flyback-transformer tester from CPC at £71.87. It comes with CD-ROM that illustrates circuits, pin-out details and equivalent types.

Two new remote control testers have been introduced by Burosch. They have LED arrays indicate the presence and strength of infrared radiation, and are ideal for customer demonstrations in the retail shop or in service reception. The more expensive version (£30.50) has eight progressive

LEDs, a variable tone generator and an oscilloscope output port! They are available from CPC.

SEME stocks two high-voltage test probes made by Fluke. The 80K-40, for TV use, measures up to 40kV DC or 28kV RMS AC; the 80K-6, for microwave ovens, measures up to 6kV DC or peak AC. They can be used with any $10M\Omega$ inputimpedance DMM that has 4mm input sockets with 20mm spacing.

Now that terrestrial DTV is about to get under way, and with cable systems changing over to digital signals, there have been developments in the TV-signal testmeter field. The Promax 8 is a hand-held, programmable signal analyser with LCD screen: it's basically a swept-spectrum scanner, with coverage from 5MHz to 862MHz, that can read relative and absolute amplitude and power, also the carrier-tonoise ratio, of both analogue and digital signals.

Satellite TV

Many signal-strength sweep-analysers can operate in both the terrestrial and the satellite TV transmission bands. Examples of this are the established Prolink 7 from Promax and the Unaohm flagship Models EP507 and EP318. All three have the capability (optional) of reading the QPSK/QAM bit-error rate (BER). The Unaohm EP507 has the luxury of a colour LCD screen for picture- and spectrum-display, while Model EP318 uses a black-and-white CRT: in other respects they are similar.

The Unaohm SBM100 battery-operated satellite BER meter covers the 920-2,150MHz range. It has QPSK capability and dual digital/bar-graph readout of the bit-error rate, also LNB power and DiSEqC switching tests.

These instruments can also be used for checking SMATV systems, where problems with data corruption may arise as a result of impedance mismatching and signal reflections.

Computers and Monitors

Pattern generators for monitor test and alignment have been covered here already. Sencore has continued the development of its range of test instruments and analysers.

Two new diagnostic systems, at opposite ends of the price spectrum, are available from CPC for those involved in fault-finding within PCs. Dr. Bear at £490 consists of a card that plugs into a free ISA slot plus leads for connection to the IDE controller and I/O ports. It runs a comprehensive series of tests automatically: the software bypasses DOS to allow systems that won't boot up normally to be tested. A much simpler card for PCI (order code CSO2999) or ISA (code CSO3000) slot-fitting is available at less than £30. It monitors and displays the POST (Power-On

Self-Test) codes generated by a PC's BIOS as the machine boots up. When an error occurs, the POST code manual supplied enables the code to be interpreted.

Other computer-system tests are provided by the Wavetek RS232 interface tester Models 725, 735 and 775, at prices from £127 to £252 (they have multiple-LED indi-



This microwave oven leakage tester is available from CPC under order code INO0096.

cation); and the Cableman PC Cable Check, which tests for open, shorted and cross-connections in a wide range of standard cable/plug configurations.

Soldering and Rework

The four main manufacturers of PCB rework stations – JBC, Leister, Pace and Weller – continue to compete vigorously. Weller has recently introduced several new products: WT50 desoldering tweezers, the 4024-1LA through-hole desoldering station, the MT1500 microtouch soldering station, and several close-controlled soldering stations in the WS and WSD ranges.

Metcal is now providing competition for



Burosch's new remote control testers.

the 'big four' in rework equipment. The Metcal Smart Heat system is based on a low-mass, quick-heat cartridge tip with built-in heater and regulator. There's a wide range of bits, tips and cartridges for the MX-RM3E handpiece and the MX500P power supply unit. The MX-Talon is a tweezer-type handpiece with bevelled-edge bits for use with the same power supply unit. Metcal is now part of OK Industries, which has a complete hot-air rework station – Model FCR2100. Its basic price is £1,025: there's a huge range of shaped nozzles at £87 each.

With the emphasis on Health and Safety at Work, there are new fume extractor ranges from Bofa and Airidus. They draw in fumes at the soldering iron and, working from compressed air, filter out the impurities in a closed chamber, returning clean air to the workshop. The cheapest fume extractor I can find – some units are very expensive! – is the Cliff bench-standing unit at £40: designed for use alongside hand-soldering operations, it uses a replaceable charcoal-filled foam filter to absorb particles down to 5 microns. Complying with health and safety legislation cannot always be cheap, as we saw with PATs.

More 'consumables' are available for surface-mount soldering and rework. Chemtronics' desoldering braid is now available in widths from 0.5 to 5mm, impregated with several different types of flux. Omega has several new rosin- and lead-free 'clean' solder products, while Electrolube has introduced a range of SM rework flux pens for pinpoint dispensing and an SM adhesive product. Alphametals has a long-life (important in small service departments) solder paste for SM work: the paste is rosin-based and is specially formulated for applications where component termination and PCB surfacefinishes are variable.

Service Aids

A fluorescent bench lamp with built-in magnifiers is indispensable for work on much of today's equipment. Unfortunately magnifier lamps tend to be expensive. Help is now available from SEME in the form of the AID3053, a big, bright bench light with a 22W circular tube, a 5in. 3-dioptre lens and a spring-balanced 45in. extension arm. Good value at only £55.

Chemtronics has introduced a rubber keypad repair kit that consists of 3g of adhesive and 0.3g of curing agent. When mixed together and painted on they provide a conductive coating that gives a new lease of life to worn remote control and other contact pads. Chemtronics also has a gold guard pen for cleaning and lubricating gold and other precious metal contacts and connectors: it cleans and lubricates in one go.

Most consumer-electronic equipment now contains chips that are ESD-sensitive. This means that precautions against static charge



The Pico OsziFOX hand-held digital storage oscilloscope.

build-up are required when servicing equipment and fitting replacement devices. A new and, at £26, relatively inexpensive static control field service kit, type 8506, is available from 3M. It consists of a wristband, earthing cords and a bright red dissipative 380 x 510mm, 0.01in. thick mat: the whole lot folds into a small package for carrying in a pocket or toolcase. Several new ESD-defensive products have been introduced by Vermason: there's a complete workstation kit; a field kit at £29 and a posher one at £47; and a couple of rather expensive wall- and bench-mounting wrist strap testers.

Round-up

The prices quoted here are trade, ex-VAT. They tend to vary as new catalogues etc. are introduced, so check before ordering. If the price of something you require seems to be high, talk to Stewart of Reading or Telnet about used test instruments at bargain prices. Most of what we've looked at in this survey has consisted of stand-alone hardware.

I cannot finish without mentioning the Philips Compair computer-based fault diagnosis, repair and set-up system and its associated technologies Customer Service Mode and Smartman, which with Compair went on sale last month. This has to be the innovation of the decade, and will hopefully be the harbinger of a whole range of software-based service systems from all the manufacturers, ideally in a form that's compatible with the Philips one.

My awards for 1998 go to HR for its very effective LOPT tester; to the various makers of those clever and realistically-priced service and alignment videotapes; and to Burosch for making such a wide range of good test equipment at such down-to-earth prices. The booby prize should perhaps go to a PAT maker who charges nearly £300 for a wee bit of floppy-disc based software and the same again for a bar-code reader.

TEST EQUIPMENT MANUFACTURERS AND DISTRIBUTORS

Note that many items are available from several different sources. The ones included in the list below have been selected because they carry a reasonable range of the named brand of equipment.

Items with brand names mentioned in the text but not listed here are available through distributors such as CPC, Chas Hyde and Son Ltd. (CHS), HRS, SEME and Willow Vale Electronics.

Adroit Technology Ltd. Available from CPC.

Alban Electronics Ltd., 6 Caxton Centre, Porters Wood, St Albans, Herts AL3 6XT, 01727 832 266.

Airidus: Available from CPC.

Altai. Available from SEME.

Avo/Megger. Avo International, Archcliffe Road, Dover, Kent CT17 9EN. 01304 502 100.

Black Star, 4 Harding Way, St Ives, Huntingdon, Cambs PE17 4WR. 01480 462 440.

Bofa: Available from CPC.

Burosch: Available from CPC.

CHS, Prospect House, Barmby Road, Pocklington, York YO4 2DP. 01759 303 068.

Coastal Aerial Supplies, Unit X2, Rudford Industrial Estate, Ford, Arundel BN18 0BD. 01903 723 726.

CPC plc, Component House, Faraday Drive, Fulwood, Preston, Lancs PR2 4PP. 01772 654 455.

Daiwa. Available from SEME.

Fluke. Available from Willow Vale Electronics.

GoldStar. Available from Maplin.

Grundig: Available from Vann Draper Electronics.

Hama, Unit 4, Cherrywood, Chineham Business Park, Basingstoke, Hants RG24 0WF. 01256 374 700. Hameg Instruments Ltd., 70-78, Collingdon Street, Luton, Bedfordshire LU1 1RX. 01582 413 174. Also available from CPC, SEME and Willow Vale Electronics.

Huntron. Available from SEME.

Instek. Available from Maplin.

JBC: Available from Willow Vale Electronics.

JVC (UK) Ltd., JVC House, JVC Business Park, Priestley Way, Staples Corner, London NW2 7BA. 0181 450 3282

Kenwood. Available from SEME and Vann Draper.

Konig. Available from CHS, Willow Vale Electronics.

Leader. Available from CPC.

Lodestar. Available from Vann Draper Electronics.

Maplin Electronics plc, PO Box 3, Rayleigh, Essex SS6 2BR. 01702 554 161.

Maxcom. Available from Vann Draper Electronics, Willow Vale Electronics.

Metex. Available from CPC, SEME.

Müter. Available from SEME in the UK, from Donberg Electronics, Ranafast, Co. Donegal (075 48 275) in Ireland.

Ozan, Freepost, Wimborne, Dorset BH21 7BR, Freecall 0500 009 070.

PC Control Systems Ltd., Hamilton House, 66 Palmerstone Road, Northampton NN1 5EX. 01604 601 677.

Philex plc, 110-124 The Broadway, West Hendon, London NW9 7PP. 0181 202 1919.

Pico Technology Ltd., 149-151 St. Neots Road, Hardwick, Cambridge CB3 7QJ. 01954 211 716

Precision Gold. Available from Maplin.

Promax. Available from Alban Electronic Ltd.

Sadelta. Available from Coastal Aerial Supplies and Willow Vale.

Satellite Solutions (UK) Ltd., 1 Hartburn Close, Crow Lane Industrial Estate, Northampton NN3 9UE. 01604 787 888.

Satfinder. Available from Willow Vale Electronics.

Satlook. Available from Satellite Solutions.

Seaward. Available from CPC, SEME, Willow Vale Electronics.

SEME Ltd., Unit 2, Saxby Road Industrial Estate, Melton Mowbray, Leics LE13 1BS. 01664 481 818.

Sencore. UK agents ITM Ltd., 34 Beaufoys Avenue, Ferndown, Wimborne, Dorset BH22 9RH. 01202 872 771.

Tektronix: Available from CPC.

Tenma. Available from CPC.

Thandar/Thurlby. Available from Willow Vale Electronics.

Unaohm. Available from Satellite Solutions.

Vann Draper Electronics, Unit 5, Premier Works, Canal Street, South Wigston, Leics LE 18 2PL. 01162 771 400. Stocks a wide range.

Wavetek: Available from CPC.

Willow Vale Electronics Ltd., 11 Arkwright Road, Reading, Berks RG2 0LU. 01189 876 444.

Test gear is also available from:

HRS Electronics Ltd., 100 Great Barr Street, Birmingham B9 4BB. 01217 666 668.

Stewart of Reading, 110 Wykeham Road, Reading, Berks RG6 1PL. 01189 268 041. Also supplies used equipment.

Telnet, 8 Cavans Way, Binley Industrial Estate, Coventry CV3 2SF. 01203 650 702.

