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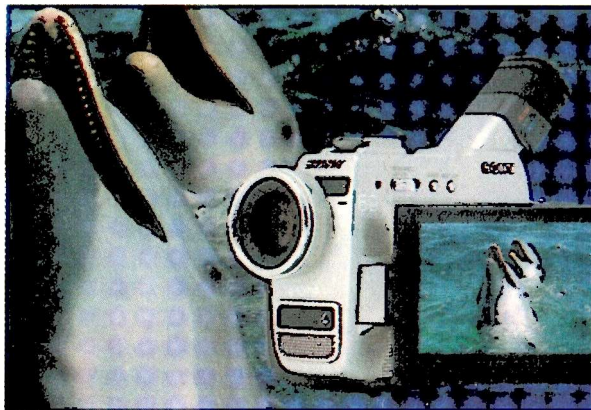
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June issue on sale May 20th.
Next issue, dated July, on sale June 17th.

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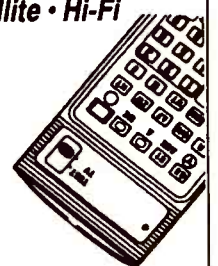
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Economics and the Real World

In recent months the Bank of England's Monetary Policy Committee has found it difficult to decide whether or not to increase interest rates. In fact on two occasions the Committee's decision, to leave rates as they are, was reached only when the Governor exercised his casting vote. The Committee doesn't, one has to admit, have an easy decision to make. Its members are drawn from those exceptionally well versed in monetary matters: if they find it difficult to reach a decision, who could claim greater prescience? The fact that the Committee has admitted to uncertainty as to how exactly monetary policy operates to achieve the intended outcome makes the problem that much more difficult.

Basically, the Bank has been set the objective of ensuring that inflation does not exceed a certain figure, 2.5 per cent. Its decision on base rates is supposed to ensure that this target is met. In the past the Chancellor of the Exchequer determined the level of base rates. Control of monetary policy was given to the Bank by the present Chancellor to try to ensure that day-to-day political considerations do not affect monetary policy decisions. In theory, this was an ideal move – which had been advocated by many authorities. But the economy is a vast and incredibly complex thing, and monetary policy/inflation is just one factor. It is also necessary to ensure that the exchange rate is not grossly out of line, that demand within the economy is kept within the bounds of what can be supplied, and that conditions are such that industry can prosper and invest to ensure future prosperity. All these factors are supposed to weigh on the deliberations of the Monetary Policy Committee.

The Committee is provided with more detailed data and analysis on the economy

than ever before. The problem of course is that the only reliable information relates to the past. You can have guesses, informed ones no doubt, but not data on the future.

While the Committee has found it difficult to arrive at its decisions, those outside the Bank have been more ready to reach conclusions. The City has tended to be hawkish, advocating on balance a tougher monetary policy. Industry, which has to pick up the pieces and make the most of the situation, has been complaining about the high level of interest rates and the resultant high exchange rate. According to the Confederation of British Industry, the pound is at a less competitive rate in real terms than for seventeen years, export optimism is at an eighteen year low and overall business optimism at a five year low. The City claims that, based on past figures, exports have not to date suffered unduly. It seems to think that making life difficult for industry is good for its soul – it encourages competitiveness. So it may, but there are limits to what is reasonable in this respect. As I have pointed out on previous occasions, the most successful exporting countries, Germany and Japan in particular, have never made the mistake of having an over-valued currency. Not only does this make exporting difficult, it means that home-market buyers become eager to buy imported goods – which is exactly what they are doing. Hence the strong growth in consumer borrowing (a record £1.4bn in March).

What it boils down to is that the current level of domestic demand is the most important factor in determining the economy's performance. It has to be restrained to avoid inflationary pressures; it also has to be restrained to maintain a balance between expenditure and supply, saving and invest-

ment. Interest rates influence this, but take a time to do so and can introduce distortions – as when the exchange rate becomes excessive. The alternative, which has a greater effect in the short run, is to increase taxes to reduce demand – and reduce them when a loosening of economic conditions is required. VAT can for example be raised and lowered without too much trouble. But this 'fine tuning' is not at present accepted economic thinking – though economics seems to have become rather subject to fashion. In addition governments of all shades are loath to increase taxes.

Yet a better balance between monetary and fiscal control does seem desirable. It is not sensible to squeeze industry rather than consumers to control the economic balance. That way you end up with depleted industries and a poorer future. It is particularly tragic in view of the fact that UK industry has had to rely to such an extent on foreign investment in recent years. With such an over-valued pound, the Japanese and Korean firms that have invested in UK manufacturing must be wondering whether they are in the right place after all. While excessive capacity worldwide was quoted by Mitsubishi as the main reason for closing its Haddington CTV plant, the move is not a good omen for UK Ltd. – especially as, with the move to digital and widescreen TV, the industry should be at the beginning of a period of expansion.