	PI	NCH ROLLEI	RS	
Model Price	Model Price	Model Price		Model Price
AKAI	FVHP615, 618, 620, 622, 710, 711, 715, 716,	BRS600, 605, 747, 777, 920, 925 140p	NS7000 140p	681, 682, 684, 685, 693,
VS10, VS9300, VS9500, VS9700, VS9800, VP7100, VP77 140p	720, 721, 722, 725, 730, FVHP810, 830, 840 140p	HRS10 140p BP5000, HRD110, 111, 120, 220, 225,	ORION VH1, VH2 140p	VC699, 700, 772, 750, 779, 780, 781, 7810, 782, 782MK2, 7822, 783,
VS1, VS2, VS3, VS4, VS5, VS6, VS8, VS9, VS12, VS15 140p	FVHP905, 906, 907, 908, 910, 911, 915, 916, 918, 970, 975, 980, 990, FVHP 5000, 5005,	455 1100p PINCH ROLLER ASSEMBLY	VC150, 180, VH3, 33, 200, 201, 205, 212, 250,	VC785, 786, 787, 793, 800, 7810, 7822, VCT72,
VS105, 112, 115, 116, 120, 125,	5050, 5075, 5100 140p	HRD140, 141, 142, 143, 150, 152, 157, 158,	254, 288, 300, 303, 312, VH404, 555, 700, 704, 712, 770, 780, 844, 900,	VC6F3, VC6V3, VCA 100, 102, 104, 131, 140, 170, 202, 203, 211, 234, 303, 501, 502,
126, 155, 165, 205, 220, 240, 244, 245, VS247, 248, 250, 512, VS515, 516,	VBR330, VBS3500, 7000, 7100, 7500, 7600, 9000, 9900 140p	160, 565, 566, 725, 755, HRP50 1350 p	1000, 2948, 3030, 3312 VHF2A, VP2948 140p	VCA602, 5011, VCD801, 802, 851, 852, 881, 882, VCM73, VCT73, VCT72,
VSX9 VS201, 301, 303, 304, 603, 606, 607, VSP8,	FVHD230, 250, 270, 370, 2000D, FVHP3, 210, 250, 300, 310, 1100,	PINCH ROLLER ASSEMBLY HRD1520, 510, 520, 521, 522, 525, 527, 560,	COMB 15000, 16000, HV03, LVH50, NEVH, NEVHM, NEVHML.	VCB361 140p
VSP82, VP58, VP82 140p VS125, VS155, VS165, VS220, VS240, VS250,	FVHP1200, 1250, 130, 132, 1340, 1340, 1400, 1410, 1440, 1500, 200.	600, 610, 620, 637, 641,	TVP230RC, VCP, VH04, 30, 103, 300, 358, 360,	VC220 140p VCA10, 30G, 60, 103, 105, 106, 111, 113, 131,
VS512 140p	FVHP320410, 420, 430, 440, 445, 470, 475,	HRD650, 720, 830, 840, 910, HRJ205, HRS5800 350p	362, 400, 416, 512, VH530, 532, 535, 536, 600, 630, 635, 640, 666,	211, 244, 254, 33, 35, 36,
VS22, 23, 25, 35, 37, 38, 53, 66, 75, 422, 425, 426, 427, 462, 465, 467,	FVSP290S, 495, 2905 140p FVHD140, FVHD40, FVHD55, FVHP1, FVHP10,	PINCH ROLLER ASSEMBLY BR7030, BRS600, HRD160, 170, 171, 180, 190,	730, 735, 744, 774, 790 VH800, 820, 850, 888, 893, 900, 930, 940, 942,	VCA37, 39, 40, 42, 454, 46, 47, 48, 50, 505, 51, 52, 53, 54, 55, 57, 58, 505,
VS485, 765, 766, 767, 768, 865, 867, 965, 967, VSA77, VSA650.	FVHP20 140p FVHD140, 40, 55, FVHP1, 10, 25, 30, 40, 4000	210, 211, 217, 227, HRD230, 271, 300, 310, 320, 321, 330, 337,	974, 1012, 1040, 1050,	VCA60, 605, 615, 62, 63, 67, 68, 1031, 11613, VCB311, 320, VCBS97, VCD805, 806, 810, 815,
VSF10, 11, 12, 15, 180, 190, 200, 210, 220,	FVHS10, 30 1350p	350, 400, 430, 440, 441,	VH1060, 1070, VH1100, 1120, 1204, 1440, 1500, 1660, 1800, 2004,	VCH80, 81, 865, 910, VCS 1000, VCT310,
221, 222, 230, 240, 30, 33 VSF330, 4, 500, 550, VSP88, VSR100, VSX400,	PINCH ROLLER ASSEMBLY GOLDSTAR	HRD470, 500, 530, 700, 750, 950, HRS5000, 5500, 9000 875p	VH2151, 2308, 22042400, 2500, 2600, 2700, VH2960, 2970, 3050,	VCT410, 610, VCT 1314, 5313, VC790 140p VC780, 790, VCA10, 103, 1031, 105, 106, 211,
450, 470	GHV51, 1221, 1232, 1233, 1240, 1241, 1242, 1243, 1244, 1245, 1246,140p	PINCH ROLLER ASSEMBLY HRD540, HRD550, HRD580, HRD660, HRD860,	VH3060, 4000, 4008, 4010, 4012, 4015, 4015, 4020, 4300, 5020,	244, 254, 255, 30, 35, VCA340, 43, 47, 50, 60, 605, 615, VCD806,
290, 340, 350, 410, 420, 43C VSF441, 440, 450, 455, 480, 490, 497, 510,	GHV1247, 1248, 1250, 1266, 1290, 1291, 1295, 1296, 1392, 1393,	HRD960 700p PINCH ROLLER ASSEMBLY	VP 10, 200, 220, 225, 245, VR821, 925, 1032,	815, VCH80, 81, 83, 85,
560, 580, 590, 599, 600,	GHV1891, 1900, 2145, 3000, 3010, 4400, 4410,	HRJ600, HRJ605, HRJ815,	2949, 2959, 2957, 2966, 2979, 2980, VTV300, VXL20, 25, 30 140p	VCH865, 87, 910, VCS 1000, VCT212, 310, 410, 510, 610, VCTI314,
VSG20, 21, 23, 24, 25, 30, 33, 34, 35, 51, 54, 55, 60, 64, 65, 70, 73, 74, 75,	51, 8000, 8200, GHV8210, 8215, 8430 GHVP1240, 1241, 1247, 1248, 1290, 1291,	HRS9200 875p MATSUI	PHILIPS VR6460 VR6920 140p	VCTS313 525 p
VSP110, VSX560, VSX580 140p VS17, 20, 22, 23, 24, 25, 26, 27, 35, 37, 38, 53,	GHVP1295, 1296, VCP4000, 4100, 4130, 4200, 4300, 4301, 4305, VCP4306, 4310, 4311, 4315,	VX6000, 730, 735, 750, 755, 765, 800, 850,	VR2020, VR2021, VR2022, VR2023,	PINCH ROLLER ASSEMBLY
55, VSA77 775p	4316, 4320, 4321, 4325, 4326, 4350, GSE1290,	VS888 VX1000, VX2000, VX2500, VX3000,	VR2024 140p VR6711 140p	SAISHO VHL3, VR1000, 2000, 2500, 3200, 3300, 3500,
PINCH ROLLER ASSEMBLY VS422, 425, 426, 427, 462, 465, 467, 485, 498,	1291, 1295, 1296, 1297, 1891, 1910, 20005, 2000 140p	VX6000A 140p MITSUBISHI	VR6540 140p DV856, 586, VR702, 703, 6485, 6585, 6589,	3600, 3650, 3800, VRS4400, VRS5000 140p VR3400 140p
765, 766, 767, 768, 865, 867, 965, 967, VSA650, VSF10, 11, 12, 14, 15,	HITACHI VT7, 11, 14, 16, 17, 18, 19, 33, 34, 35, 350, 38,	HS12, 5300, 5424, 5600, HSB11, 12, 16, 21, 27,	6785, 6880, 6948 140p	SAMSUNG
180, 190, 200, 210, 220, 221, 222, 230, 240, 30, 300, 301, 310, 320, 33,	39, 88, 330, 680, 4200,	31, 32, 41, 51, 52, 82, HSE12, 16, 17, 21, 22, 27, 31, 32, 41, 51, 52,	VR445, VR6442, VR6542, VR6643, VR6843, VR6943, 44SB9 140p	SV716, 717, VB510, 520, 610, 616, 617, 619,
330, 4, 500, 510, 600,	VT5000, 5030, 5500, 6500, 6800, 7000, 8000, 8300, 8500, 8700, 930, VT9500, 9700, 9900,	82, HSM1000, 110, 120, 15 0, 16, 170, 190, 210, 23, 25, 250, 27, 33, 34, 35,	DV464, 662, VR2220, 2300, 2324, 2330, 2334, 2340, 2350, 2414, VR2480, 2485, 2486, 2489,	620, 626, 627, 629, 900, V910, V1510, 520, 611, 616, 621, 626, 900,
VSR110, VSX100, 400, 450, 470 800p PINCH ROLLER ASSEMBLY	VM600 140p VT8, 52, 57, 61, 62, 63, 64, 65, 85, 86, 88, 100,	36, 37, 370, 380, 45, 450, 5 4, 55, 555, 57, 58, 59, 68, HSMS2, 9, HSS11,	2490, 2498, 2840, 6462, 6463, 6464, 6560, VR6660, 6860, 6861, 6862, 6863 140p	910, VX510, 520, 616,
VSS99 140p	110, 111, 113, 115, 118,	14, 15, 17, 19, 25, 5600, HV	N-1700, VR2870 140p	SVX301, 303, 305, 307, 319, 322, VB710, 713,
ALBA VCR3000X, VCR4000 140p	VT120, 122, 125, 128, 130, 135, 138, 145, 150, 168, 170, 175, 220, 225.	F125, 150, 303, 85, SV8900, 8930 750p PINCH ROLLER ASSEMBLY PART NO:	VR2025, VR6580, VR6581 140p 49SB6, VR3260, 6349, 6448, 6449, 6548,	750, 770, 971, 8220, VB8225, V1710, 730, 750, 770, 790, 8220, 8225, 970, VX710, 712,
VCR5000, VCR6000 140p VCR161, VCR222 140p	VT250, 255, 258, 260, 400, 405, 410, 413, 414, 415, 416, 418, 420, 425	948D020010 HSE11, 12, 16, 17, 21, 22, 27, 31, 32, 41, 51,	6648 140p PRESSURE ROLLER ASSEMBLY PS403-40205	VX720, 730, 750, 770, 790, 825, 8225, 970,
VCR7000, VCR7800, VCR8000, VCR8800 140p	VT426, 428, 430, 431, 435, 438, 450, 498, 510, 515, 517, 518, 520, 525,	52, 5300, 5424, 5600, HSB11, 12, 16, 21, 27,	DV186, 190, VR211, 2115, 212, 213, 223, 286,	971, 972, 8220, PX980, 981, 982, SE9000, 9001, SX7120, 7121, 7220, 7221, 7230,
VTV10 140p	VT526, 530, 535, 536, 540, 545, 546, 548, 570,	31, 32, 41, 51, 52, 82, HSM1000, 110, 120, 150, HSM16, 170, 18, 190, 210, 23, 25, 250, 27, 30,	291, 292, 311, 312, 313, VR3210, 3219, 322, 3229, 323, 535BO, 486,	SX7301, VK8220, VPX31 140p
VCR1000, 2000, 4500, 4600, 4700, 5200, 6000,	575, 576, 580, 585, 588 VT640, 830, VTF660, 665, 70, 770, 774, 775,	33, 34, 35, 36, 37, 370, 38, HSM380, 40, 45, 450, 50, 54, 55, 556, 57, 58, 59, 60, 68,	471, 562, 582, 571, 761, VR201, 202, VR203, 302, 303, 305, 6180, 6182,	VX9880 140p
6100, 6200, 8600,	780, 785, 860, 861, 865, VTL30, 1000, 2000, VTLC50, VTM598, 620,	HSMS2, 9, HSMX1, 18, 19, 2, HSS11, 12, 14, 15, 17, 19, 21, 25, 5600, HVF125, HVF150, 303,	6185, 6285, 6290, VR6291, 6293, 6362, 6367, 6390, 6391, 6393,	PX31 R, 32R, PXR30, SV80, SX3230, 3231, 3260, 3261, VS390, VX30, 31, 32, 3560, 3561,
VCR8602, 8603, 8604, 8700, 8704, 8714, 8800, 8804, 9000, 9005,	622, 625, 626, 630, 635	85, SV8900, 8930 140p	6467, 6468, 6470, 6561	370, 375, 380, VXK300, 301, 306, 307, 320,
VCR9244, 9340, DD8900, 8904, TVR1, 2, 3, 4 140p	VTM636, 640, 645, 646, 720, 722, 725, 726, 727, 728, 730, 731, 735,	HS200, HS300, HS301, HS302, HS303, HS304, HS310, HS320, HS330, HS360,	VR6570, 6581VR6670, 6676, 6710, 6760, 6761, 6762, 6870, 6970,	VXK321, 326, 330, 331, 336, 337, 350, 351, 356 140p
VCR7000 140p DD8900, DD8904, VCR6000, 6100, 6200, 8600,	VTM736, 740, 745, 746, 748, 753, 754, 820, 821, 822, 825, 830, 831,	HS700 140p HS306, HS307, HS318, HS319, HS337, HS338,	VR6975, 86BI, 63SB7, 68SB4, 71SB4, 71SB5, 72SB8, 72SB8, 92SB31, 20DV1, 20DV2,	PX990, 991, 992, S11230, 1240, SVX4000, 503, 504, 600, SX1230,
8602, 8603, 8604,	VTM835, 838, 840, 841, 845, 920, 921, 922, 925, 930, 931, 935,	HS347, HS349, HS400, HS410, HS411, HS412,	20RW7, 21DVI, 21DV2, 2SB01, 2SB02, 2SB11,	SX1231, 1260, 1261, 1566, V11560, VPK43,
VCR8700, 8800, 900>9, 9140, 9244, 9340 700p	VTS80, 85, 890, 895VM200, 2300, 2380, 3200,	HS421, HS480, HS710, HSB 10, HSB20, 30, HSE 10, 20,	2SB12, 30DV2, 31DV1, 31DV2, 31DV33SB02, 3SB03,	VX1230, 1260, 1261, VX1560, 1561, 1850 140p
PINCH ROLLER ASSEMBLY PART NO: 153148 TX3650, UF20, VCR3000, VCR3002, VCR4000,	3280, 500, VMS7200 140p VT3000 140p	30, 70 140p NATIONAL PANASONIC	3SB05 3SB11 3SB12 3SB13 280p VR231, 232, 332, 422, 4229, 512, 5229, 722,	SONY
VCR9500 300p PINCH ROLLER ASSEMBLY PART NO:	VT410, 420, 428, 430, 450, 498, 518, 520, 522, 530, VTF770, 780,	NV100, 180, 300, 330PX, 332, 333, 340, 366,	7229, 723 140p VR501 PR38 140p	SLC5, 6, 7, SL3000, 8000, 8080, 8200, SLJ 10, SLT6ME, SLT7ME 140p
2554966	VTM598, 622, 722, 740, 748, 753 650p	600, 688, 777, 788, 3321, AG6010, 6015, 6100, 6200, 6400, 6800,	SANYO	SLC9, 20, 24, 30, 33, 44, SLHF100, SLF1, 11,
DD9900, 9904, TX3650, UF20, 22, 24, VCR3000, 3002, 9500 140p	VTF150, 155, 180, 185, 250, 255, 260, 265, 280,	7450 140p NV230, 250, 260, 280, 370, 380, 430, 431, 433,	VHR1100, 1110, 1150, 1200, 1300, 1500, 2100, 2300, 2370, 2500,	20, 25, 30, 35, 60, 100, SLF200, SLF60PS, SLF90E, SLFH150, 850,
VS1004 VS1104 140p FERGUSON	285, 350, 351, 355, VTF360, 365, VTM140, 141, 145, 145, 210, 211,	450, 460, 465, 470, 480 NV630, 650, 730, 770, 780, 810, 830, 850, 870,	VHR2700, 3330, MVR220 140p VTC5000, 5150, 5300, 5350, 5400, 5500, 6000,	SLK88, 95, SLT20ME, SLT30ME,
3V00, 3V01, 3V16, 3V22, 3V23, 3V24, 3292,	212, 215, 220, 221, VTM230, 231, 235, 284, VTS390 140p	890, 2000, 2010, 3000,	6010, 6500, 9100,	SLT50ME 140p BMC 100, BMC200, BMC500 140p
8900, 8901, 8902, 8903, 8904, 8906, 8909, 8912, 8922, 8923, 8924, 8925, 8929 140p	HINARI	NV7000, 7200, 7800, 8050, 8150, 8170, 8200, 8300, 8400, 8500, 8600	VTC9300, VTCM10, 20, 11, 21, 30, 31, 40, 50, VPR5800 140p	SLV201, 202, 301, 302, 401, 402, 801,
3V29, 3V30, 3V31, 3V32, 3V52, 8930, 8931, 8933, 8940, 8941, 8942 140p	V20H, VXL5, VXL6, VXL7, 8, 9, 10, 11, 19, 90, H13V, VTV100, 200 140p	NV8610, 8620, NVG11, 14, 16, NVG7, 10, 12, 15, 18, 30, 130, 400,	VHR3100.3300, 3310, 3400, 3500, 3700, 3800, VHRD500, 700 140p	802 140p SLV210, 270, 273, 275, 300, 353, 373, 410, 415,
3V35, 3V36, 3V38, 3V39, 3V42, 3V43, 3V44,	VXL2, VXL3 140p VXL4, VXL20, VXL35 140p	AG 1000, 1050, 1200, 1500, 2100, 2200, 6500, 6810, 7500, 7510,	VTC3000 140p	474, 656, 715 300p SLV757, 777 140p
3V45, 3V48, 3V49, 3V53, 3V54, 3V55, 3V56, 3V57, 3V58, 3V59, 3V65, FV10, FVII, FV12,	VTV100, VXL10, VXL11, VLX9,	NVH70 140p	VHR120, 130, 14, 141, 143, 14, 150, 151, 153, 154, 15, 16, 171, 194, 22	SLV255 140p
FV14, 8943, 8944, 8945, 8947, 8948 140p 3V52 140p	VXL90 700p PINCH ROLLER ASSEMBLY	NVG9, NVG120 140p AG6840, 6720, 7150, 7330, 7350,	0VHR23, 235, 240, 244, 250, 251, 274, 27, 297, 310, 330, 335, 350, 390, VHR4100, 4105, 4150,	SLV275, 282, 315, 325, 353, 363, 373, 410, 415, 416, 474, 625, 656, SLV715, 725, 727, 757, 777,
8950, 8951, FV10B, 11R, 13H, 14T, 20B, 21R, 22L, 26D, 31R, 32L, FV33H, 39S, 41R, 42L, 50B,	V20H, VXL5, VXL6 MOD KIT 275p J.V.C.	7355, 7650, NVH65, 75, NVJ30, NVL20, 23, 25, 28, NVG300, NVF65, NVF70, NVFS1 NVFS	4200, 430, 4300, 4350, 4400, 474, 4770, 5080, VHR5100, 5200, 5300, 5350, 5600, 5700, 6850,	815, 825, SLVX30, 50, 55 140p
51R, 52L, VC141L 140p	HR2200, 3300, 3330, 3360, 3660, 4100,	100, NVG 19, 20, 25, 33, 40, 50, NVV8000 140p	7100, 7200, 7250, VHR7260, 7300, 7400, 7440,	SLV125, 213, 225, 252, 255, 262, SLVXI, 20, 3 140p
FV37H, FV44L, FV46T, FV43H, FV57H 140p	7700 140p HR2650, 7200, 7300, 7350, 7600, 7610, 7650,	NVD48, NVD80, NVG21 NVG45 140p	7500, 7520, 7530, 7540, 7700, 774, 780, 0VHR7810, 8000, 8070, 8100, 8200, 8250,	SLV215, 216EE, 275, 282, 315, 325, 353,
3V35, 3V36, 3V38, 3V39, 3V49, 8943, 8944 1100p	7655 140p HRD110, 111, 120, 121, 140, 141, 142, 143,	NVJ700PX 140p NVHD100, NVHD101, NCHD90, NVSD30,	8500, 8800, VHRD4400, 4410, 4500, 4600, 4610, 4710, 4890, 6700, VHRS700 140p	363EE, 373, 393, 410, 415, SLV416EE, 474, 494EE, 555UC, 559, 575UC,
PINCH ROLLER ASSEMBLY 3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54,	150, 152, 156, 157, 158, HRD160, 220, 225, 250, 257, 445, 455, 565,	NVSD40 1125p PINCH ROLLER ASSEMBLY	VCR100 140p VHR120, 135, 150, 190, 4150, 4160, 4350,	579, 585HF, 595HF, SLV60W, 615, 625, 656, 676UC, 686HF, 696HF, 715, 725, 727, 757,
3V55, 3V56, 3V57, 8945, 8947, 8948 1350p	566, 725, 755, HRP50, BP5000, BR7000,	AG5150, 5250, 5700, 6024, NVD38, 48, 80, NVF55, 65, 70, 75, 77,	5200, 5240, 5350, 7200, 7250, 7260, 7700, VHRD4410, 4610, 4710, 4890, 5450,	SLV767B, 777, 815, 825, SLVE7, 8, 9SLVX30AS,
PINCH ROLLER ASSEMBLY FV37, FV57, FV58 350p	BRS611, 811 140p HRD520, 540, 550, 560, 580, 600, 610, 620,	NVFS1, 100, 200, 88, 90, NVG 19, 20, 21, 22,	VHRS700 975p	SLVX35AF, SLVX50AS, SLVX55DH,
PINCH ROLLER ASSEMBLY FV31R 140p	637, 640, 641, 650, 660, HRD670, 720, 730, 740, 770, 820, 830, 840,	25, 28, 300, 33, 40, 45, 46, NVG50, NVH65, 75, 77, NVJ30, 33, 35, 37, 40,	PINCH ROLLER ASSEMBLY VHR3100, 3200, 3300, 3310, 3400, 3700, 3800,	SLVX65BR, SVO140, 160 1250p PINCH ROLLER ASSEMBLY PART NO:
FV41L, FV42L 925p PINCH ROLLER ASSEMBLY	860, 870, 880, 910, 960, HRD980, HRDX20, 22, 25, HRJ200, 205, 210,	42, 45, 47, NVL20, 23, 25, 28, NVW 1 300 p	VHRD500, 7000 1350p PINCH ROLLER ASSEMBLY	X37277701
3V58, 3V59, 3V64, 3V65, FV10, 11, 12, 13, 14,	215, 300, 315, 316, 318	PINCH ROLLER ASSEMBLY	SHARP	SLV210, 212, 270, 273, 275, 285, 300, 310, 335, 425, 427 350p
20, 21, 22, 26, 30, 32, 33 FV39, VC141L 875p	HRJ400, 405, 407, 410, 411, 415, 416, 507, 600, 605, 610, 615, 715, 815	N.E.C. N830, 831, 832, 833, 895 140p	VC200, 381, 383, 384, 385, 386, 388, 390, 393, 800, 2300, 3300, 6000,	PINCH ROLLER ASSEMBLY SV6700.8750, 9700, VHR3100, 3200, 3300,
PINCH ROLLER ASSEMBLY FV43H, FV44L, FV45X, FV46T 700p	HRJ97, HRS4700, 5800, 5900, 6800, 6900, SR3200, 330, 368 140p	PVC2300, 2400, 740, 744, 746, 760, 764, 766 140p	VC6200, 6300, 7300, 7700, 7750, 7800, 8300, 838, 9100, 9300, 9400,	3310, 3400, 3700, 3800, VHRD500, 700 1350p
PINCH ROLLER ASSEMBLY FV61, FV62, FV67, FV68, FV70, FV71, FV72,	HRD170, 171, 180, 210, 211, 217, 230, 300,	DX1000, 1600, 1800, 2000, 3000, N9012, 9013,	VC9500, 9600, 9700, 9800 140p	PINCH ROLLER ASSEMBLY SL100, 200, SLC20, 30, 33, 34, 40, 44, 80, 88,
FV74, FV77 775p	320, 321, 330, 337, 350, HRD370, 400, 430, 440, 441, 470, 500, 530,	9014, 9016, 9033 N9034, 9053, 9054, 9055, 9056, 9066, 9096,	VC300, 387, 402, 471, 473, 477, 481, 482, 483, 486, 488, 496, 500, 571,	9, SLF1, 20, 25, 30, 35, 45, SLF60, 65, 73, 90,
PINCH ROLLER ASSEMBLY FISHER	700, 750, 950, HRS5000, 5500, 8000, 9000, BR7030, 7040,	9110, 9120, 9510, 9520, N9530, 9610, PX 1200 140p	573, 581, 582, 583, 584, 585, 8481, VC5F3, VC5W20E, VCA1031 140p	SLHF100, 150, 950, SLK85, 95, SLO1700, SLS550, SLT0, 30, 50 300p
FVHP420, 520, 530 140p	9060,	DS6000G, DX4000, N9077	VC108, 208, 405, 408, 550, 600, 651, 671, 674,	PINCH ROLLER ASSEMBLY
		VIDEO LAMPS		

VIDEO LAMPS

Models & Description Or	rder Code	Price	Models & Description	Order Code	Price	Models & Description	Order Code	Price	Models & Description	Order Code	Price
UNIVERSAL VIDEO LAMP 9V	VL01	25p			100p	AKAI, GRANADA (VHSTJ2),	VL01	25p	AUTHENTIC (N850), DECCA	VL07	40p
80mV (310mm WIRES)			BLAUPUNKT, FERGUSON, FI			HITACHI (VT3000), ITT (VR3912,	•		(VR8300), GRANADA (VHSTJ3,		1
PANASONIC VIDEO LAMPS	VL02	30p	FISHER, FUJITSU, FUNAI, G.I. GOLDSTAR, GRANADA, GRU			VRP3833), JVC (HR2200, 3300, 3330, 3660), MITSUBISHI (HS20	101				
SHARP VIDEO LAMPS	VL02	30p	HINARI, HITACHI, ITT, JVC (H			TELEFUNKEN (VR510, 519, 610)			WJ1, WJ3), ITT (VR3913, 3914,		
HITACHI 5381682 (VT63, VT64)	VL04	135p	SERIES), MATSUI, MITSUBIS			THOMSON (VK300, 305, 306, 33	301),		3963) JVC (HT7200, 7300, 7350,		
VIDEO LAMPS			NEC, ORION, NATIONAL,			FERGUSON (3V00, 16, 22, 24, 3			7700) TELEFUNKEN (VR450, 52	n	
AKAI IVS 10), GRANADA	VL06	40p	PHILIPS, SAISHO, SALORA, SAMSUNG, SANYO, SHARP,			8900, 8901, 8902, 8903, 8909, 59	31Z,				
(VHSXJ3), TT (VR3993,3994), JVC			SIEMEN, SONY, TELEFUNKE	N.					529, 540, 549, 620, 640, 920, 193	20),	
(HR2650, 7600, 7610, 7650, 7655),			THOMSON, TOSHIBA	•		BLAUPUNKT, ORION (VH1, 2A) NATIONAL (NV200.2010, 3000.	, VL02	30p	THOMSON (V4100, VK308, 309	, 312,	
TELEFUNKEN (VR530, 535, 539, 55 630, 650), THOMSON (V309, 316, 3			GRANADA (VHSAY3),SHARP	VL08	45p	7000, 8150, 8200, 8400, 8600, 86	610.		410), FERGUSON (3V23, 29, 30,		
VK309, 411,TX8000), FERGUSON			(VC200, 381, 384, 385, 386, 38			8620), SHARP (VC2300, 6000, 6					
(3V31, 8941, 8942)			390, 393, 9300, 9500, 9700)			6300, 7300, 7700, 8300)			8923, 8924, 8929, 8930, 8931, 8	940)	

VIDEO SERVICE KITS

		VIDEO SERVICE	IZILE	<u> </u>			
AMSTRAD		HITACHI			V600/NV688		
VCR700		VT11/VT33 Contents			Contents Belt Set, Pinch Roller,	Economy Kit Contents BELT SET, PINCH ROLLER	
Contents BELT SET, PINCH ROLLER, REEL IDLER, VIDED LAMP		BELT SET. PINCH ROLLER, TENSION BAND, IDLER TYRES		P	PLAY IDLER. FF/REW IDLER,	PLAY IDLER TYRE. FF/REW	
Order Code: SK41	£5.50	Order Cade: SK08	£5.0	٠,	ENSION BAND	IDLER TYRE	£6.00
FERGUSON & JVC		VT11/VT33		١٣	Order Code: SK25 £12	2.00 Order Code: SK26	10.00
3V42/43	l	Contents Economy Kit Contents BELT SET. T/UP REEL TABLE BELT SET. PINCH ROLLER.			NV730/NV770		
HRD455/HRD725		TYRE, SUPPLY REEL TABLE FF/REW IDLER TYRE, T/UP			Contents SLDT IN BELT. LOADING BELT	Economy Kit Contents SLDT IN BELT, LOADING BELT.	
Contents Economy Kit Contents BELT SET, PINCH ROLLER, BELT SET, PINCH ROLLER		TYRE. PINCH ROLLER. FF/REW TABLE TYRE. SUPPLY REE IDLER. CLUTCH PLATE. TABLE TYRE			PINCH ROLLER, IDLER UNIT.	PINCH ROLLER, IDLER TYRE	
CLUTCH MECHANISM, TENSION SUPPLY CLUTCH, TAKE UP		IDLER. CLUTCH PLATE. TABLE TYRE TENSION BAND			ENSIDN BAND		
BAND CLUTCH Order Code: SK37 £16.00 Order Code: SK38	£9.00	Order Cade: SK45 £13.00 Order Cade: SK46	£3.7	5 0	Order Cade: SK19 £	5.50 Order Code: SK20	£3.00
E10.00 Graef Gode. 3830	25.00	VT52/61/62/63/64/65/85/86/640			NV370/NV380/480/630/780/830/8	50/AG2100PK/AG2200PK	
3V58/59/64/65	1	Contents Economy Kit Contents			Contents	Economy Kit Contents BELT SET, PINCH ROLLER	
HRD170/180/210/230/300/320/370/400/430/530/700/750 HRS5000		BELT SET, PINCH ROLLER, FF/REW ARM. CLUTCH PLATE. BELT SET, PINCH ROLLER FF/REW IDLER			BELT SET, PINCH ROLLER, DLER. TENSION BAND	IDLER TYRE	
Contents	ļ	TENSION BAND		0		5.00 Order Code: SK22	£2.75
BELT SET, PINCH ROLLER, IDLER ARM, TENSION BAND	£7.00	Order Code: SK49 £14.00 Order Code: SK50	£3.0		NV777/NV788		
Order Code: SK44	17.00	VT400/405/410/13/14/15/18/420/25/26/28/430/31/35/48/450/498/			Contents	Economy Kit Contents	
3V29/3V30		510/520/25/26/530/35/36/540/545/46/48/570/75/576/580/85/88	` `		BELT SET, PINCH ROLLER,	BELT SET, PINCH ROLLER	
HR7200/7300/7350		Contents TIMING BELT. PINCH ROLLER, FF/REW ARM. CLUTCH BASE.			DLER UNIT. TENSION BAND Order Code: SK17 £	IDL'ER TYRE 6.00 Order Code: SK18	£4.00
BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES		TENSION BAND		\$	SHARP		200
Order Code: SK05	£5.00	Order Code: SK52	£9.7	١,٠	/C381	Facanamy Vit C	
3V35/36, 38/39/49	ļ	VT100/110/111/113/115/118/120/125/128/130/135/138/145/150/			Contents Belt set. Pinch Roller.	Economy Kit Contents BELT SET. PINCH ROLLER	
HRD110/111/120/225		175/220/225/250/255/258/260/VTL30 Contents		F	REEL IDLER. TENSION BAND.	REEL IDLER TYRE	
Contents BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES		BELT SET. PINCH ROLLER, FF/REW ARM, CLUTCH PLATE.		V	VIDED LAMP Order Code: SK47 £	8.00 Order Cade: SK48	£3.25
Order Code: SKO4	£5.00	TENSION BAND Order Code: SK51	£14.0	- 1	under Gues, SR4/ I	5.00 State 6446, 5840	1.0.23
			114.0	١,	VC500/VC571/VC581/VC582/VC58		
3V31/3V42 HR7600/7610/7650/7655		PANASONIC			Contents Belt set, Pinch Roller.	Economy Kit Contents BELT SET. PINCH ROLLER	
Contents Economy Kit Contents		NV2000/NV2010NV7000/NV7200/NV7800 Contents Economy Kit Contents		F	REEL IDLER, TENSION BAND	REEL IDLER	
BELT SET, T/U REEL TABLE BELT SET, T/U REEL TABLE		BELT SET. PINCH ROLLER. BELT SET. PINCH ROLLER		0	Order Code: SK60 £	9.50 Order Code: SK61	£5.00
TYRE. PINCH ROLLER. REEL IDLER. T/U CLUTCH, T/U IDLER. IDLER TYRE. T/U IDLER TYRE.		TENSION BAND, IDLER TYRES TENSION BAND, IDLER TO Drder Code: SK03 £5.00 Order Code: SK02	'HES £5.0	տև	VC781/VC7810/VC7822/VC785/VC	786/VC793/VC800/	
TENSION BAND, VIDEO LAMP T/U CLUTCH				- 1	VCA100/VCA102/VCA104/VCA20	2	
Order Code: SK33 £11.00 Order Code: SK34	£5.00	NV300/NV330/NV333/NV340/NV366 Contents			Contents	Economy Kit Contents BELT SET, PINCH ROLLER	
3V35/36/38/39/49		BELT SET. PINCH ROLLER. TENSION BAND, IDLER TYRE			BELT SET. PINCH ROLLER. REEL DRIVE UNIT. TENSI O N	REEL DRIVE UNIT TYRE	
HRD110/111/120/121/225		Order Code: SK01	£5.0	20 E	BAND		
Contents Economy Kit Contents BELT SET. T/U REEL TABLE BELT SET. T/U REEL TABLE		NV2000/NV2010		1	Order Code: SK64 £1	3.50 Order Code: SK65	£3.75
TYRE, SUPPLY REEL TABLE TYRE, SUPPLY REEL TABLE		Contents Economy Kit Contents		1	VC681/VC682/VC684/VC685/VC6	93/VC699/VC6F3/VC700	
TYRE. PINCH ROLLER. T/U TYRE. PINCH ROLLER. T/U		BELT SET. PINCH ROLLER. FF IDLER, PLAY IDLER. TENSION IDLER TYRE. PULLEY TYRI			Contents	Economy Kit Contents	
CLUTCH. T/U IDLER, REEL CLUTCH. T/U IDLER TYRE. REEL IDLER, TENSION BAND IDLER TYRE		BAND. VIQEO LAMP		١,	BELT SET. PINCH ROLLER. REEL DRIVE UNIT. TENSION	BELT SET. PINCH RÖLLER REEL DRIVE UNIT TYRE	
Order Code: SK35 £10.00 Order Code: SK36	£5.50	Order Code: SK13 £6.00 Order Code: SK14	£3.5	~ ·E	BAND		
3V29/3V30		NV7000/NV7200/NV7800		19	Order Code: SK62 £1	3.50 Order Code: SK63	£5.00
HRD7200/7300/7350		Contents Economy Kit Contents BELT SET, PINCH ROLLER, BELT SET, PINCH ROLLER					
Contents Economy Kit Contents		IDLER UNIT. PLAY IDLER IDLER TYRE. CLUTCH TYR			FOR MORE	DETAILS OF OVER 50	0
BELT SET. T/U REEL TABLE TYRE. SUPPLY REEL TABLE TYRE. SUPPLY REEL TABLE TYRE. SUPPLY REEL TABLE		TENSION BAND Order Code: SK11 £8.50 Order Code: SK12	£3.2	₂₅	TYPES ()	F SERVICE KITS	
TYRE. PINCH ROLLER. REEL TYRE. PINCH ROLLER. REEL			13.2			ASE RING US!	
IDLER, T/U CLUTCH, T/U IDLER. TENSION BAND, VIDEO LAMP T/U CLUTCH TOUR TYRE. T/U CLUTCH		NV300/NV330/NV333/NV340/NV366 Contents Economy Kit Contents		٦L	, ru	ASE RING US:	
Order Code: SK31 £10.00 Order Code: SK32	£5.00	BELT SET, PINCH ROLLER, BELT SET, PINCH ROLLER		1	SERVICE V	IT & UPGRADE F	OR.
3V44/45/48/53/54/55/57		IDLER UNIT. PLAY IDLER. IOLER TYRE, PLAY IDLER TENSION BAND				A TV CHASSIS	OV.
HRP50/HRD140/150/158/160		Order Code: SK15 £7.00 Order Code: SK16	£3.2	25			
HRD250/257/565/566/755				_[]		D401 ON THE 20/21 CHASSIS) IS NOT
Contents Economy Kit Contents BELT SET. PINCH ROLLER. BELT SET. PINCH ROLLER		NVG7/NVG9/NVG10/NVG11/NVG12/NVG14/NVG15/NVG16/ NVG18/NVG30/NVG120/NVG130/NVG400/NVH65 (PX/AC)/			UNCOMMON.		- 1
CLUTCH MECHANISM. TENSION		AG1810 (P/K)				ASSEMBLED AS A REPAIR	
BAND	£9.50	Contents Economy Kit Contents LDADING BELT. CAPSTAN LOADING BELT. CAPSTAN				ES AND AS AN UPGRADE I	OR THE
Order Code: SK39 £15.00 Order Code: SK40	13.50	BELT. PINCH ROLLER. IDLER BELT. PINCH ROLLER. IDL		- [1	POWER SUPPLY.		- 1
FISHER		TENSION BANO TYRE Order Code: SK27 £6.00 Order Code: SK28	£3.0	₀₀		ALL THE REQUIRED COMP	
FVHP905/906/907/908/910/911/916/918 Contents Economy Kit Contents			2010	1	AND COMES COMPLE CIRCUIT DIAGRAM.	TE WITH FULL INSTRUCTION	UN9 GND
BELT SET, PINCH ROLLER BELT SET, PINCH ROLLER.		NV332 Contents Economy Kit Contents				TO CIT THE FOLLOWING	VEC AND
IDLER, GEAR IDLER UNIT. IDLER TYRE		BELT SET, PINCH ROLLER, BELT SET, PINCH ROLLER			THE KIT IS DESIGNED MODELS.	TO FIT THE FOLLOWING MA	KES AND
TENSIDN BAND Order Cade: SK57 £13.00 Order Code: SK58	£5.00	PLAY IOLER, FF/REW IDLER. PLAY IDLER TYRE, FF/REV TENSION BAND, FF/REW TYRE IDLER TYRE	1				
		TENSION BAND. FF/REW TYRE IDLER TYRE Order Code: SK29 £12.00 Order Code: SK30	£5.1	10	* ALBA / BUSH	* AKAI	
FVHP615/618/620/622/710/711/715/716/720/721/722/725/ 730/830/840					* GOODMANS	* HINARI	
Contents Economy Kit Contents		NV230/250/260/280/430/450/460/470/650/810/890/ AG1200PK/AG1500PK	r.		* JVC	* MATSUI	- 1
BELT SET, PINCH ROLLER. BELT SET, PINCH ROLLER. IDLER TYPE		Contents Economy Kit Contents			ORDER CODE : C	NWAKIT DDICE	: 1200p
IDLER. GEAR IDLER UNIT. IDLER TYRE TENSION BAND		BELT SET, PINCH ROLLER, BELT SET, PINCH ROLLER IDLER. TENSION BAND IDLER TYRE				LREADY TAKEN STEPS TO UPGRADE THE PO	
Order Code: SK68 £11.00 Order Code: SK69	£300	Order Code: SK23 £6.00 Order Code: SK24	£3.2	25 I			

REPLACEMENT VIDEO CASSETTE HOUSINGS

Name	Models	Code	Price	Name	Models	Code	Price	Name	Models	Code	Price
AKAI	V\$35, VS53, VS55,				FV31R	CH19	4300p		VCA103, 103GV, 106, 106GVM,		
	VS56, VS75	CH18	3200p		HRD515, 520, 527, 540, 550, 580,				254GVM	CH23	2500p
GRANADA	VHSDP1	CH05	1100p		600, 610, 620, 660, 670, HRD830,				VCS211, 244, 5055, 605, VCB230,		
	VHSYJ2	CH01	2800p		840, 850, 860, 4050, 6600, FV37H	CH20	2200p		VCD806G, 810G, VCT212, 310,		
GOLOSTAR	GHV1290P, 1291P, 1295P, 9400,				HRD540, 580, 830, 860, 910, 960,				410G, 610	CH24	2500 p
	73401, GSE1295P, GSE1891P,				HR 0 970, HRDX20,			TELEFUNKEN	VR2970	CH02	2800p
	20001Q, 20051Q, VCP4200, 4300,			FERGUSON	FV57H	CH27	2400p	THOMSON	V320, 321, 323, 326, 4200, 4300	CH01	2800p
	4301, 4305, VCP4306, 4311, 4315,			I,T.T.	VR3605, VR3905	CH01	2800p		V342, 343, 352, 353, 360, 364, 368,		
	4316, 4320, 4321, 4325	CH25	2000p		VR3916, 3926, 3946, 3948, 3976,				4210, 4230, 4260, 4400, V5500,		
	GHV51, 1221, 1232, 1240, 1241,				3986, 3995, 3997, 6948	CH02	2800p		6000, 8540	CH02	2800p
*	1242, 1244, 1246, 1248, GHV8000,				VR3916, 3926, 3946, 3948, 3976,			TOSHIBA	V55, V57	CH01	2800p
	8200	CH26	2900p		3986, 3995, 3997, 6948	CH02	2800p		V65, V66	CH02	2800p
FERGUSON & J.V.C.	3V38, 3V39, 8943, 8944, 8951,			NATIONAL PANASONIC	NV730	CH06	4300p				
	3V35, 3V36, 3V49, HRO 110, 111,			N.E.C.	N830EG, N831EG, N831EG, N832,			A - A - A - A - A	**	b & 0	4
	120, 121, 225	CH01	2800p	1	N833EG	CH01	2800p	MMMMM		N GN G	AI PAI
	3V42, 3V43, 3V44, 3V45, 3V48,				N895	CH02	2800p	AMS7	TRAD MOD I	ZIT	*
	3V53, 3V54, 3V55, 3V57, 8945,			PHILIPS	CASSETTE LIFT ASSEMBLY (691203	66)		W AIVIO	KAD MOD I	<u>711</u>	
	8947, 8948, HRD 140,				DV186, 190, 286, 471, 562, 761,			*			*
	141, 150, 157, 158, 160, 250,				VR6180, 6182, 6185, 6285, VR6290,						
	HRD257, 455, 565, 566, 725, 755	CH02	2800p		6291, 6293, 6362, 6367, 6393, 6467,			FITS:			*
	8948, 8950, FV10B, 12L, 13H, 14T,				6468, 6470, VR6561, 6670, 6760,			🏠 VCR 4500 , 46	600, 4700, 5200, TVR 1	,2,3	
	20B, 21R, 22L, 26, 395, HRO230,				6761, 6870, 6970	CH05	1100p	*			*
	430, 530	CH03	2800p		VR6443	CH22	2900p	A DDICT	. CO OF 1 XIATE .	1.	
	3V58, 3V59, 3V64, 3V65, FV11R,				VR6448	CH23	2500p	RICE PRICE	E: £2.25 + VAT e	acn	*
	8950, 8951, HRD170, HRO180,				49SB6	CH24	2500p	A A A A A	-AAAAA	A_A_	A _ A _
	HRD370	CH04	2800p	SHARP	VCA100, VCH851, VCH852	CH22	2900p	MMMMM	****		AF TAP

NV2000, 2010, 7000, 7200, 7800 (VS50048)

NV230, 260, 430, 810, 870, 2300, 4300

(VSS0110)

NV830 (VSS0091)

NV300, 333, 340, 366, 688, 777, 778

(VSS0060

NVG21, 25, NVH65, NVD80 (VSS0175A)

UDIO CONTROL HE AMSTRAD ORIGINAL NO: 150751

£3.50

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£2.10

£3.75

£2.00

d 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

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, S DER, SEG, SENTRA, SHINTOM, TASHIKO, TATUNG, TOWADA UNIVERSUM ORDER CODE: AH02 PRICE: 1450p

for National Panasonic

MODELS NVG7 etc 875p VBR0050 NV300, NV340 etc 875p V8R0061 NV777 etc 875p VBR0103A NV250, NV450 etc 625p VBR0125 625p

SET OF 8 ALLEN KEYS

0.90mm

1.50mm

2.00mm

3.00mm

Price: 90p

0.77mm

1.27mm

160mm

2.40mm

Replacement Audio Control Video Sound Head

IDEO TOOI

VIDEO CLEANING STICKS

Price 17p each 15p each pack of 10pcs 13n 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

3 REVERSIBLE SCREWDRIVERS SPRING HOOK

VCR HEAD EXTRACTOR

CIRCLIP PLIERS MICRO SCREWDRIVER

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

UP BAT MIDRIDS

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: 150p

SATELLITE PS REPAIR

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

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

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 (Surensen)	SATPSU15	700p
AMSTRAD SRD700, SR950, SRX100, 301, 501, 502, 1002, 2001, SRD2000 SAT250	SATPSU16	650p

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 impedence: 70 Ohm * Power amplifier: 18db *Detection Range: -60 to -10 DBM
- Max. input signal: -10 DBM

ORDER CODE: TOOL22

PRICE: 8500p

REPLACEMENT

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:

(POWER SWITCH 21mm +Remote)

Order Code: SW6

Price: 130p

SONY 2 PIN FUNCTION SWITCH

Order Code: SW9

Price: 35p

		FUSES		
	TIME LAG (20mm)		QUICK BLOW (20mm)	
CURRENT RATING	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

CERAM	IIC PLUG TO	OP
CURRENT RATING	ORDER CODE	PRICE
3A	FUSE33	100p
5A	FUSE34	100p
13A	FUSE35	100p

32 mm CERAMIC SLOW BLOW

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

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

VOLTAGE TESTER

A terminal screwdriver incorporating continuity & voltage with Euroslot

ORDER CODE: TOOL11

PRICE: 220p

 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

38mm CER	AMIC TIME	ELAG
CURRENT RATING	ORDER CODE	PRICE
10A	FUSE48	825p

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.