Industry has to take a rather longer-term view than the City and, one has reluctantly to conclude, most economists do. You can't develop products and the manufacturing facilities required overnight, and the associated R&D activity is essentially long-term. It's a pity that governments nowadays find it so difficult to act in a fiscally responsible manner.

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2N555	0.12	2SD1246	0.30	BAT43	0.52	BD233	0.23	BUL544R	1.27	BZY8812	0.09	P6KE180A	4.65	TD1060	1.08	TDA8175	6.41
2SA1013	0.35	2SD1275	1.41	BAT85	0.96	BD234	0.36	BUT11	0.65	BZY882V7	0.23	PIC16C8404S04	5.50	TD1085C	2.74	TDA8178FS	5.95
2SA1015	0.11	2SD1276	1.39	BAV21	0.21	BD237	0.31	BUT11A	0.95	BZY883V0	0.11	R2KL	0.77	TD1170N	2.57	TDA8180	4.87
2SA1020	0.44	2SD1292	0.64	BAX14	0.17	BD238	0.24	BUT11AF	1.18	BZY884V7	0.09	R2M	0.84	TD1170S	2.05	TDA8350Q	3.59
2SA1029	0.26	2SD1330	0.31	BC107B	0.20	BD243	0.45	BUT12A	1.17	BZY885V1	0.13	R4050	3.04	TD1180P	2.48	TDA8380	2.53
2SA1048	0.19	2SD1397	2.31	BC108	0.24	BD243A	0.60	BUT12AF	1.87	BZY88C12V	0.09	REGBABY10	13.00	TD1516Q	3.59	TDA9503	2.13
2SA1145	0.36	2SD1398	2.14	BC109A	0.00	BD243C	0.44	BUT18AF	1.37	CD4001	0.24	RG2	0.64	TD1518Q	4.27	TEA1039	2.11
2SA1286	0.60	2SD1426	3.51	BC141	0.36	BD244A	0.34	BUT56A	1.19	CD4017	0.47	RGP10G	0.26	TD1519A	2.74	TEA2018A	2.29
2SA1370	0.43	2SD1427	2.91	BC147A	0.24	BD244C	0.43	BUW48A	1.97	CD4049	0.35	RG15G	0.33	TD1520B	4.50	TEA2029C	7.04
2SA1706	0.50	2SD1432	5.04	BC148A	0.35	BD245C	0.94	BUW11A	1.32	CD4052	0.29	RG15J	0.17	TD1524A	7.52	TEA2031A	4.26
2SA733	0.18	2SD1439	5.86	BC148B	0.11	BD433	0.29	BUW41B	1.39	CD4053	0.61	RG15M	0.44	TD1553Q	4.79	TEA2164	3.40
2SAB72A	6.10	2SD1441	5.98	BC158B	0.12	BD434	0.31	BUW8A	1.03	CNK62A	1.29	RG30M	0.30	TD1554Q	8.12	TEA2260	2.48
2SA933	0.36	2SD1453	3.85	BC168	0.04	BD436	0.52	BUX6A	1.03	CNK82A	2.10	S200A	2.57	TD1557Q	4.23	TEA2261	3.68
2SA940	0.82	2SD1497	4.74	BC182	0.14	BD437	0.52	BUZ71A	1.03	CNK83A	2.55	S200A3	3.59	TD1558Q	7.69	TEA5101A	6.48
2SA950	0.18	2SD1541	4.96	BC182L	0.14	BD438	0.38	BUZ80	3.52	CNY758	0.52	S200AF	1.46	TD1670A	2.98	TC106D	0.82
2SA966	0.41	2SD1548	5.95	BC184A	0.12	BD681	0.47	BUZ80A	4.15	DT114E5	0.31	S2055AF	3.74	TD1675A	3.85	TC126D	1.54
2SA992	0.31	2SD1554	3.25	BC184L	0.06	BD826	0.43	BUZ90A	3.40	DT124E5	0.77	SA129302	10.37	TD1904	1.63	TC106D	0.60
2SB1010	0.35	2SD1555	2.65	BC187	0.47	BD839	0.57	BUZ90AF	3.30	DTC144E5	1.19	SAB3035	1.71	TD1908A	5.61	TP110	0.35
2SB1066	0.82	2SD1556	5.11	BC212	0.09	BD901	0.52	BY127	0.18	FR605	0.90	SG264A	12.88	TD2002	1.12	TP112H	0.77
2SB1143	0.77	2SD1651	2.38	BC212B	0.19	BD902	0.60	BY133	0.08	FXT749	0.43	SGSF344	10.70	TD2005	1.83	TP120	0.40
2SB1243	0.60	2SD1858	0.43	BC212L	0.18	BD911	0.52	BY206	0.20	HA13001	0.85	SL1430	1.92	TD2006	1.06	TP122	0.89
2SB560	0.43	2SD1877	2.14	BC237	0.12	BDT64C	1.18	BY227	0.13	HA13119	2.05	SL1431	2.82	TD2030H	0.91	TP2955	0.40
2SB643	0.29	2SD1878	2.63	BC237B	0.19	BDT65C	1.68	BY228	0.26	HA13151	13.20	SN74141N	0.17	TD2030V	1.46	TP29E	0.77
2SB647	0.57	2SD1879	3.16	BC238	0.11	BF194	0.22	BY2291000	1.31	HA51338SP3	7.69	STK4132H	10.00	TD2050	4.56	TP3055	1.08
2SB649A	0.77	2SD1884	3.35	BC238B	0.16	BF195	0.07	BY255	0.14	HM6251	14.32	STK4141I	10.23	TD2270	12.08	TP31A	0.36
2SB688	1.61	2SD1887	3.56	BC307	0.06	BF197	0.18	BY299	0.18	ICH281	0.26	STK4142H	9.40	TD2540	1.29	TP32C	0.40
2SB698	0.35	2SD288	0.85	BC307B	0.15	BF199	0.18	BY397	0.20	IRF954	15.79	STK4152H	10.95	TD2541	1.12	TP35C	1.82
2SB716	0.43	2SD350A	1.97	BC308	0.09	BF258	0.04	BY398	0.16	IRFBC40	5.98	STK4192H	14.64	TD2577A	3.45	TP41C	0.65
2SB772	0.50	2SD381	1.66	BC308A	0.09	BF420	0.21	BY399	0.12	KIA6210AH	6.15	STK5332	2.82	TD2578A	3.20	TP42C	0.52
2SB774	1.61	2SD400	0.34	BC308C	0.26	BF421	0.24	BY448	0.30	LA4270	2.73	STK5342	4.07	TD2579A	4.91	TP4761A	1.85
2SB891	0.60	2SD401A	0.77	BC309B	0.10	BF422	0.19	BYD14J	0.35	LA4280	3.12	STK5372H	6.84	TD2581Q	2.57	TP4791A	1.25
2SB892	0.35	2SD468	0.28	BC327	0.10	BF423	0.14	BYD33D	0.12	LA4282	5.11	STK5421	9.52	TD2582	3.85	TP4792C	1.03
2SC1008	0.24	2SD667	0.38	BC328	0.14	BF459	0.43	BYD33J	0.16	LA4445	3.45	STK5481	8.12	TD2593	1.12	TP4793C	1.89
2SC124	0.48	2SD669A	0.64	BC337	0.14	BF471	0.37	BYD33M	0.26	LA4460	2.50	STK7253	7.69	TD2600	7.69	TP4794C	1.89
2SC1318	0.19	2SD718	1.90	BC338	0.06	BF487	0.57	BYD1040	2.55	LA4700	4.27	STK7308	6.41	TD2611A	0.64	TMP47C434N3537	15.19
2SC1473	0.21	2SD756	0.47	BC368	0.18	BF491	0.41	BY95B	0.21	LA6324	2.05	STK7348	5.74	TD2611AQ	1.32	TMP47C434N3555	15.22
2SC1573	0.52	2SD837B	1.12	BC369	0.18	BF494	0.12	BY96C	0.28	LA6510	2.94	STR11006	7.37	TD2653A	4.70	TMP47C434N3555	16.63
2SC1675	0.14	2SD856	0.79	BC372	0.53	BF759	0.38	BY96D	0.27	LA7830	1.88	STR4211	9.40	TD2654	2.05	TPU2732	10.05
2SC1685	0.21	2SD882	0.43	BC546A	0.11	BF869	0.38	BY96E	0.53	LA7832	2.40	STR50020	9.38	TD3305	2.40	U2829B	3.46
2SC1740	0.16	2SD898B	6.41	BC546B	0.12	BF871	0.41	BY96F	0.31	LA7835	2.99	STR50103	4.48	TD33560	6.13	UC3842	1.40
2SC1815Y	0.11	2SD965	0.67	BC547	0.11	BF959	0.18	BY96G	0.21	LA7837	4.19	STR50103A	5.56	TD33561A	3.85	UC3844	1.20
2SC2001	0.23	2SD965R	1.05	BC547A	0.04	BF960	0.30	BY96E	0.50	LC7132	4.70	STR54041	5.15	TD33562A	4.62	UC3844N	1.91
2SC2023	3.18	2SK1117	3.40	BC547B	0.11	BF970	0.43	BY955600	0.23	LED3G	0.10	STR5412	4.02	TD33565	2.74	UPC1318AV	3.85
2SC2073	1.03	2SK1118	3.40	BC548	0.11	BF990A	0.68	BZV10	1.34	LED3R	0.10	STR58041	3.42	TD33566	6.41	UPC139	

WIND GENERATORS 380 WATT

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WORLDS SMALLEST TESLA COIL/LIGHTENING DISPLAY GLOBE PLANS Produces up to 750,000 volts of discharge, experiment with extraordinary HV effects, "Plasma in a jar", St Elmo's fire, Corona, excellent science project or conversation piece. £5/set Ref F/BTC1/LG5.