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

TELEVISION Edition 6

Lists more than 8,450 faults with 460 pages covering 58 different brands Price: 1600p only – no VAT. Order Code: BOOK02

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 1997/8

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

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

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
VIDEO 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
AERO DUSTER	200ML	SP08	340p
AERO DUSTER	400ML	SP17	580p
PLASTIC SEAL	200ML	SP09	250p
GLASS CLEANER	250ML	SP10	170p
COLDKLENE	250ML	SP13	235p
EXCEL POLISH 80	250ML	SP18	180p
AOHESIVE 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 COMPOUNO	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
SOLDERING STAND & SPONGES		
SOLDERING STAND (MADE BY ANTEX)	S108	350p
SPARE SPONGE	\$109	55p
SOLDER		
18 SWG 500 GRAMMES	S110	500p
20 SWG 500 GRAMMES	\$111	650p
22 SWG 500 GRAMMES	\$112	7000
DESOLDERING AIDS		
SOLDER MOP STANDARD GAUGE 1.2MM X 1.5M	S107	100
SOLDER MOP 1.2MM X 10M	S113	420
DESOLDERING PUMP	S105	320
	S103	60p
SPARE NOZZLE	3100	001

I.C. PROTECTORS

ICPF10, ICPF15, ICPF20, ICPF25, ICPF38, ICPF50, ICPF75
ICPN5, ICPN10, ICPN15, ICPN20, ICPN25, ICPN 38, ICPN50, ICPN75

PRICE: 30p EACH ONLY



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CASSETTE DC MOTORS

9V MOTOR 12V CW MOTOR 12V CCW MOTOR 13.2V MOTOR

170p 170p 170p 170p 290p

CASSETTE TAPE HEADS

MONO HEAD STEREO HEAD 110p MINI HEAD 150p AUTO REVERSE HEAD 200p

		2006	
Access to the second se	$\mathbf{C}\mathbf{D}$	PIC	CK UPS
Models & Description	Order Code	Price ,	Models & Description
AWA			SAD30, SLCH9, SLP150
XC007	KS\$S151A	1900p	SLP370G, SLP400C, SLF
DX-990A, DX-DIA	KSS152A	1600p	SLPJ26, SLPJ27, SLPJ37
CXL60, CXL66G, CXL80, CXN3100, CXN320, CXN3300, CXN360, CXN400, CXN430, CXN540,			PHILIPS
CXN550G, CXN990, CXN999, CXNV20, CXSL70, DXZ9100M, FDN636, FDN6636, FDN939, LCX60, LCX66G, LCX70M, LCX80, M7400, M75, NSX320, NSX360, NSX400, NSX430,		J	AZ8304, CD070, CD080,
NXS990, NSX992, NSX999, NSXD636, NSXD939, NSXV20, SXFN550.SXFN520, XC300,			CD100, CD130, CD1380,
XC550, XC750, XC900, XC950, XCN992, XG320, XG360, XG400, XG990, ZD3000M, ZD3100M	KSS152A	1600p	CD480, CD482, CD500, C
CXAP1, CXL7, CXL8G, CXLC50P, CXZ58, DXM740, DXM75, DXM76, DXM77, LCX50, LCX7,	110010211		CD781, CD782, CD840, C AS440, AS445, AS540, A
LCX8G, LCXAP1, XC002, XC004, XC005, XC777	KSS210B	2000p	CD690, CD710, CD720, C
XP31, XP33, XP55, XP80G	KS220A	2500p	FW26, FW330, FW36, FV
XP6.XP7	KSS331A	3400p	CD1210/40
AKAI		- 1	AZ8006
CD73, DC93	KSS151A	1900p	FW11
CD25, CD26, CD27, CD32, CD36, CD37, CD52, CD55, CD57, CD650, CD670, CD69, CD750, CD79,	KC02104	4000	PIONEER
CDM480, CDM600, CDM670, CDEM770, CDM959, MX550, MX570, MX650, MX670, MX750, MX950	KSS210A	1300p	PDM400, PDM410, PDM
DENON DCD1500II, DCD1520, DCDE3520	VCC1E1A	****	PDT303, PDT403, PDT50
DCD1400, DCD600, DCD800	KSS151A KS152A	1900p	PDZ82M, PDZ83M, PDZ9
DCD1420, DCD520, DCD610, DCD620, DCD660, DCD810, DCD820, DCD860, DCD910, DCD920	KS 52 10 A	1600p 1300p	N32, N90M, ,PD101, PD20 PD7700, PD8700, PD970, F
DCD1015, DCD1290, DCD2060, DCD2060G, DCD315, DCD480, DCD580, DCD615, DCD715,	KOOZ IVA	13000	PDM430, PDM450, PDM55
DCD825, DCD890, DCD895, DN2000F	KSS240A	2000p	PDP920M, PDS501, PDS60
GOLDSTAR			PDZ84M, PDZ970M, PXA1
CD952A, CD952AJ, CD952LJ, CD952SJ, FFH101KL, FFH101WL, FFH222A/L, FFH272L,			S707DTM, S909DM, S990D1
FFH333L, FFH373K, FJ606, FR606L	KSS210A	1300p	PDM400, PDM410, PDM
CD320A/L, CD630S/L, FFH212A/L.FFH212E	KSS210B	2000p	PDT303, PDT403, PDT50
GRUNDIG	_		PDZ82M, PDZ83M, PDZ9
CD360, CD435	НОРМ3	2150p	SAMSUNG
CCD300, CD101MCD904, MC10, NEW ORLEANS CD	KSS210A	1300p	CD20
KRCD100, RR1900CD, RR3100CD, RR4000CD, RR610CD, RR700CD	KSS210B	2000p	CD1200, CD1310, SCM-6
CDP60, CDP90	KSS220A	2500p	RCD1200, RCD1300, RCD
CDP65 CD905	KSS331A	3400p	SANYO
HITACHI	OPTIMA5	1600p	DCFS3, DCT55, DCX502,
DAW560	HODING		PART No. 6142186855
FX-10	HOPM3 KSS210A	2150p 1300p	DCFS5, MCD450K, 660K, DCX1000MD, DCX1003, I
AXC10	KSS210B	2000p	DCD10, DCD11U, DCD20
I.V.C.	NOOZ IOD	2000p	DCX210, DCX220, DCX99
1990-1992, LATE 1987-1988 – XLE300BK, XLE31BK, XLE51BK, XLE900BK, XLME91BK, XLV101BK,			MCDZ2L, MCDZ3L, PART
XLV211BK, XLV222BK, XLV311BK, XLV333BK, X:Z1010TN, XLZ411BK, XLZ444BK, XLZ555BK, XLZ611BK	OPTIMA3	4000p	DCD12. PART No. 64500
CDRADIO CASSETTE, MINI SYSTEMS - MODELS 1990-1992	OPTIMA4S	5000p	MCDZ31L, MCDZ41L, MC
CA-C33, CA-MX30BK, CA-MX33BK, UX-A5, UX-A6, XL-M309, XL-M403BK, XL-M408, XL-M409,			SHARP
XL-M504BK, XL-M505TN, XL-M508, XL-M509, XL-M705TN, XL-V131BK, XL-V151TN, XL-V221BK,		J	CD-111, CD-301, CD-302,
XL-V241TN, XL-242BK, XL-V251TN, XL-V252BK, XL-Z1050TN, XL-Z551TN, XL-Z552BK	OPTIMA5	1600p	CD-X12, CD-X15, CD-X16
1994 ONWARDS - CAE48BK, CAMCG7, CAMXG9, CAS20BK, CAS30BK, VAS50, CAS60RBK,			DX-460, DX-461, DX-650,
MXS20, MXS30, MXS60, PCX105, PCX130, PCX95, RCX230, RCX320, RCX520, RCX620, RCX720, UXA4, UXA5, UXA55, UXC7, UXT1, UXT3, XLF115, XLF116, XLF215, XLF216,			DX-R77, DX-R770, DX-R8
KLMC100/M, XLMXG7, XLMXG9, XLV163TN, XLV164BK, XLV174, XLV263TN, XLV264BK,			QT-350CD, QT-37CD, QT- SG-W1CD, SG-W2CD, SY
KLV274BK, XLZ463TN, XLZ464BK, XLZ574, XLZ674, XTMXG7, XTMXG9, XTS60	OPTIMA6S	1600p	QT-50CD, QT-60CD, QT80
KENWOOD	0.111117400	10000	DXR-840B, PART No. RC
DP47, DP660SG, DP8020, DP87, L1000D	KSS152A	1600p	CDS360E, 360H, 370, 450
DP1030, DP1510, DP2010, DP2030, DP3010, DP3030, DP3050, DP4030, DP491, DP5010, DP5030.	ROSIJEA	ТОООР	PART No. RCTRH8136AF
DP5040, DP520, DP7030, DP7040, DP7050, DP730, DP920, DP930, DP950, DPM650, DPM6630,			SONY
PPM7730, DPM850, DPM991, DX6620, M225, M25, M450, M850, PD3030, PDM991, RDX25.			KSS240A
RXDC3, RXDC3L, UD202, UD302	KSS210A	1300p	KSS121A
DPC42, DPC72, DPC77, DPC80, DPC92	KSS220A	2500p	KSS151A
P1050, DP2050, DP3060, DP501, DP5060, DP722, DP76, DPB5, DPB9, M77A, PD3060,			KSS210A
JD502, UD70, UD701, UD90, XE5 PC321, DPC521, DPC531, DPC631K, DPC721, DPC731	KSS240A	2000р	KSS210B
PC321, DPC521, DPC531, DPC631K, DPC721, DPC731 P1060, DP2060, PART No: RCTRH8136AFZZ	KSS331A	3400p	KSS220A
	RH8136A	4500p	KSS331A KSS360A
P anasonic SLP177a, SLP202a, SLP212a, SLP222a, SLP277a, SLP377a, SLP477ak, SLP477a,			
ILP 177A, SLP20ZA, SLP21ZA, SLP2ZA, SLP277A, SLP377A, SLP477A, SLP477A, ILPG 100A, SLPG200A, SLPG400A, SLPG500AK, SLPG500AS, SLPJ24A, SLPJ26A,		ì	TECHNICS SLP200, SLP230, SLP250,
SLPJ27A, SLPJ28A, SLPJ325A, SLPJ325A, SLPJ37A, SLPJ38A, SLPJ46A	691-30209	5500p	SLP200, SLP230, SLP250, SLPJ45, SLPS700, SLPS9
	331-30203	3300F	on 140, on 5100, 51759

Models & Description	Order Code	Price
SAD30, SLCH9, SLP150, SLP170, SLP200, SLP202, SLP222, SLP230, SLP250, SLP333, SLP370G, SLP400C, SLP555, SLP777, SLP999, SLPA10, SLPC20, SLPC25, SLPJ25,		
SLPJ26, SLPJ27, SLPJ37, SLPJ45, SLPK25, SLPK26, SLPS50, SLPS70, SLPS700, SLPS840, SLPS900	SOAAD70A	2350p
PHILIPS		
AZ8304, CD070, CD080, 690, 910, 920. PART NO. 4822-691-20768	4822-691	3100p
CD100, CD130, CD1380, CD1482, CD200, CD204, CD210, CD300, CD303, CD304, CD380,		
CD480, CD482, CD500, CD502, CD582, CD583, CD584, CD610, CD620, CD630, CD780,		
CD781, CD782, CD840, CD883, CD960, CDF104, CDM4/19, FCD185	691-30209	5500p
AS440, AS445, AS540, AS640, AZ8048, AZ8640, CD070, CD080, CD091, CD163, CD165,		
CD690, CD710, CD720, CD732, CD740, CD750, CD910, CD920, CD935, FW17, FW21,	CD4440.4	
FW26, FW330, FW36, FW360, FW3801, FW40, FW41, FW46, FW56, FW66, FW68 CD1210/40	CDM12.1	1800p
AZ8006	CDM12.4 KSS210B	2200p
FW11	OPTIMA6S	2000p
	UPTHMA05	тосор
PIONEER		
PDM400, PDM410, PDM500, PDM510, PDM600, PDM610, PDM700, PDM710, PDM730,		
PDT303, PDT403, PDT503, PDX940M, PDX950M. PDZ560T, PDZ72T, PDZ73T, PDZ81M,		
PDZ82M, PDZ83M, PDZ960M, XDZ53T, XDZ54T	KSS151A	1900p
N32, N90M, ,PD101, PD201, PD32, PD41, PD4500, PD4700, PD52PD5700, PD65, I PD6500, PD6700,		
PD7700, PD8700, PD970, PDCP420, PDCP520M, PDCP520T, PDJ400T, PDJ500T, PDJ800M, PDJ900M,		
PDM430, PDM450, PDM550, PDM630, PDM650, PDM750, PDM901, PDP710T, PDP720T, PDP910M.		
PDP920M, PDS501, PDS601, PDS701, PDS701G, PDS901, PDT310, PDT510, PDZ, PDZ570T, PDZ74T,		
PDZ84M, PDZ970M, PXA1349, S125CDT, S135CDT, S303CDM, S303CDT, S505DM, S505DT, S707DM,		
S707DTM, S909DM, S990DT, XCP410M, XCP410T, XDZ54T, XDZ55T, XDZ64M, XDZ84T, XRP310, XRP320	PEA1030	4400p
PDM400, PDM410, PDM500, PDM510, PDM600, PDM610, PDM700, PDM710, PDM730,		
PDT303, PDT403, PDT503, PDX940M, PDX950M, PDZ560T, PDZ72T, PDZ73T, PDZ81M,		
PDZ82M, PDZ83M, PDZ960M, XDZ53T, XDZ54T, XDZ55T, XDZ62, XDZ62M, XDZ630, XRZ82	PWY1009	4800p
SAMSUNG		
CD20	НОРМ3	2150p
CD1200, CD1310, SCM-6000, SCM6900	KSS210A	1300p
RCD1200, RCD1300, RCD1350, RCD1600, RCD2600, RCD990, RCD995, SCM6900	SOH90T4N	3600p
SANYO		
DCFS3, DCT55, DCX502, DCX701, DCX702, DCX802, DCX891, DCX891N, MCDZ10.		
PART No. 6142186855	614218	2300p
DCFS5, MCD450K, 660K, MCDZ30L, 60F. PART No. 6142205006	614220	5600p
DCX1000MD, DCX1003, DCX900MD, DCX903, DCX915	KSS210A	1300p
DCD10, DCD11U, DCD20, DCD30, DCD30AT, DCD6, DCD8U, DCMS1, DCX110, DCX120,		
DCX210, DCX220, DCX993, DCX994, MCDMS40L, MCDMS50L, MCDMS660L, MCDZ1L,		
MCDZ2L, MCDZ3L. PART No. 6142391303	614239	3300p
DCD12. PART No. 6450055966	645005	3700p
MCDZ31L, MCDZ41L, MCDZ61L, MCDZ71L	KSS210B	2000p
SHARP		
CD-111, CD-301, CD-302, CD-304, CD-310, CD-C3, CD-L700, CD-L800, CD-U1, CD-U10, CD-X10,		
CD-X12, CD-X15, CD-X16, CD-X17, CD-X20, CD-X9, CKL650, CMS95CD, DX-150, DX-160, DX-450,		
DX-460, DX-461, DX-650, DX-660, DX-999, DX-A3, DX-N45, DX-R554, DX-R7, DX-R75, DX-R750.		
DX-R77, DX-R770, DX-R820, DX-R840, DX-Z100, DX-Z1000, DX-Z1500, GFCD55, QT-30CD, QT-33CD,		
QT-350CD, QT-37CD, QT-38CD, QT-CD20, QT-CD33, RS95, SC-77CD, SC-99CD, SC-RS95, SG-A1.		
SG-W1CD, SG-W2CD, SYS302, ZCD7CD. PART No. RCTRH8122AFZZ	RH8122A	5750p
QT-50CD, QT-60CD, QT80CD. PART No. RCTRH8124AFZZ	RH8124AF	2900p
DXR-840B. PART No. RCTTRH8130AFZZ	RH8130AF	2900p
CDS360E, 360H, 370, 450H/E, CMS150CDH, CMSR400CDH, CP150, CPR400, CPS360, 370.	101013071	23000
PART No. RCTRH8136AFZZ	RH8136AF	4500p
SONY	111013074	40000
(SS240A	V000404	
KSS121A	KSS240A	2000p
(SS151A	KSS121A	3500p
KSS210A	KSS151A	1900p
SS210B	KSS210A	1300p
SS220A	KSS210B	2000p
(SS331A	KSS220A	2500p
(SS360A	KSS331A	3400p
	KSS360A	2600p
FECHNICS		
SLP200, SLP230, SLP250, SLP333, SLP555, SLP777, SLP999, SLPA 10, SLPC20, SLPJ25,		
SLPJ45, SLPS700, SLPS900	SOAD70A	2350p

			REN	TOI	E	CONTROLS					
Description	Code	Price	Description	Code	Price	Description	Code	Price	Description	Code	Price
AKAI			A512120/230	RC900	650p	PANASONIC			SONY		
RC-V10A	RC876	650p	A514790	RC901	650p	EUR51200	RC200	650p	RM604, RM605, RM606	RC140	650p
RCV 37 B	RC891	650p	A5088470	RC902	650p	TC2200	RC204	650p	32 CHANNEL	RC140	650p
V25A	RC896	650p	A518612	RC903	650p	VSQ0357/NV730	RC202	650p	RM613	RC141	650p
DECCA			SCL002	RC904	650p	TNQ1621	RC203	650p	RM632, RM636	RC160	600p
RC70	RC894	650p	C2096	RC905	650p	PHILIPS			TATUNG	110100	ooop
FISHER			A511940	RC906	650p	RC5002,5154	RC134	650p	FXA	RC877	650p
RC905B	RC879	650p	655602H	RC 1920	650p	KT3 NDN TEXT	RC135	650p	RC70	RC883	650p
	110073	ooop	HT			69117032	RC178	650p	FX70 FASTTEXT	RC894	650p
GRANADA	D.Cono	000-	IFB13, 14, 15	RC143	650p	69117194	RC180	650p	TELEFUNKEN	110034	ooup
UNIVERSAL TEXT	RC309	650p	FS4	RC148	650p	RC5991-UNIV RC38	RC300	550p	FB632	RC632S	T CEA
MK4 TEXT, 70155G, 70115G, 70133G 95288E	RC880 RC882	650p 650p	RG305	RC305	650p	KT3 TEXT	RC301 RC5301	650p 650p	FB639	RC639	650p
94490D	RC884	650p	RG306	RC306	650p	RC5352	RC5352		THORN/FERGUSON	HC033	oaup
	NG 004	anah	FS9/1-10/1	RC307	650p	RC5375	RC5375		3V35-42	DCn40	con-
GRUNDIG			VS5 RUK	RC308	650p	RC5 STANDARD	RC300	550p		RC342.	600p
TP160E	RC107	650p	VS4-1	RC308	650p	RC5903	RC5903		3V31-32 3V57-58	RC344	650p
TP200, TP300	RC380	650p	MULTICONTROL (17C20)	RC311	650p	SALORA			1 X10 TEXT	RC628	650p
TP400	RC401	600p	LOEWE			SERIES L	RC190	650p	TX10 STEREO TEXT	RC732 RC738	575p
TP590-600	RC600	650p	DC11	RC146	650p	86173	RC882	650p			575p
TP390, TP610	RC610	650p	MATSUI			SANYO			TC9-90-100	RC740	600p
TP621 TP630, TP650	RC612 RC650	650p	010270601	RC889	650p	RC218, RC222, RC228, RC238	RC140	650p	3V55, FV11	RC783	650p
TP666	RC660	650p 650p	VX770	RC892	650p	JXGE	RC878	650p	TX100 FASTTEXT	RC789	650p
TP661	RC661	650p	NOKIA			JXDE	RC884	650p	TX100 ST, FASTTEXT	RC789	650p
	NU001	oaah	SATELLITE	RC550	650p	VHR2300	RC890	650p	PROFESSIONAL	RC790	650p
HITACHI				110000	osup	RC628	RC865	650p	TOSHIBA	00000	
CLE800-CLE830	RC140	650p	ORION			SHARP			CT937	RC950	650p
A617402/655602	RC1920	650p	RC53	RC892	650p	G0121CESA, 123CESA, 204, 251	RC140	650p	CT9117	RC951	650p

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continued from page 34

Philips 14GR1227 (GR1-AX Chassis)

The set was dead. Its line output transformer had failed, which is quite common with this chassis. After fitting a replacement transformer there was a normal picture but the sound was severely distorted. A new TDA7052 audio output chip was required to complete the repair.