COPPER VAPOUR LASER PLANS Produces 100mw of visible green light. High coherency and spectral quality similar to Argon laser but easier and less costly to build yet far more efficient. This particular design was developed at the Atomic Energy Commission of NEGEV in Israel. £10/set Ref F/CVL1.

VOICE SCRAMBLER PLANS Miniature solid state system turns speech sound into indecipherable noise that cannot be understood without a second matching unit. Use on telephone to prevent third party listening and bugging. £6/set Ref F/VSS.

PULSED TV JOKER PLANS Little hand held device utilises pulse techniques that will completely disrupt TV picture and sound! Works on FM too! DISCRETION ADVISED. £8/set Ref F/TJ5.

BODYHEAT TELESCOPE PLANS Highly directional long range device uses recent technology to detect the presence of living bodies, warm and hot spots, heat leaks etc. Intended for security, law enforcement, research and development, etc. Excellent security device or very interesting science project. £8/set Ref F/BHT1.

BURNING, CUTTING CO2 LASER PLANS Projects an invisible beam of heat capable of burning and melting materials over a considerable distance. This laser is one of the most efficient, converting 10% input power into useful output. Not only is this device a workhorse in welding, cutting and heat processing materials but it is also a likely candidate as an effective directed energy beam weapon against missiles, aircraft, ground-to-ground, etc. Particle beams may very well utilize a laser of this type to blast a channel in the atmosphere for a high energy stream of neutrons or other particles. The device is easily applicable to burning and etching wood, cutting, plastics, textiles etc. £12/set Ref F/LC7.

DYNAMO FLASHLIGHT Interesting concept, no batteries needed just squeeze the trigger for instant light apparently even works under water in an emergency although we haven't tried it yet! £6.99 ref SC152

ULTRASONIC BLASTER PLANS Laboratory source of sonic shock waves. Blow holes in metal, produce 'cold' steam, atomize liquids. Many cleaning uses for PC boards, jewellery, coins, small parts etc. £6/set Ref F/ULB1.

ANTI DOG FORCE FIELD PLANS Highly effective circuit produces time variable pulses of acoustical energy that dogs cannot tolerate £6/set Ref F/DOG2

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INFINITY TRANSMITTER PLANS Telephone line grabber/room monitor. The ultimate in home/office security and safety! simple to use! Call your home or office phone, push a secret tone on your telephone to access either. A) On premises sound and voices or B) Existing conversation with break-in capability for emergency messages. £7 Ref F/TELEGRAB.

BUG DETECTOR PLANS Is that someone getting the goods on you? Easy to construct device locates any hidden source of radio energy! Sniffs out and finds bugs and other sources of bothersome interference. Detects low, high and UHF frequencies. £5/set Ref F/BD1.

ELECTROMAGNETIC GUN PLANS Projects a metal object a considerable distance-requires adult supervision £5 ref F/EML2.

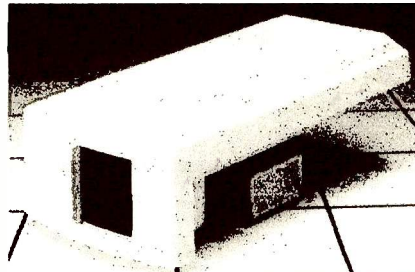
ELECTRIC MAN PLANS, SHOCK PEOPLE WITH THE TOUCH OF YOUR HAND! £9/set Ref F/EMA1.

SOLAR POWERED WIND UP RADIOS BACK IN! These FM/AM radio's have a solar panel and a hand operated charger! £17.95 ref SOLRAD

PARABOLIC DISH MICROPHONE PLANS Listen to distant sounds and voices, open windows, sound sources in 'hard to get' or

hostile premises. Uses satellite technology to gather distant sounds and focus them to our ultra sensitive electronics. Plans also show an optional wireless link system. £8/set ref F/PM5

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SMOKE ALARMS Mains powered, made by the famous Gent company, easy fit next to light fittings, power point. £4.99 ref SMOX

CONVERT YOUR TV INTO A VGA MONITOR FOR £26! Converts a colour TV into a basic VGA screen. Complete with built in psu, lead and s/ware. Ideal for laptops or a cheap upgrade. Supplied in kit form for home assembly. SALE PRICE £25 REF SA34

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***4 WATT FM TRANSMITTER KIT** Small but powerful 10W transmitter kit. 3 RF stages, mic & audio preamp included £24 ref 1028

YUASHA SEALED LEAD ACID BATTERIES 12v 15AH at £18 ref LOT8 and below spec 6v 10AH at £5 a pair

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12V OPERATED SMOKE BOMBS Type 3 is a 12v trigger and 3 smoke cannisters, each cannister will fill a room in a very short space of time! £14.99 ref SB3. Type 2 is 20 smaller cannisters (suitable for simulated equipment fires etc) and 1 trigger module for £29 ref SB2

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NEW LASER POINTERS 4.5mw, 75 metre range, hand held unit runs on two AA batteries (supplied) 670nm. £29 ref DEC49

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NEW HIGH POWER MINI BUG With a range of up to 800 metres and a 3 days use from a PP3 this is our top selling bug! less than 1" square and a 10m voice pickup range. £28 ref LOT102.

BUILD YOUR OWN WINDFARM FROM SCRAP New publication gives step by step guide to building wind generators and propellers. Armed with this publication and a good local scrap yard could make you self sufficient in electricity! £12 ref LOT81

NEW LOW COST VEHICLE TRACKING TRANSMITTER KIT £29 range 1.5-5 miles, 5,000 hours on AA batteries, transmits info on car direction, left and right turns, start and stop information. Works with any good FM radio. £29 ref LOT101a

CCTV CAMERA MODULES 48X70X29mm, 30 grams, 12v 100mA, auto electronic shutter, 3.6mm F2 lens, CCIR, 512x492 pixels, video output is 1v p-p (75 ohm). Works directly into a scart or video input on a tv or video. IR sensitive. £79.95 ref EF137.

IR LAMP KIT Suitable for the above camera, enables the camera to be used in total darkness! £6 ref EF138

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SUPER WIDEBAND RADAR DETECTOR Detects both radar and laser, X K and KA bands, speed cameras, and all known speed detection systems. 360 degree coverage, front beam waveguides, 1.1"x2.7"x4.6" fits on sun visor or dash £149 ref

CHIEFTAN TANK DOUBLE LASERS 9 WATT+3 WATT+LASER OPTICS

Could be adapted for laser listener, long range communications etc Double beam units designed to fit in the gun barrel of a tank, each unit has two semi conductor lasers and motor drive units for alignment. 7 mile range, no circuit diagrams due to MOD, new price £50,000 us? £199. Each unit has two gallium Arsenide injection lasers, 1 x 9 watt, 1 x 3 watt, 900nm wavelength, 28vdc, 600hz pulse frequency. The units also contain an electronic receiver to detect reflected signals from targets. £199 for one. Ref LOT4.

NEW LOW PRICED COMPUTER/WORKSHOP/HI-FI RCB UNITS Complete protection from faulty equipment for everybody! Inline unit fits in standard IEC lead (extends it by 750mm), fitted in less than 10 seconds, reset/test button, 10A rating. £6.99 each ref LOT5. Or a pack of 10 at £49.90 ref LOT6. If you want a box of 100 you can have one for £250!

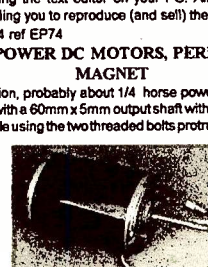
DIGITAL PROPORTIONAL B GRADE RADIO CONTROLLED CARS From World famous manufacturer these are returns so they will need attention (usually physical damage) cheap way of buying TX and RX plus servos etc for new projects etc. £20 each sold as seen ref LOT2DP.

MAGNETIC CREDIT CARD READERS AND ENCODING MANUAL £9.95 Cased with flyleads, designed to read standard credit cards! complete with control electronics PCB and manual covering everything you could want to know about whats hidden in that magnetic strip on your card! just £9.95 ref BAR31

WANT TO MAKE SOME MONEY? STUCK FOR AN IDEA? We have collated 140 business manuals that give you information on setting up different businesses, you peruse these at your leisure using the text editor on your PC. Also included is the certificate enabling you to reproduce (and sell) the manuals as much as you like! £14 ref EP74

HIGH POWER DC MOTORS, PERMANENT MAGNET

12-24v operation, probably about 1/4 horse power, body measures 100mm x 75mm with a 60mm x 5mm output shaft with a machined flat on it. Fixing is simple using the two threaded bolts protruding from the front



£22ea REF mot4



Special offer. Save £15 on the amazing Capacitor Wizard

Readers of *Television* can purchase a Capacitor Wizard (black version only) at the special price of £120 + carriage and VAT (total £152.75 in the UK – overseas orders please contact ICHE at the address given below). The offer is available until the end of June only – so don't delay sending in your order!

The Capacitor Wizard tests the goodness of those ever-troublesome components electrolytic capacitors. It does this by checking the capacitor's ESR (Effective Series Resistance) while the component is in circuit.

As a result, you can greatly reduce the time spent on fault-finding and thus increase your job completion rate. The increased profits will mean that your Capacitor Wizard pays for itself within a very short time – while making life a lot easier for you!