Ferguson TX100 Chassis

Gurgling and spluttering noises came from the LOPT area. The tell-tale sign that R143 was charred then indicated that the BC372 Darlington line driver transistor TR8 was in trouble. In fact it was very leaky collectorto-emitter. After replacing TR8 and R143 I was surprised to find that the symptom was still present.

When I checked the BU508A line output transistor I found that it had developed base-emitter leakage. But a replacement still didn't get the set going. Instead it produced the familiar "click, click, reach for the transformer" noise. With a new LOPT installed the set at last behaved itself.

Hitachi VT14

The AC fuse on the small vertically-mounted rectifier board on the right-hand side of this VCR was shattered. This section supplies HT to the large multi-regulation board at the rear of the machine. I measured a direct short-circuit to chassis at its output connector. When the dew sensor plug was disconnected there was no short, and on applying power the machine worked correctly. I managed to scrounge a working sensor from a scrap machine.

Ferguson 51J8 (TX99 Chassis)

An old boy summoned me to his car and pointed to the set resting on the back seat. "Lift it out for me mate, me back's gone again. Happened when I put it in."

I did as asked, and soon had the set on the bench waiting for its owner to catch us up. When he arrived he took a couple of deep breaths and started to speak.

"Every time I go to switch on the telly the mains under the stairs trips out. So I called out an electrician bloke. Real clever fella he was. Polite too – you don't get a lot of that nowadays. Anyway he says it's the telly that's tripping the mains, only he don't fix tellys. Charged me thirty quid call out, but I suppose you have to pay for expertise.

I thought if that's clever then I'm a genius, and was about to speak when he continued.

'I don't want an expensive repair bill, as I've already forked out thirty quid on it."

I did my best to hide it, but felt irritation and annoyance taking hold of me. So it's all right for someone to point to a TV, say there's something wrong with it then charge £30 for his "expertise", but I'm supposed to penny-pinch fixing it! I walked him to the door and suggested that he should phone later.

The on/off switch was jammed and was coated with black, burnt carbon. The contacts had shorted every which way. This explained the mains tripping. When I'd fitted a new switch and discarded the old, cracked mains plug, which contained five turns of wire wrapped around the fuseholder pretending to be a fuse, the set came to life. But the picture was awful!

There was no degaussing action and the picture was was all greens and blues. I looked to see if the degaussing plug was disconnected. It wasn't. Then I checked under the PCB for dry-joints at the degaussing posistor, but the connections seemed to be OK. I resoldered all the joints anyway, including the degaussing coil socket pins. Still no difference. Then I found a second-hand PTH451C posistor that didn't rattle and soon had it fitted. But the symptom was still there. It wasn't until I cut off the degaussing plug and soldered the two leads directly to the socket pins that a normal picture appeared. Phew!

Later in the day the old boy was on the phone for a progress report.

'It's all done" I said, "forty quid to you."

"What!" he exclaimed, "that means I've spent seven-

ty pounds on the set. Is it worth it?"
"Yes" I replied, "it's definitely worth £40 to have the set working again, but if you don't want it done pay me £30 instead. As you said, you have to pay for exper-

Sanyo CBP2145 (E2-B21 Chassis)

Intermittent field collapse was the problem with one of these sets. Resoldering obvious dry-joints at the pins of the TDA3651 field output chip IC431 cured the trouble, but on test I noticed that the three primary colours would drop out at random and return. Gently tapping the small, vertically-mounted RGB output subpanel on the tube base PCB made no difference, and the soldering on it appeared to be OK. But resoldering the panel did the trick.

Sony KVM1620 (BE2A Chassis)

Apart from the familiar Sony switch-on buzz and a slight flicker from the standby indicator this set seemed to be dead. In fact its power supply was producing the correct 120V HT output, but this didn't reach the line output transformer because the CPN15 circuit protector PS801 had gone open-circuit.

A replacement protector brought the set back to life, and a long soak test proved that all was well.

Amstrad CTV250

There was a normal picture but no sound, just a faint buzz at high volume settings. When I removed the back I noticed that the vertically-mounted PCB which contains the sound IF and audio circuitry had become detached from its chassis-mounted guide. As a result it was leaning over to the left, with its track side resting against the body of the tuner unit - exactly where the soldered joints of the TDA3857 sound IF chip are situated. I returned the PCB to its correct position, but there was still no sound.

A check showed that the 5V supply was present at pin 19 of the chip. So I presumed that it had been damaged, and was about to order a replacement when I spotted a charred stand-off resistor some distance away. It was designated R215, and had 12V at one side and nothing at the other - in fact it was open-circuit. I didn't have the circuit diagram, but assumed that it provides a supply to maybe the Nicam section. Normal sound returned when a replacement had been fitted. During a long soak test the resistor remained cool, with 12V at one side and 11.2V at the other.

JVC HRD830

In the E-E mode the sound was low and distorted - it could just be heard amongst the white noise - and the picture was blanked out. When testing the machine I found that the sound might improve after a while, to almost normal, but the screen remained blank. The 2SD1863 5V regulator transistor Q02 in the tuner/IF block was very hot to touch and the surrounding area was scorched and damaged. Once the board had been repaired and a new transistor had been fitted everything was OK.

Digital TV Processing

Cedric Applewright provides a brief guide to the processing applied to the digital signals that arrive at your dish, aerial or cable termination

igital TV has now arrived in the UK: regular Sky Digital broadcasts via Astra at 28.2°E started on October 1st. Until about ten years ago the idea of transmitting a TV signal in digital form would have been out of the question, because of the bandwidth that would have been required.

To convert a video signal from analogue (the camera's output) to digital form the signal has to be sampled at a rate of at least twice the highest frequency present. For reasonable definition, equivalent to the analogue original, each sample consists of eight bits (this gives 256 signal levels). With a luminance signal that extends to 5.5MHz (system I), the sampling rate is set at 13.5MHz. So the bit rate is 13.5 x 8 = 108Mbits/sec. To this must be added two chroma signals that are sampled at 6.75MHz. Thus the total becomes 216Mbits/sec. This implies a bandwidth of some 135MHz! And that's before adding extra data for error detection and correction.

Compression

To make digital TV a feasible proposition, signal compression is required. This is possible because a video signal contains a vast amount of redundant information. If, for example, a picture contains a large area of blue sky, there will be a large number of identical blue pixels. To compress this, we can simply transmit a signal

that tells the receiver how many blue pixels are present and where. This type of redundancy is called spatial redundancy. There is also temporal redundancy, since much of the content of successive TV frames is identical. So we don't need to transmit each complete frame. In practice one in twelve frames is transmitted with just the spatial redundancy removed. These are called Intraframes (I frames). The data for the other eleven frames (P and B types) tells us about the changes taking place from one frame to the next.

The signal compression standard used is called MPEG-2. Implementation has been made possible by the tremendous advances in digital signal processor chip technology in recent years, and huge reductions in the price of processor and memory chips. The amount of compression possible with MPEG-2, from about 216Mbits/sec of video information to 4-16Mbits/sec depending on the amount of action in the scene, means that several digital TV programmes can be transmitted simultaneously within the bandwidth of a single conventional analogue signal channel.

Block Diagram

Fig. 1 shows in simplified block diagram form what digital TV involves at the transmission end. The analogue signal is first converted to digital form, by sampling then quantisation, i.e. conversion to 8-bit bytes.

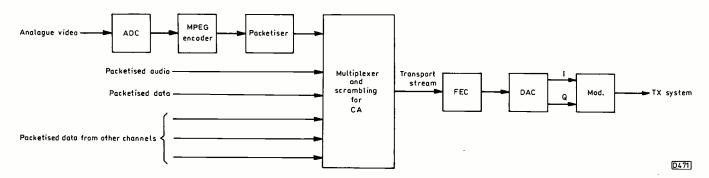


Fig. 1: Block diagram showing the basic processing carried out at the transmission end of the signal path.

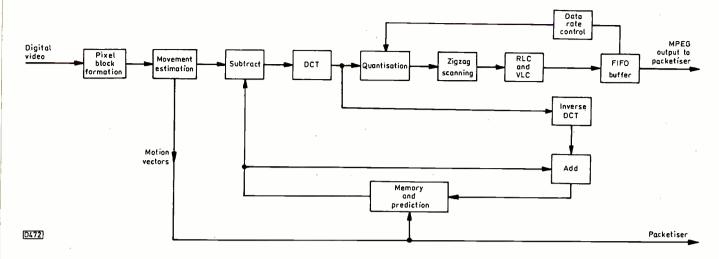


Fig. 2: Much simplified block diagram to illustrate the action of an MPEG-2 video encoder.

The next step is MPEG encoding, where the compression takes place: we will return to this. The output from the encoder is next chopped into 187-byte packets. A one-byte sync signal and an identification signal are added to each packet.

These packets are fed to a multiplexer, which produces an output stream of packets for transmission. The audio and any data packets (e.g. teletext) are added at the multiplexing stage and, as several different programmes can be transmitted in a single channel, other signals can be added here. The audio signal has also undergone AD conversion and MPEG coding of course – the latter is quite different from video MPEG coding. Scrambling for conditional access (pay TV or pay-perview) is also undertaken at this point.

From the multiplexer we get what's known as the transport data stream. It consists of video/audio/data packets for one or several programmes interspersed in a single data stream. Forward error correction (FEC) is then applied. This means the addition to each packet of extra data that can be used by the receiver to check for errors introduced by the transmission path and, if the errors are not excessive, to carry out correction – packets with too many errors are simply rejected. In practice there's more to the FEC process than this, as we shall see later. Once FEC has been applied the signal is fed to a DAC for conversion to I and Q form. It then goes to the modulator, after which it's applied to the transmitter – or sent down the cable.

MPEG Video Encoding

We have referred to spatial and temporal redundancy in the video signal. This is a handy way of appreciating how redundancy arises. Removal of spatial and temporal redundancy is not undertaken separately however. It's all part of one highly complex process. Fig. 2 gives an impression of what's involved.

The initial step is to divide the picture into blocks of 8 x 8 pixels – actually 8 x 8 luminance pixels plus 2 x 4 each red and blue chroma pixels. These are passed to a movement estimator, which checks for changes between successive frames. Each twelfth frame is passed straight through to the DCT section. These are the I frames: the term intraframe indicates that it's coded without reference to any other frames, i.e. the frame is subjected to spatial redundancy compression only.

DCT stands for discrete cosine transform. This means that the amplitude differences between the discrete

pixel sample bytes in the block are converted to cosine equivalents which are then represented by their coefficients (multiplication factors). The signal is thus converted from one that represents amplitudes to one that represents frequencies. In itself this doesn't contribute to compression: it enables the compression techniques that follow to be applied.

Once the DCT has been carried out, quantisation can be undertaken as part of the compression. Coefficients below a certain level are reduced to zero (this is known as thresholding), and the coefficients are rounded up and down. These steps take into account the inability of the human eye to detect very small changes in a picture.

We now have 8 x 8 blocks of quantised coefficients. These have to be scanned to convert them to serial data form. A zigzag scan is carried out, starting at the top left coefficient, which represents the DC signal level. As the zigzag scan proceeds, higher and higher frequencies are scanned. The advantage of this form of scan is that the resultant serial data stream is optimised for the next compression applied, run-length and variable-length coding.

Run-length coding converts long series of zeros to a code that indicates the number of zeros in each series. Variable-length coding uses the same principle as the Morse code: short code lengths are used to encode the values that occur most often.

The result of all this is a data stream whose rate varies continuously. The following packetisation and multiplexer require a fixed data rate input. This problem is solved by feeding the variable-rate data into a FIFO (first in, first out) buffer memory then reading it out at a constant rate. If the buffer should overload, feedback is used to block the input temporarily (data rate control).

So much for an intraframe, which is subjected to a relatively low level of compression. The other eleven frames in each group of twelve are of the P (predicted) and B (bidirectional) type. A P frame occurs every third frame after an I or P frame, from which it is predicted using motion-compensated prediction. This is why the movement estimator is required. Its action is based on the comparison of macroblocks (16 x 16 pixels) in successive frames. This is a highly complex procedure that has a significant effect on the performance of an MPEG encoder. B frames are coded by bidirectional interpolation between the nearest I and P frames. All this is referred to as interframe coding.

This interframe coding makes use of the lower section

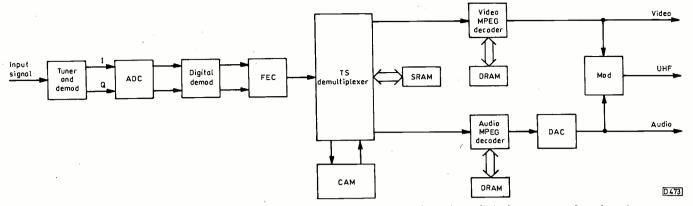


Fig. 3: Block diagram to show the basic signal processing carried out in a digital TV set-top box/receiver.

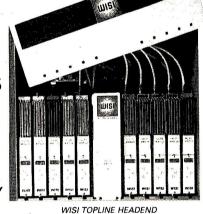
of the block diagram shown in Fig. 2. What the MPEG encoder is doing here is to remove temporal redundancy by means of a movement-compensated feedback system. The output from the zigzag scanner is taken to an inverse DCT and is then fed back to the subtract box. This P and B frame coding is a complex procedure that greatly increases the signal compression.

The above is only a very approximate account of MPEG-2 video encoding. It mentions the main processes and their role in the overall system. The highly complex processing is hidden away in silicon chips. It's possible that different chip set designers employ different arrangements. We don't need to know the finer detail.

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Packetisation, Multiplexing and FEC

Packetisation and multiplexing are self-explanatory and have been referred to already in connection with Fig. 1. The multiplexer's output, the transport stream, consists of a series of data packets, all with identification so that they can be found and extracted at the receiver. Audio, video and data packets for one or maybe several programmes are interspersed.

FEC adds codes to enable errors generated in the transmission path to be detected and corrected - provided the data corruption is not excessive. Standard techniques such as Reed-Solomon coding are employed. The Reed-Solomon coding adds 16 parity bytes to each packet, which thus becomes 204 bytes long. But there is rather more to this part of the signal processing.

Signal randomising is carried out to provide energy dispersal; interleaving to spread errors; and convolutional coding to aid correction of random errors caused by noise. Convolutional coding complements the Reed-Solomon coding and interleaving: it is not used with cable distribution, which is a relatively benign environment for the signals.

The convolutional coding provides powerful protection but reduces the channel's information bit rate by a factor that's specified, for example, as 1/2, 2/3, 3/4. These code-rate figures represent the ratio between the information and the total transmitted bit rate.

Transmission

Different modulation techniques are used for satellite. terrestrial and cable transmission - QPSK, COFDM and 64-QAM respectively. Each offers advantages for the particular transmission medium. QPSK is less sensitive to the effects of phase shifts, CODFM is less sensitive to fading and multi-path effects, while 64-QAM provides very efficient spectrum use.

Because of these different modulation techniques, receivers for satellite, terrestrial and cable use need different digital demodulators. FEC differences (see above) also affect receiver front-end design.

Receivers

An article elsewhere in this issue describes the basic sections of a digital TV receiver, with specific reference to servicing. Fig. 3 provides an overall outline. The channel tuned in is demodulated and, after error correction, is applied to the transport demultiplexer which sorts out the packets required for the selected programme. The video MPEG decoder carries out the reverse processing to the encoder described earlier, but is considerably simplified since movement estimation is not required.



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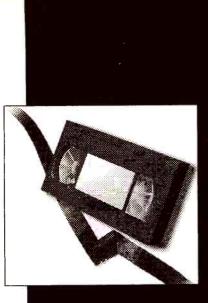




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Reports from
Philip Blundell, AMIIEelec
Eugene Trundle
Michael Dranfield
Michael Maurice
Richard Flowerday
Gerald Smith and
Pete Gurney, LCGI

Samsung VI375

The power supply had previously failed, no doubt after its outputs had risen, and a new one had been bought and fitted. Now the machine was dead again. When the main PCB was removed R638 and R664, both 100Ω surface-mounted resistors, were found to be open-circuit while the case of the KA8301 loading motor drive chip had split.

Once these three items had been replaced the machine was found to be none the worse for its ordeal. Note that in later production a 27V, 1W zener diode is connected across R116 in the power supply to provide improved overvoltage protection. **P.B.**

Philips VR522

If the power supply is 'chirping' and its output voltages are low and pulsing, suspect that C2112 (100μF, 385V) has lost capacitance. The voltage across C2112 may still be correct even though the capacitor is faulty. Its part no. is 4822 124 41556. **P.B.**

Samsung S13240 Series

The cassette lift drive gears sometimes go out of alignment. A modified cassette lift right-hand side is now supplied. The part no. is 62203-0025-01 (Willow Vale code 79030CR). Also check the gear eject drive for wear – part no. 61473-0051-01 (Willow Vale code 79326J).

VCR Clinic

The above applies to Models SI3240, SI3260, SI3560, PI30R and VI30R, P.B.

Daewoo 5172 and 7372

These machines are now about five years old and the F mechanism they use is beginning to wear. One effect of this is bad sound wow and/or flutter because of a problem in the reel-drive clutch that's incorporated in the reel-drive gear assembly (part no. 97SA46900). It is possible to dismantle the assembly and doctor the clutch, but it's better to replace the whole thing. E.T.

Panasonic NVHD610

This newish machine had a fullylaced tape in it. When it was switched on the drum ran at a million miles an hour and the front display showed the error code F09. This means that there's no serial clock signal transmission between IC6001 and IC7501. In fact the cause of the problem turned out to be IC6001's 6MHz crystal X6001. If you touched it with a finger, the machine came to life and continued to work all day. But next day, when the machine had been standing overnight, the fault would be back. A new 6MHz crystal put an end to the trouble. M.Dr.