The Wizard is particularly helpful when checking faulty chopper power supplies.

To order, simply fill in the coupon and post it, with cheque/PO, to ICHE, PO Box 142, Nottingham NG9 3RX. Tel. 01159 320 152, fax 01159 444 004.

- * **Accurately measures the ESR of capacitors with values of 1µF upwards.**
- * **Measures the ESR of capacitors with values between 0.1µF and 1µF with adjusted readings – a chart is included with the instructions.**
- * **Can check diodes and transistors for shorts/leakage in circuit, including back-to-back diodes and transistors that incorporate a parallel diode.**
- * **Measures small inductors (0.3µH to 48µH).**
- * **Audio beep for good component indication in addition to the meter reading.**
- * **Comes with a clear, detailed operating manual.**

Brief specification

Test signal: 100kHz sinewave at less than 1.5mV peak-to-peak (less than 5mV RMS).

Input resistance: 2.5Ω.

ESR range: 0-30Ω, expanded scale.

Power supply: Four 6V alkaline AA batteries. Power drain 30mA. Battery life 60-80 hours.

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TELETOPICS

NTL's Digital Service

NTL is to launch a new digital service that will provide consumers with discount telephone calls, internet access and digital TV broadcasting. The Digital TeleNetwork is aimed at cable and telecoms companies: NTL hopes that it will be adopted by them as a standard system.

The new service is to be launched in three phases. It will start in June as a telephone and PC based internet service costing £17.95 a month. At the end of the year a telephone and TV based service will be introduced: it will use the NetChannel TV/internet service bought by

NTL earlier this year with a set-top box developed by Acorn Computers. The box will plug into an existing domestic TV set and a telephone socket, and will include a 33-6kb/sec modem and a proprietary browser. Users will, in early 1999, also be able to receive digital cable or digital terrestrial TV services for £27.95 a month, using the same box.

NTL hopes to attract at least 1.2m users: the company points out that there are 18m UK homes without a PC. It's currently talking to several set-top box manufacturers.

Satellite Update

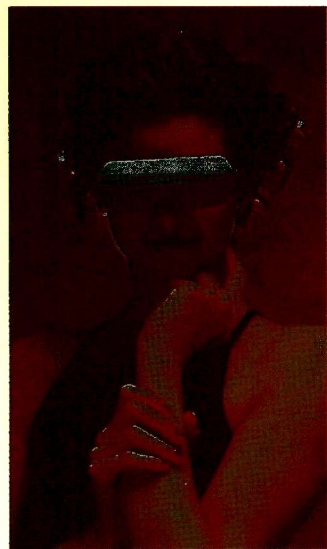
Eutelsat and SES are apparently close to settling their dispute over the 29°E orbital position. SES plans to transmit digital TV channels from its Astra 2A and 2B satellites at 28.2°E, while Eutelsat is to position its Europesat-1 craft, for which the go-ahead has just been given by Eutelsat's Board of Signatories, at 29°E. Europesat-1 is to be built by Matra Maconi Space and will be launched by mid-2000. It will have 36 transponders that will be connected to one fixed and two steerable aerials.

According to Eutelsat an agreement with SES on frequency sharing is in the process of being finalised. As a result, owners of equipment for the reception of BSkyB's digital satellite services will also be able to receive transmissions from Eutelsat. Europesat-1's design will ensure successful co-existence between the craft at 28.2°E and 29°E.

SES claims that at the end of 1997 70m homes in Europe were receiving transmissions from its Astra satellites. In the UK, 4.31m homes were able to receive

the transmissions directly (18.1 per cent of total UK households) while a further 2.21m (9.3 per cent) were able to receive them via a cable network. The UK is the largest satellite pay-TV market in Europe. There are now 62 English-language channels available via Astra, compared with just eight in 1989.

Intelsat, which is inter-government owned with 142 members, is to privatise part of its operations by setting up a new company to be called, initially, New Skies Satellites. It will have five of the Intelsat craft plus one that's under construction, and will mostly provide new services such as TV and internet access. Intelsat will own ten per cent of the new company's stock initially, with the rest distributed amongst its members. The new company will be based in the Netherlands. Once a management team has been appointed, a series of public share offerings will be made and a different home base may be selected. The new company is already seeking partners amongst existing satellite companies.



Olympus Optical has developed this head-mounted display device called Eye-Trek. It comes with earphones, and can be connected to a TV set, games machine or VCR. Two small 180,000-pixel LCDs within the device give the user the impression of watching a 62in. wide screen. A rechargeable lithium battery powers the unit, which has been released in Japan initially.

Digital TV

BDB and BSkyB are holding discussions with the ITC in order to resolve the dispute between them over set-top box inter-operability – BDB has selected the SECA conditional access system, which BSkyB says is not fully compatible with the CA system it will be using. While the ITC does not have the power to enforce a solution, it hopes to be able to ensure that digital TV has a smooth launch in the UK. At the Audio-Visual Conference held in Birmingham in March Canal+, one of SECA's parent companies, demonstrated how a set-top box could handle different CA systems by using Simulcrypt technology.

BDB has set up a Retail Helpline to enable retailers to obtain information on digital terrestrial TV (DTT), BDB subscriptions, receiving equipment and the company's programme plans. The line will be available during the run-up to the start of its services at the end of the year. The number to call is 0870 600 5656: the lines will be open from 9am to 8pm Mondays-Fridays, from 9am to 6pm of Saturdays and from 10am to 4pm on Sundays. Retailers who register their interest in BDB and DTT will receive regular updates from BDB as and when information becomes available, and an information pack.

Digital Satellite Cable

Satellite Scene (PO Box 5070, Derby DE74 2ZU) has introduced what it claims to be the world's first satellite dish downlink cable designed specifically for use when picking up digital transmissions. The cable, which is available in both single and twin form, has a heavy-duty copper inner conductor and is of foam-filled rather than air-spaced construction. This form of construc-

tion has been adopted to eliminate the 'kink' factor and the possibility that cable clips might flatten the cable. Free samples, with trade and retail prices, are available from Satellite Scene which can be contacted at 01332 812 588 or satscene@ontv.co.uk Alternatively you can check at Satellite Scene's web site

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

Standby Consumption

A voluntary agreement to reduce the power consumption of TV sets and VCRs in the standby mode, made by sixteen major manufacturers, has been approved by the European Commission. The aim is to reduce European electricity consumption by some 3.2TWh (terrawatt hours) a year by 2005. The scheme required EC approval because it contravened EU competition rules that prevent companies working together.

Under the agreement the manufacturers have promised that by

January 1st 2000 their TV sets and VCRs will have a standby power consumption of no more than 10W, and that the average standby power consumption will be less than 6W. A survey carried out by BREMA in 1995 found that the average power consumption of a 21in. set in the standby mode was 9W.

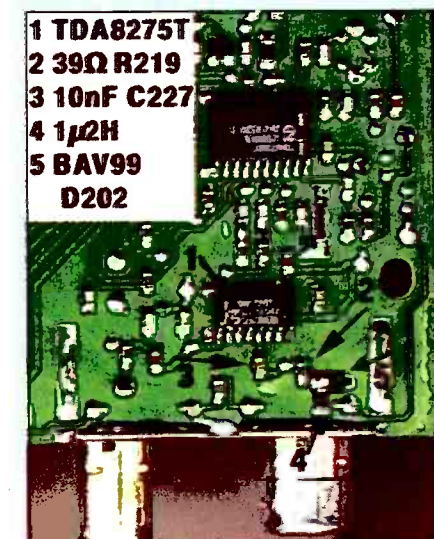
UK-based manufacturers that have signed the agreement include Aiwa UK, Hitachi, JVC, Panasonic, Pioneer, Samsung, Sanyo, Sharp, Sony and Toshiba.

Mitsubishi pulls out of the CTV Market

Mitsubishi has decided to withdraw from the colour TV market in the UK and is to close its Haddington plant on July 4th. The company blames low prices and global excess production capacity. Mitsubishi colour set production in the USA ceased earlier this year and in Canada two years ago. Production of Mitsubishi VCRs at Livingston is to continue – the range will be increased to include digital models.

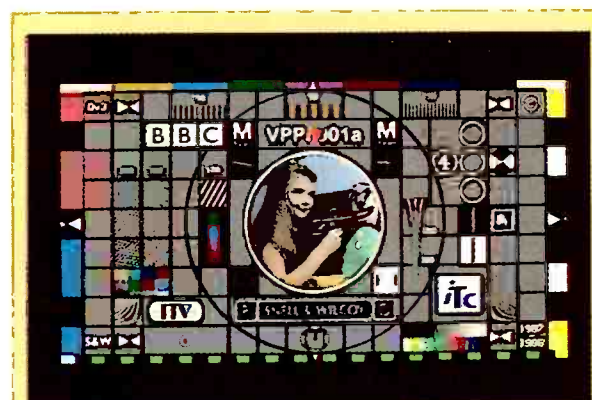
Widescreen Boost

BREMA expects the market for widescreen TVs in the UK to increase by 140 per cent this year, to some 175,000 sets. Demand is being fuelled by the World Cup and the advent of digital TV. Last year saw an almost fourfold increase in widescreen TV set sales at 73,000, up from 18,000 in 1996. An estimated 60 per cent of the sets sold this year will be produced in the UK. Hitachi, Panasonic, Toshiba and Sony are to increase production of widescreen TVs at their UK plants.