Aiwa HVGX750

This new machine wouldn't come out of standby. Checks around the main microcontroller chip showed that the power-on line (pin 60) remained low. There was a 10MHz clock signal at pins 72/73, and the real-time clock crystal at pins 69/70 was also active. But the serial clock/data lines, at pins 90-91, remained inactive. The reset pin 16 was low at 2V: to reset the microcontroller chip correctly, this pin must be above 3·3V.

Multimeter checks failed to reveal the cause of the problem, but when we disconnected all the components connected to pin 16 we came to a small decoupling capacitor, C565 (0·1 μ F), which was holding the reset pin low. A check on C565 produced a reading of 200k Ω . Replacing it cured the fault. **M.Dr.**

JVC HRJ425

Failure to eject was the complaint with this machine. The carriage is driven by the capstan motor in this deck. In the eject and tape loading mode, the 'gear-change' drives the carriage via the 'belt-change'. The gear-change is engaged/disengaged by the arm-change assembly, item 74 in the diagram in the manual. A spring, item 76, holds the arm in position in this mode.

The plastic lug on the armchange assembly had broken, the result being that the gear-change didn't engage with the pulley. A new arm-change assembly cured the fault. Its replacement required a fair amount of dismantling. M.M.

Aiwa VXT1410

This TV/VCR combination's fault was in the video section. When the unit was cold, the servos would hunt and there were gross tracking errors. After a while the servos would stabilise and a picture would appear – with severe patterning. The cause of the trouble was C523 ($100\mu F$, 16V). Although my tester produced a reading of $88\mu F$, the capacitor responded to heating and freezing when in circuit. A new capacitor cured the fault. **M.M.**

Toshiba V204

There was a tape stuck in this machine. The customer said that cassette insertion had been difficult before. It was easy to remove the tape: the cause of the problem was simply that the cassette-flap opener on the right-hand side of the carriage had become unclipped. Refitting it and reassembly should have been the end of the matter, but

the customer had been of the opinion that a liberal spraying of WD40 through the cassette flap would cure the problem. So a further half hour had to be spent cleaning it up. Fortunately it hadn't ruined the heads. M.M.

Ferguson FV71LV

This machine was dead apart from the power supply which was ticking. The cause of the problem was eventually traced to a 10µF, 63V capacitor that's mounted on the print side of the power supply PCB. Note that the power supply ticks when unloaded, i.e. not connected to the main PCB. M.M.

Matsui VP9501

This machine failed to wind the tape into the cassette on eject. The capstan motor didn't even turn. There were no problems once the mode switch had been replaced. M.M.

Sharp VCA49

This machine had been brought in about six months previously because the upper drum had failed. It was now back, the complaints this time being low sound and noise bars through the picture. When I tested the machine I found that there was also poor rewind.

The cause of the trouble was excessive friction between the tape and the AC head, because of excessive wear. Once a new AC head had been fitted and aligned the symptoms had cleared. M.M.

Toshiba V226B

No playback or E-E sound was the customer's complaint with this almost new machine, which was still under warranty. It recorded sound however, proved by playing a test recording on another machine. The cause of the fault was easily traced to the BA7795LS audio record/playback chip IS001, from which there was no audio output. It's not the first time we've had this problem with these Toshiba machines and their Ferguson-badged equivalents. **R.F.**

Akai VSG855

When a tape was inserted the clock display went out and the machine 'died'. Some checks in the power supply revealed that the 14V output wasn't smoothed. Replacing C222 cured the fault. G.S.

Toshiba V726

When this machine was switched on there were no functions and auto

tune showed in the display. After many fruitless checks I found that a replacement tuner unit cured the fault. G.S.

Daewoo V215

There were intermittent symptoms with this machine: no mode functions and the clock becoming blank. I had to wait patiently for the fault to appear, then found that crystal X701 wasn't running. A new crystal cured the fault. G.S.

Tatung TVR933

This machine produced very snowy E-E pictures with low luminance. Checks revealed that the AGC output at pin 2 of IC4001 was low and cramped. A replacement chip restored good E-E pictures. G.S.

Aiwa HVFX2500

This machine had a picture fault in both the E-E and playback modes. In the E-E mode the left-hand side of the picture was too dark while the rest of the picture was too bright. In the playback mode the picture had dark streaks. The problem was cured by resoldering the pins of the Y/C processor chip IC301. **G.S.**

Philips VR6490

This machine had failed when it was unplugged: when the mains supply was restored it remained dead. The power supply is not the easiest section of the machine to reach, being burried under the main PCB. But you can remove it then reconnect it outside the machine, the harness being just long enough to permit this.

I found that the power supply worked and that its outputs were correct, except for the 5V line which was low at 3V. Quick scope checks at the relevant reservoir and smoothing capacitors C119 and C120 (both 1,000μF, 16V, 105° types) revealed that they were virtually open-circuit. As the ventilation in these machines is poor, I decided to replace all the electrolytic capacitors on the secondary side of the power supply, using the correct low-ESR types. **P.G.**

Mitsubishi HSB82

This S-VHS machine's video output was very poor: there was rolling, and the video was extremely crushed. In fact the output was poor from the scart and phono sockets and the RF modulator, which helped to narrow the field of search a bit.

A look at the myriad signal

paths and switching ICs showed that the common source of the video signal is at the buffer transistors Q208/7/6. Q208 feeds the scart connector and the RF modulator. The Y output from the YC S-VHS socket J204 was similarly crushed and distorted. Its source is prior to Q208, at the emitter of Q206. The cause of the problem was C232, a 10μF, 16V surface-mounted capacitor that couples the video signal to the base of Q206. On closer inspection, visible leakage could be seen on the PCB. A clean-up and new capacitor cured the fault. P.G.

Goodmans TX1200

There was severe patterning in the E-E mode, but the severity of the symptom decreased the longer the VCR was left on. A check on the tuning revealed that the channels didn't correspond with the selected channel numbers. This suggested that there was a tuning voltage fault.

The 30V supply was found to be low, and a scope check showed that a large AC component was present. The cause of the trouble was traced to C803 (100 μ F, 50V) which was open-circuit. When a replacement had been fitted the channels had to be retuned back to their correct channel numbers - the customer had altered them over a period of several months to compensate as the capacitor dried up. **P.G.**

Samsung SI1260

Tape chewing was the complaint with this machine. Everything seemed to be OK when a dummy tape was loaded, but after a few minutes the capstan motor refused to work in the play mode and wouldn't spool the tape back when unthreading. Fast forward and rewind were not affected initially, but eventually failed.

A quick check at the supply plug (CN201) to the motor on the main PCB showed that the voltages were mostly correct. The exception was the permanent 15V motor feed voltage, which varied erratically depending on which function was selected. The feed comes from the always 15V rail via two series-connected 1N4001 diodes, D212/3. What was happening was that D213 went open-circuit under load. A replacement diode cured the problem.

In the past I've had D212 cause similar problems, but in addition intermittent/poor loading – the junction of D212/3 feeds the loading motor drive chip IC206. **P.G.**

Portable Appliance Testing

Regular testing of portable electrically-powered appliances is a requirement under the Electricity at Work Regulations 1989. It can form a useful source of additional income for the service department. Russ Phillips describes what PAT testing involves

nyone who reads this magazine should be aware of the Electricity at Work Regulations 1989. The Health and Safety Executive (HSE) periodically visits companies to ensure that these regulations, and any other relevant safety requirements, are being observed. Many people however are probably not aware of what portable appliance testing (commonly known as PAT testing) involves – or that offering the service to local businesses can provide a useful source of extra income.

Unfortunately the law is unclear about PAT testing requirements and how often it should be carried out. In my area the HSE maintains that all appliances connected to the mains supply via a flexible lead and plug should be tested at least once a year by a competent person. What is meant by a "competent person" is not clear either, but it seems reasonable to assume that anyone qualified to repair TV sets has the required competence. Appliances that have been tested should be identifiable, often by some sort of serial number or bar code, and the results of a test should be kept for future reference.

PAT Testers

A PAT tester is required to carry out this work. It's used to check the resistance of the earth cable while this is passing a high current (up to 25A), and to test the appli-

ance's insulation when a high voltage (normally 500V DC) is applied.

Cheaper units often have a fixed earth test current and use LEDs to indicate whether or not the appliance being tested has passed. More expensive units supply selectable earth test currents. They provide an analogue or LCD indication of the earth cable's resistance and the appliance's insulation.

There are also units that can store all the test results for subsequent transfer to a PC, and can recognise bar codes used to identify appliances. Many of these more expensive units can also carry out load tests, leakage current tests and 'flash tests' (where the insulation resistance is measured at around 1-1·5kV). Such tests are not really necessary however. So I wouldn't recommend buying a tester of this type unless you have a real need for these extra facilities.

The problem with cheaper units is that they are less flexible. My recommendation therefore is to select a mid-price unit that has a selectable earth-test current and an analogue or LCD display to show the result of the tests

Visual Inspection

The first and arguably most important thing in a portable appliance test is the visual inspection. Most faults will be discovered during this part of the test.

Check the mains plug first. It should be intact, with no cracks or other damage, be of a BS-approved type, and should have shrouded live and neutral pins. If the plug is not moulded on to the cable, open it up and check that it's correctly wired. Also that the correct value fuse is fitted. The cable should have the modern colour coding – brown for live, blue for neutral and green/yellow for earth.

There should be two layers of insulation throughout the length of the cable, which should be free from damage and be securely gripped where it enters the appliance – so that it can't be pulled out, pushed in or twisted. If the cable is damaged it should, ideally, be replaced rather then repaired.

If a connector is used it should grip the cable's outer sheath securely at both points of entry. With connection via a plug and socket, the plug should be connected to the appliance and the socket to the mains supply. It should not be possible to touch the socket's live or neu-

portable appliance tester. This simple unit provides insulation and earth-bond tests with separate pass/fail indication for each. Available from CPC under order code INPAC500-240 at £175.16. The price includes a carrying case and operating instructions.

The Seaward PAC500



tral connectors when the plug is disconnected. Note that connectors of either type can increase the earth connection resistance.

The appliance itself should be undamaged, with the outer casing securely connected.

Where an extension lead is in use, open the socket to make sure that it is correctly wired and that the cable grip holds the cable securely by its outer sheath. If the socket has a fuse, make sure that its value is correct.

If the appliance has a detachable lead, make sure that the connector on the appliance is male, of a BS-approved type, and that there are no obvious signs of damage. The connector should be secured in such a way that it cannot be opened or removed without the use of tools. The cable should be secured to the female connector tightly, so that it cannot be pulled away.

If there are accessible fuse holders, they should be undamaged and should not permit the user to touch a part live at more than 50V when the carrier is removed.

Any output connectors should be undamaged. If an output voltage is greater than 50V, the short-circuit current should be less than 5mA.

Finally the mains on/off switch should work correctly, with no visible signs of damage.

Earth-bond Test

An earth-bond test is the next step with an earthed appliance. If the appliance is not earthed, it should be marked as double-insulated – the symbol for this is two squares, one inside the other.

The earth-bond test is carried out by plugging the appliance into the tester and connecting the test lead to the appliance's conductive case. A high current, at least twice the appliance's fuse rating (up to a maximum of 25A), is then fed via the earth lead for five seconds while the resistance is measured. The reading obtained should normally be no greater than $0 \cdot 1\Omega$, or $0 \cdot 5\Omega$ if the fuse rating is 3A or less. This figure does not include the resistance of the mains cable. The two resistances should be added. As a general rule, a combined resistance of $0 \cdot 5\Omega$ or less $(0 \cdot 75\Omega)$ where the fuse rating is 3A or less) is usually OK.

Insulation Test

The final step is the insulation test, which is carried out at a voltage of at least 500V DC. With an earthed appliance, the live and neutral pins are shorted together and the resistance between them and the earth pin is measured — no other connection to the appliance is necessary. When a double-insulated appliance is being tested, connect the test lead to any exposed metalwork. A voltage of at least 500V DC is applied for five seconds while the insulation resistance is measured. To pass the test, the reading should be at least $2M\Omega$ with an earthed appliance and at least $7M\Omega$ with a double-insulated appliance.

Keeping Records

It is a good idea to mark each appliance with a serial number and the dates when it was last tested and when the next test is due. It's probably easiest to use a self-adhesive sticker. Suitable stickers can be bought from component supppliers or they can be specially printed for the job. If you have a tester that can read bar codes (some of the more expensive ones can), a bar-code system could be used.

As a practical point, note that appliances which get hot, kettles for example, tend to melt the adhesive on a sticker. With such appliances it is often a good idea to use a fine-point permanent marker to write the serial



number on the appliance directly.

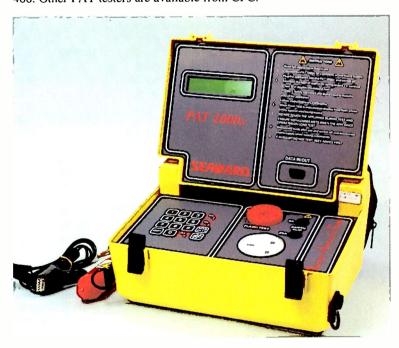
The record of a test visit normally shows each appliance number, the appliance's make and model designation, the manufacturer's serial number where appropriate, and the results of the earth-bond and insulation tests. It might also be worthwhile making a note of any work that had to be carried out on each appliance for it to pass the test, for example plug or fuse replacement.

In Conclusion

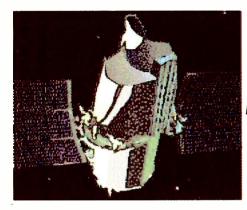
Finally, I hope that this article will help some of you to earn extra income. It probably wouldn't be possible to run a business that relied on PAT testing alone, but it can provide additional work that generates useful income.

The testers illustrated are available from CPC Plc., Component House, Faraday Drive, Fulwood, Preston, Lancs PR2 9PP. Phone 01772 654 455, fax 01772 654 466. Other PAT testers are available from CPC.

The Seaward PAC1000 portable appliance tester. This model can handle most appliances, with particular emphasis on information technology and business equipment. It has a large liguid-crystal display and a wide measuring range, and doubles as an accurate insulation continuity tester. Available from CPC under order code INPAC1000 at £348.84. The price includes test leads, a carrying strap and operating instructions.



The Seaward PAT10005 portable appliance tester. This model will test in a manual or automatic sequence a series of eight conditions and stores up to 1,000 test results in a battery-backed memory. Use is simple via menu and screen prompts on the high-contrast LCD screen. Available from CPC under order code INPAT1000S-240 at £619.65. The price includes an attached accessory pouch that contains the earth test lead, flash test probe, mains lead with plug and a comprehensive instruction manual. A printer lead is available as an optional extra at £25.75.



DX and Satellite Reception

Terrestrial DX and satellite TV reception reports and news. A new satellite band for uplinking. The proposed digital LAN system, a potential source of interference. Roger Bunney reports

RTS (Serbia) ch. E3.

There was, as usual, reduced terrestrial DX-TV signal propagation during August. Fortunately Sporadic E signals arrived on a few days. The settled hot weather from August 8-11th produced a slight tropospheric enhancement, with Band III and UHF signals from the Benelux countries, France, Denmark and the closer German stations received across the South Eastern and Eastern coastal areas of the UK. You couldn't call it a "wide-open" period, but at least it gave a lift to an otherwise quiet time. It's some years since we had a really widespread tropospheric opening - put it down to global warming!

The SpE log for the period is as follows:

5/8/98 RAI (Italy) ch. IA. 6/8/98 YT (Ukraine) ch. R2; 10/8/98 Several unidentified signals on chs. E3, E4 and R2. 12/8/98 RAI IA, B: Video (Italy) E2. 13/8/98 RTP (Portugal) E2, 3; TVE (Spain) E4. 14/8/98 SR (Sweden) E2; YLE (Finland) E3 15/8/98 RTP E2, 3;TVE E2, 3, 4; RAI IA; RTL+ (Hungary) R2. 16/8/98 TDF (France Canal +) F2, 4; LTV (Lithuania) R2; TVE E3, 4; NRK (Norway) E2, 3; Video

18/8/98 RTL+ R2; HRT (Croatia) E4; unidentified R2 signals. 23/8/98 RTS E3.

23/8/98 RTS E3. 29/8/98 Video E2; TVE E2, 3. 30/8/98 RAI IA; TVE E3; Video E2. 31/8/98 TVE E2; RTP E3.

1/9/98 TVE E2 2/9/98 TVE E3.

On August 8th Ruud Brand (the Netherlands) received a ch. E2 transmission from 1755-1835GMT (-1hr BST), with coloured announcers and programme participants. The picture quality was marred by a degree of multiple imaging. Nominal carrier frequency was 48-2504MHz. This suggests reception from the Pico do Basil transmitter (1kW ERP) in Equatorial Guinea. At about the same time a Dutch radio amateur was in communication with 3C51 in Malabo, French Guinea. Ruud is

checking with 3C51 for confirmation of frequency and programme content. If the reception is confirmed as being from Equatorial Guinea this is good news and an exciting end to the '98 season. Our thanks to *Skywaves* bulletin for some of this information.

Typical of the use of Band I these days is the report that RSL FM station Wings FM (87·7MHz) used a 52·875MHz studio-transmitter link (STL) during the Royal International Air Tattoo at RAF Fairford

Congratulations to Alan Smith (Chonburi, Thailand) who married recently and has moved "down the road". His dish is to follow shortly. The local UBC DTH digital TV service to which he subscribes offers 28 channels, five film, at £15 a month: the receiver and 60cm dish come at £150. BBC World has problems there with "freezing pictures". This could possibly be because of a low data rate from the BBC on the several hops to the regional satellite downlink to Thailand. Alan welcomes the return of BBC World, which was dropped by Star TV two years ago for political reasons. In mid-June Star TV advertised that it would go digital on July 1st. The analogue TV plugs were all pulled on July 7th, leaving most of Star's SE Asian viewers without pictures and with no IRDs available!

Satellite Sightings

I've been exceptionally busy during the past few weeks, with varying degrees of success. After a lot of





thought I eventually bought an RSD ODM300 digital receiver. The results have been frustrating. Several evenings were spent setting frequencies, symbol rates etc., but only frozen pictures have been seen. When I checked the news feeds via Intelsat K (11.566GHz) I found that the system was partially working. Reuters' Moscow and Washington identifications appeared, but when actual news material came along all I got were freeze frames with occasional jumps - and no audio. More recently the unit has refused to lock even with previously receivable services. I'm awaiting advice from the manufacturer.

More luck with band C however. Lots of signals have been resolved using my trusty Echosphere SR1000 and a Manhattan LT6300 Plus Mk 2 receiver. The latter is a basic IR-controlled model, i.e. it's cheap. But it has full potential for DXing - fast tuning, no OSDs, full frequency readout, ease of use and threshold extension down to 3dB. It operates in both the C and Ku bands. I hope to review it shortly in these pages - basically it provides, with modern technology, the service you get from a manual, rotarytuned receiver.

For C-band work I'm using my old 1.5m dish. The results, from many satellites, have been encouraging. Even weak news feeds via Arabsat 2B at 30.5°E can be seen easily with threshold extension. It proves that you don't need a 3m or larger dish for effective C-band work.

One recent problem was picture degradation, noise etc. with Kuband reception whenever the Cband system was connected with its power supply on. The manual A/B switch I had been using to connect either the Ku-band (A) or C-band (B) LNB to the receiver was the cause - there was poor isolation between the inputs. I solved the problem by using a high-isolation, F-socket A/B switch from Maplins (order ref. number MY30, price about £7). The defective and more expensive switch had been obtained from a London satellite firm.

There have been lots of reports of sports feeds. The European Athletics Championships at the Nep Stadium, Budapest were given wide coverage by the BBC, with feeds via the French Telecom 2B and 2C satellites at 5°W and 3°E respectively. The transponder mostly used was the 12.645GHz vertical one aboard 2C. Good to find that SIS

(sound in syncs) plus audio was used rather than digital!

The month saw a mega corporate event in the merger between oil companies Amoco and BP. On the evening of August 11th a London facility house was seen preparing for a two-way staff conference the following morning. The up tests, via Intelsat K, were in analogue form at 11.682GHz vertical. They continued to well past 2300 hours.

The Omagh bomb blast received extensive coverage, with the BBC using Telecom 2C for contributions to local TV programming as well as interviews and reports to London for network news. Telecom 2B was used at 1830 for a report to London on the Mo Mowlem visit.

During the same period the transatlantic satellite circuits were busy with coverage of the President Clinton/Monica Lewinsky affair. Intelsat K and PAS-3 (43°W) carried most of the analogue material fed to London for Sky and other broadcasters.

There was a live report on Hurricane Bonnie on the 27th at 1800BST, with a reporter at a US east coast beach attempting to stand and shout his piece to the camera despite the high wind, driving rain and mega waves behind. Having completed the shot, the cameraman called over "the studio wants a take 2". This elicited a profound comment from the reporter! All via our favourite, Intelsat K - at 11.498GHz horizontal.

While exploring the esoteric world of C band on the 26th I came across weak colour bars, with the identification "Kourou CTS", via Telecom 2A at 8°W. The signal was at 3.772GHz with RHC polarisation and I suspect was related to the launch of Astra 2A, though nothing else was seen while I was monitoring the signal.

Arabsat 2B at 30.5°E is a good source of news from the Middle East and SE Asia. During a morning Reuters news package (at 3.967GHz RHC) I noticed an odd form of scrambling: the central three-quarters of each frame was upside down and reversed, the top and bottom eighths being normal. Subsequent monitoring indicates that this is a common practice simple but effective.

In all a busy and varied month.

Terrestrial News

Sweden: As only eight channels are available in the first DTT multiplex, the following allocations have been agreed. TV3 and Kanal 5 will



share one channel, TV8 and Cell Internet another. National Broadcaster SVT will transmit SVT-1 and a planned sports/news service SVT-24, shelving plans to include the SVT-2 network. TV4 has a nationwide single channel, allowing for regional opt-outs. Canal + has a channel to itself.

Iraqi TV via Nilesat at 7°W. There's a familiar face in the shield at the centre of the logo!

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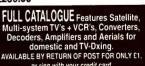


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Test for a two-way staff conference on the BP/Amoco merger. Via Intelsat K.

Below left: Roger Bunney's C-band LNB with Chaparral feedhorn mounted on his 1.5m dish.

Below right: A hitech C-band LNB cover - the bottom of a two-litre white spirit polythene container, sprayed green. Plenty of ventilation, but keeps the system dry.

SVT will regionalise services in five areas and share with Kunskaps TV.

The Netherlands: A number of

new Dutch regional/local stations

are due on-air by the end of 1998. using existing transmitter sites. They offer considerable DX potential. For details see Table 1. Belgium: The PM5544 test pattern used by RTBF-2 now has "La Deux" in the bottom square and the transmitter identification at the top, e.g. "Tournai Canal 63" Philippines: The world's highestpower, solid-state VHF transmitter has just been installed for GMA-TV at Tandang Sora, Manila. Details will be included in the 1999 Guiness Book of Records. The transmitter has "nearly 1,200 paralleled transistors, 96 fully redundant amplifier modules, 40 cooling units and a dual 50kW switchless combiner system with a circularly

Some 48 VHF/UHF transmitters are being installed for the GMA network to provide optimum

polarised antenna". The 750ft high

mast also carries the aerials for a

40kW UHF transmitter.

Table 1: New Dutch regional/local stations.

Station	Channel	Power	Site
TV Noord Omrop Fryslan TV Drenthe TV Oost TV Oost TV Oost TV Gelderland TV Gelderland TV Gelderland TV Gelderland TV Gelderland Omroep Flevoland Omroep Zeeland	E36 E28 E25 E22 E36 E36 E32 E58 E40 E24 E26 E54	100kW 150kW 250kW 200kW 50kW 200kW 100kW 32kW 50kW 50kW	Hoogezand Irnsum Smilde Zwollerkerspel Hengelo Markelo Apeldoorn Arnhem Ruurlo Tiel Lelystad Goes

nationwide coverage.

50MHz Amateur band: The following beacons are now active: Czech Republic OKOEY 50·011MHz; Croatia 9A1CAL. The RSGB's 50·050MHz beacon GB3NHQ has closed permanently after a serious PA fault. A replacement using the same call sign may be established elsewhere. The RSGB has applied to the RA for a 1kW experimental permit to operate at 50MHz.

RSL-TV: Still no date for the start of transmissions from TV-12 on the Isle of Wight. The French have now agreed to a channel allocation and equipment problems are being blamed for the delay.

K band

Programme uplinking for Ku band satellites is usually at around 13-14GHz. But conditions in the Clarke belt are becoming tight, with vast quantities of transmissions from satellites only 3° apart. Agreement has therefore been reached to use band K (17·3-18·4GHz) for uplinking. It offers better transmission protection with

increased bandwidths. So it will be K up and Ku down.

The Andrews Corporation, which is well-known for high-quality communications dishes, is well into K-band aerial design. With a 60 per cent efficiency dish the corporation is achieving typical beamwidths of 0·1° at the -3dB points. That's really sharp. Isolation between feeds has improved to 35dB. This avoids interference between adjacent and opposed-polarity uplink signals.

Interference Sources

Each month seems to bring more radio/TV interference problems. For example a neighbour's computer now produces a mass of white dots on any ch. E4 pictures received here. It hit the air waves about six weeks ago!

Dave Lauder, in his EMC column in the August issue of the RSGB's journal *Radcom*, mentions a potentially alarming threat to radio/TV reception. It's called DPL (digital power line) and is being tested by NOR.WEB. We've already had local communications,





e.g. baby alarms, via house mains wiring. The DPL technique uses the mains distribution cables as a LAN (local area network) system. The digital LAN system currently being tested is reckoned to be able to provide over 1Mbits/sec downloading between the source and a subscriber. But it means that RF is being sent along the mains supply lines.

Worries have arisen in amateur radio circles because the tests used a carrier at close to 4MHz, with sidebands/harmonics extending into the 3.5-3.8MHz amateur band. What if higher frequencies are used as mains carriers? Would HF interference be radiated from the mains distribution system to houses etc.? With mains power distribution often via poles, widespread interference could occur.

Filtering might be included at domestic users' inputs to prevent interference to equipment - and perhaps to prevent hacking - but the costs would be high. It's possible that the system will simply be brought into use with any subsequent interference complaints dealt with on a one-off basis.

The immunity levels quoted by Dave in his column are such that amateurs, medium-/short-wave DXers, other weak-signal operators and even MW cordless phones could be adversely affected

NOR.WEB DPL has been formed as a company to market the system, so we can expect it to be developed commercially. It's unlikely that the company will be concerned about the interests of minority hobbyists. Fortunately the RSGB is taking up the issue of DPL with the DTI, RA, OFTEL and OFFER. We'll have to keep an eye on the outcome.

Satellite News

The long-awaited Canal+ news channel is expected to open in the autumn of 1999. A new partner is being sought as the newspaper Le Parisien has decided to leave the project. A 24-hour Spanish-language news service called CNN Plus is expected to start this December via Canal Satellite Digital, run by Canal Digital, Canal+ Espana and CNN.

NRK (Norway) has signed with Canal Digital to provide a joint satellite TV service with both analogue and digital channels. Canal Digital is already transmitting the NRK-1 and -2 channels - the new smart card includes NRK, TV2 and TV Norge. The latter is to change from clear analogue at 1°W to D2-MAC. There will eventually be a common Scandinavian conditionalaccess standard.

The Arianspace launch base at Kourou, French Guyana has had a quiet time recently because of a shortage of satellites. The PAS-7 satellite is receiving further checkouts, and ST-1 is being factory modified. Eutelsat's new W1 satellite suffered fire damage at the Aerospatiale factory. Arianspace still hopes to achieve its annual quota of twelve launches this year, including a firing of the new Ariane 5 launch rocket.

Eutelsat has ordered a spare W series satellite from Matra Marconi for delivery in December 1999. It will provide Hot Bird type coverage and act as a back-up for the 7, 10, 16 and 36°E slots.

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Reports from Chris Hawkins Gerry Mumford Philip Blundell, AMIIEelec Russ Phillips and Ian Field

Bull Micral DM1914/ADI3014

Two of these monitors have come in recently. With the first one Windows 95 opened and shut every few seconds. The cause of the trouble was dry-joints at coils L802 and L803. The second monitor's power supply cut in and out at random. This time dry-joints at the two voltage regulators V902 (VA7815) and V903 (LM317T) were to blame.

If the problem is fine flyback lines, try replacing C713 on the CRT base panel. C.H.

Compaq 472P

This monitor took a good five minutes to produce a visible display. Although lots of dubious solder joints around the CRT base connector were dealt with, the cure was CRT regeneration. C.H.

Hyundai HCM438EU

You had to be very quick to use this monitor. After five minutes the display just faded away! The CRT's EHT and heater voltages were OK, but when the fault was present the first anode voltage was non-existent. A large blue 10nF, 1kV disc capacitor near the tube base was leaky. Its replacement enabled the owner to stop working in the dark. C.H.

Tatung TM3401

The power LED was illuminated but there was no display. The cause of the problem was dry-joints at coil L402, the line driver transformer T403 and R465.

Monitors

Other common sites for dryjoints are R804, R805, D813, D815 and connector PL802. C.H.

Microspot M1595LR

This monitor produced a distinctly yellow display. The cause was a duff 2SC1370 video output transistor (Q903) on the CRT base PCB. A BF472 restored colour to its cheeks – and its customers'. C.H.

Ideal PV1776A

This monitor was dead because the IRF640 chopper FET Q621 had overheated and gone short-circuit. As a result, the power supply had shut down. Strangely, the line output transistor was OK. When a replacement FET had been fitted and power was reapplied the picture wobbled badly and Q621 soon burnt out again. The cause of the trouble turned out to be C629 (22µF, 250V). It's a smoothing capacitor in the HT supply. G.M.

Olivetti DSM50-148

This monitor suffered from intermittent EW bowing. When the fault was present there was no EW correction parabola at the diode modulator in the line output stage. Tracing back to its source, I found that it went missing at coupling capacitor C302 (1nF, 100V) which was going open-circuit intermittently. G.M.

Hyundai HCM428B

This monitor was dead because of a power supply blow-up. The 2SC3457 chopper transistor Q101 was short-circuit and its 2SC2316 driver transistor Q102 had shattered, blowing the $1 \cdot 2\Omega$, 1W fusible feed resistor R109. **G.M.**

Samtron SC428PSL (TLQ Chassis)

The problem with this monitor was uncontrollable EW bowing and excessive width. One of the pincushion distortion correction diodes, D406 (RU4D), had gone short-circuit, killing the driver transistor Q406 (KSE800). Use a

UF5408 diode in position D406 and a BD679 transistor with insulating kit in position Q406. G.M.

ICL 15505

If the display is over bright – you may hear the CRT base spark gap arcing – check R446 ($2 \cdot 2M\Omega$) which is probably open-circuit. It's at the chassis side of the CRT's first anode control. **P.B.**

Viglen 14S

If the picture is lost after a few seconds because the CRT's heater voltage disappears, replace D841, D842 and R878. **R.P.**

Dell D1528LS

This monitor was dead with the 2SC5048 line output transistor short-circuit. Note that the correct type, 2SC5048, must be used: a BUW13A, BU508A etc. won't cope. I tried a BUW13A initially to prove that the line output transistor was the cause of the fault, but it immediately went short-circuit. **R.P.**

Viglen CA1428LE

This monitor was dead with its BU2508DF line output transistor Q312 short-circuit. In addition the following items in the power supply had to be replaced: the UC3842 chopper control chip IC1; the 2SA966 transistor Q2; the BUW12AF chopper transistor Q1; and the 0.47Ω , 1W resistor R2. R.P.

ACI VG340

There was lack of height because R206 (1Ω , 1W), which is in series with the frame scan coils on the chassis side, had increased in value to $2 \cdot 2\Omega$. When this happens, the reduced frame scan current upsets the operation of the EW correction circuit. You will find that this second sympton also goes when R206 has been replaced. **I.F.**

AST LR14

If one of these monitors rustles up briskly then quietly dies, suspect

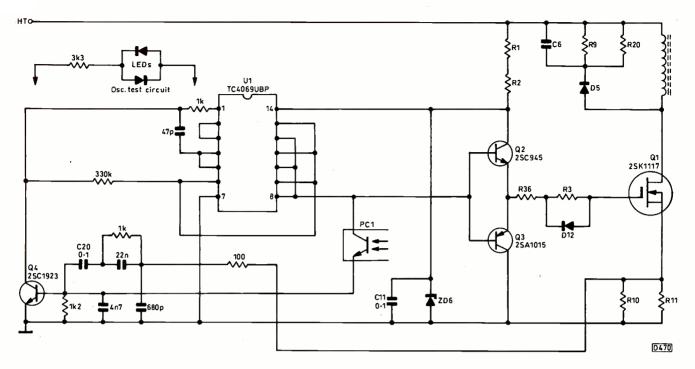


Fig. 1: The basic chopper power supply arrangement used in the Acorn A4000 monitor. The values of vulnerable components will be found in the accompanying text.

Q208 (2SB1149). It's one of the HT supply selector transistors for the line output stage. The fault could cause confusion by giving the impression that the line output transformer has failed. I've had it only once to date. I.F.

Acorn A4000

This monitor was dead with a power supply blow-up – you get this when the 2SK1117 chopper MOSFET Q1 fails. As a precaution, I decided to check the mother board by hooking it up to a PC chopper power supply. Incidentally the mother board power connector is identical to a disc drive plug, but the connections are not the same. Once the mother board was found to be OK, repairs to the power supply began.

As you can see from the circuit – Fig. 1 shows the basic chopper arrangement – the power supply is neat and simple. Though a lot of it is destroyed when Q1 fails, repair isn't too difficult. Before starting, note that the markings on the PCB for R3, R10 and R11 are close together, so these items may not correspond to the official circuit diagram.

Q1 had gone short-circuit, destroying R10 (1Ω , 1W) and R11 ($1\cdot 2\Omega$, 1W). C20 provides a DC block in the excess-current sensing circuit: although it doesn't look as if it is adequately rated, it prevented damage to Q4 (2SC1923). When R10 and R11 had gone

open-circuit, the current flowing via Q1's gate had destroyed Q3 (2SA1015), which had gone short-circuit after venting soot on the side of C11. Q2 (2SC945 – a 2SC1815 will do as a replacement) had also gone short-circuit, taking with it the 12V zener diode ZD6 and U1 (TC4069UBP). Note that this chip's UBP suffix is important. It must be unbuffered CMOS with a drain voltage supply rating of up to 18V: an HC or HCT type must not be used!

In addition, the following components must be checked: R36 (10 Ω), PC1 (PC111), R1 and R2 (both 33k Ω , 3W), R3 (47 Ω), D12 (1N4148), and the snubber network components C6 (33nF), R9 and R20 (both 100k Ω , 1W) and diode D5 (1N5397) – to ensure that snubber network failure was not the basic cause of the trouble.

When rebuilding, leave Q1 out until last so that the oscillator can be checked with power applied. For this purpose use a pair of inverse-parallel connected LEDs with a 3.3k Ω resistor in series, as shown in Fig. 1 (top left). First connect this network between pins 8 and 13 of U1: both LEDs should light. Then move the lead connected to pin 8 to the junction of Q2 and Q3's emitters and R36: the result should be the same. If both these tests fail, check R1 and R2 which, though start-up resistors, also provide the running supply for the chopper drive circuit. It's also

important to check the voltage stabilised by ZD6: if this falls below 12V, Q1 will be under-driven and will overheat.

If you have any difficulty obtaining a 2SK1117 MOSFET, the specification for the 2SK1118 is the same except that the latter is fully insulated and has a power rating of 45W instead of 100W. It seems to me that a TO220 device plus mounting kit and a fully insulated TO220 device with a lower power rating amount to the same thing! Alternatively the MTP6N60 is the same as the 2SK1117 while the MTP6N60AFL is the same as the 2SK1118. They are all 6A, 600V devices. **I.F.**

NCR 0261

When switched on this monitor produced a dim picture that gradually brightened until the power supply was overloaded. The cause of the trouble was a crack in the CRT base panel – the only track affected was the one to the control grid pin.

When I reassembled the monitor I noticed that the foam rubber pad glued to the CRT base shielding was oversize and had been permanently deformed by the pressure. Trimming it down seemed to be a good idea.

This chassis is identical to the **AST LR14**, with four controls that point down under the side edge and an odd-shaped sub-panel inside. **I.F.**

What a Life!

Bores and other problems, mainly with tellys. Donald Bullock's monthly round up

Greeneyes never forgets a face. I do. I can talk to someone for half an hour in the shop and, unless they have green hair or two heads or something, I'm unlikely to know them next day. Some of them find this disconcerting. They can't understand why the chap who showed such interest in a set brought in yesterday doesn't seem to know who they are when they call for it the following day.

Bores

While I'm in the confessional box, here's something else. I find it very difficult to keep up an appearance of friendly interest with a bore. As I'm told for the third or fourth time how a set failed and what was on at the time, then the service history of their previous set is unfurled, my eyes glaze over and I find myself reliving the time I caught that 22pound pike at Waltham Pits.

Take the fellow who staggered in the other day with a monster Philips set, Model 24CE3588/05B (CP110

"Ha, ha" he started, "the set was all right until we pulled the plug and went on holiday. To Blackpool actually. We watched the Ester Poltergeist programme just before we went. Do you know Blackpool? Yep, right as rain it was till we went there. And her's was the last programme we watched. Funny, ennit? I remember the missus saying, as I switched 'im off, 'pull out the plug Charlie'. And of course I did. I likes Blackpool, do you?"

I picked up a pen. "Name?" I asked.

He looked at the set. "Philips" he

"And your name?" I asked, trying desperately in smile.

"Phillips" he replied.

And Another

As he walked out a similar sort of chap came in and deposited a

Ferguson set on the counter.

Pinged three times and died, he did. Just as that Bruce Foresight chap comes in. I was having me dinner at the time. The missus gets sausages and mash twice a week. Do you like sausage and mash? Yeah, pinged three times 'e did. Or was it four? No three times, that's right. I remember saying to the missus 'reckon these sausages are fresh?' Not as 'er'd give me bad uns, mind. Yea, Bruce Foresight was on at the time . .

"Name?" I asked, dishing my smile.

"Ferguson" he replied.

"No, your name?"

"Yes, Ferguson. Do you like Bruce Foresight?"

Marconi

As Steven settled down to the sets a foreign looking chap came in with an old Marconi radio. I drew up a card.

"Mr Marconi?" I asked.

He raised an eye and looked at me. "I haf never called my wireless 'Mr" he said, "vie do you call wirelesses 'Mr' in this country?"

"Oh, er, ha, ha . . . My mistake" I said.

Work

Meanwhile Steven had pulled the Philips set on to the bench. "The capacitor 'battery' has gone" he said. For better access he pulled out both the speaker and the degaussing plug, then fitted the new capacitor. After doing that he was called to the phone.

I sauntered over and replaced the plugs. The yellow one in the yellow socket, the reddish-brown one in the red socket. When I switched the set on it went bang and emitted a puff of smoke. But it came on - without any sound.

"Ah" said Steven, "the yellow plug came from the red socket, and the reddish-brown one from the yellow socket."

"Of course" I said, "should have known.3

We fitted a new TDA8190 sound channel chip but there was still no audio output. Its safety-type feed resistors R3102 and R3672 were both open-circuit. Once we'd replaced them all was well.

The Ferguson set was a Model 66M3, which is based on the ICC5 chassis. Steven disconnected pins 8 and 10 of the line output transformer, connected a 100W bulb from pin 8 to chassis and switched on. The bulb pulsed three times then went out.

"Power supply's OK" he said. After removing the line output transformer he tried again. This time the HT came up and remained, with no pulsing. The line output transistor proved to be OK, so we fitted a new transformer and tried again. The HT pulsed three times and shut down.

An hour later Steven had made no progress, despite checking a dozen or so associated components. He took the new transformer out and tried again. As before, the HT came up and remained. Steven sat down and pondered. I was at a loss too. Could the new transformer be faulty? We checked it for shorts and didn't find any, but this didn't prove much.

As a long shot Steven moved over to the power supply and checked the BU508A chopper transistor. It tested perfectly of course. But he fitted another and tried again. This time the set sprang to

An Akai VCR

Meanwhile Paul was working on an Akai VSF30 VCR. After replacing the usual carriage gear he tried it out. The monitor's screen flickered blue a few times then the machine

"Now I'm in trouble" he com-

mented. After a further hour's investigation he found that FR221, a 120Ω safety resistor, was open-circuit. It's in the 30V line to the tuner/display and control circuitry. No reason for its failure could be found, and a replacement brought the machine back to life.

Mr Zwymer

Then Mr Zwymer brought in a Ferguson T14R portable. "Is new" he said, "unt is dead. Bot fot can I do about it? Ze vife von it in a raffle. Silly voman! Vie did I marry such a voman?"

The set's fitted with the TX805 chassis, and there was no HT across C17 (100 μ F, 160V). So the Wessel combined chopper/line output circuit wasn't working. Most times it's not necessary to do anything other than check the three $68k\Omega$ resistors in the start-up circuit. Sure enough RP41 had failed.

When Mr Zwymer called for it we presented him with a bill for £12.50. He broke into an hysterical laugh.

"Vie, that is chicken feed" he declared, "now I lof my vife again!"

A Tatung

Squadron-leader Pettigrew has a moustache that's wider than his face. "You'll have to get the old telly out of the car for me" he said. "You and you" he ordered, pointing at Paul and me. "I'm giving it one last chance. Seems to want to mess me about – and nobody does that!"

We brought it in and he took his leave. It was a Tatung TV9704 (170 series chassis). We plugged it in and switched on. As it warmed up the picture started to flicker and shake. Then it slipped sideways across the screen, went to black and white, next to a blue screen, then faded to nothing. We reached for the freezer, but it didn't help.

At the back of the chassis there's a 4in. PCB that stands upright. Between this and the metal chassis surround there's an LM317T regulator (1802) that provides a 12V output. At some time in the past it had been unscrewed from the metal, which acts as its heatsink. As a result it had overheated and was now leaky.

A replacement cured the fault. When we'd boxed the set up and tried it again I let it know the score. "No more playing up" I said, "or it'll be curtains for you."

Some Onwas

Doris Blugg called in with a Bush 2059NTX. "No picture, Mr

Bugbear" she grinned, "he's like my husband, no good for nuffin."

The set was dead and wouldn't go into the standby mode. When we advanced the setting of the first anode control we got a milky raster with flyback lines. This proved that the 12V supply was missing. So we checked R422, the $3\cdot3\Omega$, 2W safety resistor that feeds the 12V, 1W zener diode D402. As it was opencircuit we fitted a replacement. Then we checked the zener diode, which was short-circuit. This was replaced as well.

Before switching on again we checked C909 (47μF, 25V) and C910 (10μF, 50V) in the power supply. C909, which couples the drive to the base of the chopper transistor, produced an odd reading. We fitted a replacement rated at 50V, 105°C. Although C910 tested OK, we decided to replace it with a 105° type.

When we switched on again we had a picture. But when standby was selected the set remained on though the screen darkened. We've also had this fault before: Q907 (2SC2335) goes short-circuit and R920 rises in value. We fitted a new BUT560A transistor in the Q907 position and a new resistor. This time all was well.

When Doris Blugg returned she was still on about her husband. "He wants to take some of that Niagra stuff" she said, "if there's one thing worse . . ."

"Thank you Mrs Blugg" I cut in. "Now we'll just get this set to your car."

As you'll have gathered, the set uses an Onwa chassis – though it's a rather more complex one than usual.

With the next set, an Osume OS1464 14in. portable, we were again faced with an Onwa chassis. It tripped three times at switch on.

"We should be able to polish this one off quickly" said Steven.
"We'll check the usual suspects."
The 12V zener diode ZD401 was short-circuit and its feed resistor R414 was open-circuit. After replacing them we checked the BU508D line output transistor Q402 which was also short-circuit.

Once we'd fitted replacements we moved to the power supply and renewed the troublesome electrolytics C909 and C910, using 105° types.

"That'll probably be it" Steven said, "these stock faults can be moneymakers."

When he switched the set on there was terrible arcing from the



A foreign looking chap came in with an old Marconi radio.

scan coil area and from the tube's anode cap to its Aquadag coating. Looking shaken, he switched off quickly, then disconnected the feed to the line output transformer and checked the voltage across the HT reservoir capacitor. It was very high at 193V.

"It's still unregulated despite what we've done" he said, then started to examine the chopper circuit in greater detail. The two zener diodes ZD901 (8.2V) and ZD902 (9.1V) and the 0.1µF capacitor in the drive pulse shaping network were all short-circuit. He replaced them and, for good measure, the 2SA1815 error detector transistor Q901, though it read OK.

When he switched on again the HT voltage reading was correct at 109V and was properly adjustable. But when he reconnected the feed to the line output stage the set tripped three times and shut down.

Further checks showed that the line output transformer had been damaged by the over-voltage condition – it had shorted internally.

The customer had accepted our quote for regulator repairs, but refused the increased quote to include the transformer. So the work we'd done was a waste of time.

HELP WANTED

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

Wanted: LOPT type 3220012 for the Orion 20JT/20JR. Wes Campbell, 7 Silverstream Park, Bangor, Co. Down, N. Ireland BT20 3LU. 01247 455 675

Wanted: EW coil (circuit ref. no. LG11) for the Ferguson 59P7 (ICC5 chassis). D. Goodfellow, 5 Green Lane, Clifton, Ashbourne, Derbyshire DE6 2BL. 01335 344 805.

For disposal: Twelve VHS VCRs, a couple of TV sets and various handsets, free. Phone 01932 565 248 (Chertsey) after 7p.m. and ask for Terry.

Wanted: Spares for the Samsung CI212R Voyager 10in. TV set plus service information with voltages marked. Philip Gay, 80A Milton Brow, Weston-super-Mare, Somerset BS22 8DE.

Wanted: LOPT type MHF 023-21 7X18 (?) for the Hantarex Model MTC9000 video monitor. Also a replacement display for the Akai VS765EK VCR. Ian Johnson, 24 Seymour Road, St. Albans, Herts AL3 5HW

Wanted: Circuit diagram, the power supply circuit or the number of the chopper output stage in the IBM 6542-103 monitor. S. Falzon, 142 Fleur-de-Lys Road, B'Kara, Malta. Phone. 443802, fax 448257.

Wanted: LOPT for the Sunkyong SCT1045 radio/TV, also a circuit diagram for the Goodmans Compact 110 TV. A. Mc Ghie, 1 Boyach Crescent, Isle of Whithorn, Wigtownshire DG8 8LD. 01988 500 443.

Wanted: Wells Gardner monitors/chassis, dead or alive, Models 13K7893, 25K7124, 27K7329 or similar, also tubes A63ADG and G-A68ACT00X, and Zenith chassis CD27MAMF1, CD25MVRF07 and anything similar, LOPTs etc. Call Phillip Hardacre on 01482 329 957, fax 01482 585 414 or mobile 0860 671 056.

Wanted: Circuit diagram for the Pye Model 42K7228/15W, photocopy OK. John Dove, 9 Bernard Street, Ely, Cambs CB6 1AU. 01353 662 298.

For disposal: Complete PCB and power supply for the Goodmans GHC40, with Dolby Pro Logic including SSM2126A decoder and all other chips and service manual. Full switch bank as well if required. All or part for small money offer. D. Williams, 382 Kings Road, Stretford, Manchester M32 8GW. 0161 862 9432.

Wanted: Timer/clock panel PCB module for the Sharp VC381H VCR. Pete Shepherd, 25 Tomkins Close, Stamford Le Hope, Essex SS17 8QU. 01375 640 618.

Wanted: HV unit (H Stat) part no. 1 228 482 31 for the Sony Model KV2060UB and HV unit part no. 1 226 733 11 for the Sony Model KV2212UB. Ray Smith, 51 Compton Road, Pedmore, Stourbridge, W. Midlands DY9 0TG. 01562 886 493. For disposal: Television magazines dated May 1994 to December 1997 inclusive. C. Godleman, Flat 4, 35 Station Road, Harlesden, London NW10 4UP. 0181 838 3340. Wanted: Two SN76023N audio ICs. Ian G. Jeffery, 275 Monks Road, Lincoln LN2 5JY. 01522 540 521 Wanted: Copy of the power supply circuit for the Osaki/Philips Model

circuit for the Osaki/Philips Model P140. R. Brown, 44A Middle Road (side door), Shoreham, Sussex BN43 6GA. 01273 464 339.

Wanted: Capstan motor, capstan fly-

Wanted: Capstan motor, capstan flywheel and capstan flywheel bearing for the Sharp VC9300 VCR. H. Wright, 90 Harvelin Park, Lee Bottom, Todmorden, W. Yorkshire. 01706 814 505.

Wanted: IF can/coil (WE121.19. 0231) for the Philips B4X12A/19A valve radio. A. Mansfield, Lederbach 32, Herisau 9100, Switzerland.

Wanted: Circuit diagram/service manual for the Uniden UST8008 analoge satellite receiver. Photocopy OK. Also need original remote control unit. Richard Warwick, Scarborough, N. Yorkshire. 01944 728 267. Wanted: User's manual or circuit

Wanted: User's manual or circuit diagram for the Fisher FVHP906 VCR, photocopies OK. C.T. Hawker, 89 Brooklyn Gardens, Cheltenham,

Glos GL51 8LP. 01242 582 971. Wanted: Mains transformer for the Samsung TV Model CI338X-14. D. Jennings, 4 York Drove, Bitterne Village, Southampton SO18 5SA. 01703 490 174.

Wanted: Instruction manual/circuit diagram (photocopy OK) for the Telequipment Serviscope (valve model). I need to know resistor values. Also circuit diagram for the Cobra 19GTL FM citizen's band radio (photocopy OK). John McClean, 66 Castle Park, Limavady, Co. Londonderry, N. Ireland BT49 0SB. 01504 763 045.

Wanted: Service manuals/circuit diagrams for the following: Pioneer SX600L; Technics SUC03; Sansui AUD22. Rerturn guaranteed if required. J. Hall, Cortons Electrical, 29 Red Lion Street, Aylsham, Norfolk NR11 6ER. 01263 733 391.

Wanted: Telefusion panels to fit side

windows of Escort Mk II estate. Other companies' panels considered. Philip Barry, 6 Cowling Road, Burrill, Bedale, N. Yorkshire DL8 1RN. Wanted: Circuit diagram for the Cathay CTV3501B colour portable (or is there an equivalent model in another range?). Also an STR451 IC. Donald Bills, 69 Greenfields Road, Kingswinford DY6 8EG. Wanted: Camcorder battery ref.

VMB1 for the Amstrad Videomatic Model VMC100. Also a remote control for the Mitsubishi B11 VCR. Stuart Stark, 43 Brunswick Road, Edinburgh EH7 5PD. 0131 478 1020. Wanted: Panasonic G deck adjustment information or copies of the May/June 1991 issues of *Television* that cover the alignment in depth. Gary Williams, 1 Dunblane Close, Garswood, Wigan WN4 0SH. 01942 728 161 or e-mail

garywillliams 1 @compuserve.com For disposal: Television issues from December 1976 to December 1997 (some missing), also B&K 15MHz precision scope. Offers please. S.P. Webb, 38 High Street (back), Dolby Cottage, Ely, Cambs CB7 4LQ. 01353 668 407.

Answer to Test Case 431 - see page 19 -

There's no auto grey-scale tracking in the Tatung D series chassis to confuse the diagnosis when an incorrect colour balance fault is present. And there's no need for RGB drive controls, such is the stability of modern picture tubes and the components used in the drive circuitry. The standing voltages at the tube's cathodes are governed by those at the outputs from the decoder chip. But the trouble wasn't being caused by this IC - as Cathode Ray discovered when he fitted a replacement!

In fact the problem remained unsolved until Television Ted returned from his holiday. He was quite horrified by Cathode Ray's action, and made him refit the original jungle chip and return the new one to stores. The cause of the fault was a very minor problem on the CRT base panel: R922 (100k Ω) had changed value.

This resistor provides DC feedback to stabilise the working point of the two-tranistor blue output amplifier. The corresponding resistors in the red and green output stages are R912 and R932 respectively. They had also started to increase in value. By way of preventive medicine, all three resistors were replaced. After that a correct grey scale was achieved with the three set-up potentiometers at very close to their centre settings. And there was no more colour drift.

NEXT MONTH IN TELEVISION

Servicing the Panasonic Alpha 2 chassis

The Alpha 2 chassis remained in production for about six years and was used in a number of models. So there are a lot of these sets around. John Coombes provides a detailed faultfinding guide.

Chips for DTT

LSI Logic has developed a sophisticated set of chips for digital TV decoders-receivers. The latest addition is a DTT COFDM demodulator chip that was developed in conjunction with the BBC. A look at the demodulator, its performance and the complete chip set.

Power at remote locations

Bill Wright on a simple way of obtaining low-current mains voltage at remote locations - via coaxial cable as low-voltage AC. Applications include TV distribution and surveillance equipment.

The Velleman hand-held oscilloscope

The Velleman K7105 is a hand-held scope with LCD screen and a multi-function digital voltmeter in kit form. There's also a ready-built version (HHS5). It is ideal for field servicing and won't hurt your pocket. Pete Roberts has built two of them and describes the procedure. With some interesting features it's a worthwhile investment.

Toshiba service briefs

More know-how from Toshiba Technical.

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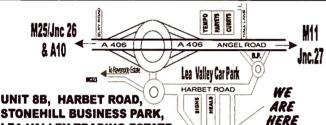
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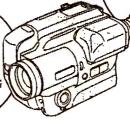
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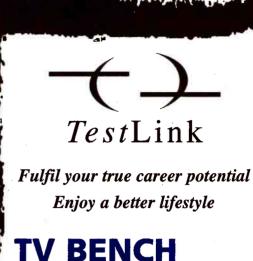
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UNING POTS – 8 WAY MISTRAD ISSPILAY PANEL – LONG CHASSIS – 1992/93 RONT PANEL FOR ALL 1992 MODELS IEAD AND DRUM – 6000 IEAD AND DRUM – 6000 IEAD AND DRUM – MCAM ANEL-CLOCK DISPLAY – 8,900 OWER SUPPLY SUPPLAY – 8,900 OWER SUPPLY, LONG OR SHORT CHASSIS 1991/1992 MODELS OWER SUPPLY SWITCH MODE – DOUBLE DECKER 0 OPF MIXED NOKIA ITT. ALORA FINLEX SERVICE MANUAL	£4.00 £12.00 £12.00 £5.00 £3.00 £5.00	PANEL-TELETEXT G8P – ISSUE 6 PANEL-TELETEXT PC315-11 – ISSUE 7 PANEL-TELETEXT PC5 F S.T. – ISSUE 6 PANEL-TEXT-VT753E POWER SUPPLY TV SWITCH MODE STR 4211 ISSUE 10 POWER SUPPLY VIDEO SWITCH MODE VTM312ELM THICK FILM-HM9204A	£15.00 £15.00 £20,00 £8.00	MITSUBISHI CAPSTAN-HSE41-I/C M51782ASP HANDSETS CPT1408T, CPT2176, CPT2178	£4.00	ORION D1094 ORION D1096 ORION D2096 ETC CAPSTAIN MOTOR FOR ABOVE DECKS AND HAND SETS AND HAND SETS AHEAD DECK FOR 1500 EACH 230. EACH 23
UNING POTS – 8 WAY MSTRAD ISPLAY PANEL – LONG CHASSIS – 1992/93 RONT PANEL FOR ALL 1992 MODELS EAD AND DRUM – 6000 EAD AND DRUM – NICAM ANEL-CLOCK DISPLAY – 8/90 OWER SUPPLY – SONO OVER SUPPLY LONG OR SHORT CHASSIS 1991/1992 MODELS OWER SUPPLY – SWITCH MODE – DOUBLE DECKER 10FF MIXED NORIA ITT. ALORA FINLEX SERVICE MANUAL ALORA FINLEX SERVICE MANUAL ALORA FINLEX SERVICE MANUAL ALORA FINLEX SERVICE MANUAL	£4.00 £12.00 £12.00 £5.00 £3.00 £5.00 £3.00 £5.00	PANEL-TELETEXT GRP – ISSUE 6 PANEL-TELETEXT PC315-11 – ISSUE 7 PANEL-TELETEXT PC3 F-S.T. – ISSUE 6 PANEL-TELETEXT PC5 F-S.T. – ISSUE 6 PANEL-TEXT-VT733E POWER SUPPLY TV SWITCH MODE STR 4211 ISSUE 10 POWER SUPPLY VIDEO SWITCH MODE VTM312ELM THICK FILM-HM9204A HOSIDEN CUBE BASE – Mixed 10 for	£15.00 £15.00 £20,00 £8.00 £10.00 £3.50	MITSUBISHI CAPSTAN-HSE41-I/CM51782ASP HANDSETS CPT1408T, CPT2176, CPT2178 CPT2476, CPT2478 TEXT. REPLACES PHILIPS KT3, K30, K4 ETC.	£4.00 £5.00 £5.00 £9.00	ORION D1094 ORION D1094 ORION D2096 ETC CAPSTAIN MOTOR FOR ABOVE DECKS 115. AND HAND SETS AND HAND SETS 13. 4 HEAD DECK TOR 1 500 POSTER EQV 98009-ETC 20 HIGHI VOLFAGE CAPS 1500V - 2000V MIXED 11. 100 TRANSISTOR MIXED VIDEO PATTERN GENERATOR MODEL T9535 240V MAINS SMALL - SEND FOR DATA 220. 421 TV ADAPTOR - RGB IN UFH OUT 425.
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