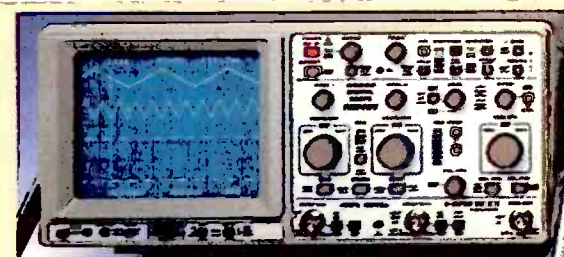


Gremlins:

We apologise for some printing errors in last month's issue (May). The wrong photograph appeared in Fig. 1 on page 477 (Satellite Workshop). The correct photograph is shown on the left. There were colour errors on some pages because of a colour-separation mix up, and a couple of words were omitted from the standfirst (below the heading) on page 506.



Digital TV equipment developer Snell & Willcox is to direct a programme to create a 'test card' for digital TV transmissions in the UK. The company will be responsible for identifying the requirements of a test pattern and creating the digital test sequences necessary for monitoring the quality of digital transmission paths. The project is being overseen by the DTI under the Digital Broadcast Test Bed programme, which is supported by the BBC, ITV, Channel 4 and the ITC.



Hameg Instruments, 70-78 Collingdon Street, Luton, Beds LU1 1RX (01582 413 174, fax 01582 456 416) has introduced two new oscilloscopes, Models HM404 and HM407. Our picture (above) shows the HM407.

The HM404, at £550 plus VAT, is a dual-trace analogue scope with remote control via an RS232 interface and the popular Hameg Component Tester. It has auto set, save and recall, screen readout, cursor measurement, an RS232 interface with free Tools software and a delay timebase. The specification includes five set-up memories, a bandwidth of 40MHz, 1mV/div to 50V/div sensitivity, 0.5sec/div to 10nsec/div timebase speeds, automatic peak-to-peak triggering to above 100MHz, alternate trigger and a sync separator.

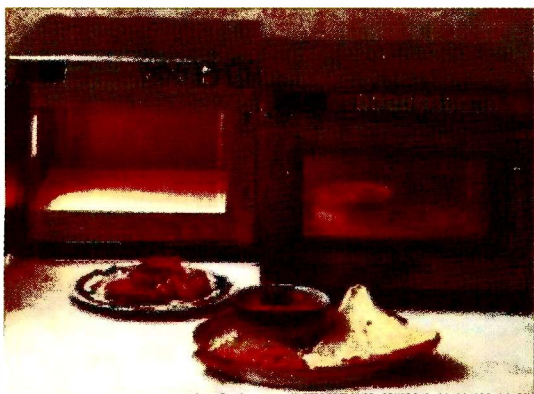
The HM407, at £724 plus VAT, is a dual-trace analogue/digital scope. Its analogue specification is as above. The digital specification includes a 100MS/sec sampling rate, a 100sec to 100ns/div timebase, two 2k x 8bit storage plus two reference memories, pre-trigger, refresh, roll, single, XY, envelope and average modes and free Windows and Tools software.

DVD Latest

Cirrus Logic has developed a single-chip DVD processing system for DVD-Video and DVD-ROM machines. The new chip performs tasks at present carried out by five chips, and is expected to reduce equipment costs significantly.

According to market research company Dataquest, production of DVD-Video players will increase from 4.5 million units this year to 21m in 2001.

Polygram launched six DVD titles in the UK at the end of April.



More on Microwaves

J. LeJeune's article on servicing microwave ovens, in our April issue, brought in much know-how on the subject from other readers. The following letters cover the main points raised

Radiation

J. LeJeune was incorrect in describing microwaves as *ionising* radiation. Microwaves are radio waves – very short ones. Ionising radiation gets its name from its ability to break chemical bonds. It includes ultra-violet, X-ray and gamma radiation, as well as alpha, beta and the radiation from other more exotic particles. Ionising effects start to occur at wavelengths of about 700 nanometres downwards. Yes, visible light is ionising radiation – if it wasn't we would not have sight. Light is perceived by the bleaching of visual purple in the retina: this bleaching is most definitely a chemical action. Another biochemical process driven by visible light is photosynthesis, without which we'd have no oxygen to breathe nor anything to eat.

In sufficient quantity, ionising radiation destroys living tissue – by tearing apart, amongst other things, the strands of DNA that hold a cell's genetic information. DNA damage usually results in cell death, but sometimes damaged cells survive, and we know all too well what can happen once they start replicating . . .

Microwaves themselves don't cause chemical changes. The frequency used for the radiation in a microwave oven was not chosen arbitrarily: 2.4GHz is the resonant frequency of water molecules. The use of radiation at this frequency provides optimum coupling of energy to most (water-containing) foodstuffs. The microwave energy increases the thermal agitation of the water molecules in food, thus increasing its temperature. All the chemical changes produced in the food are identical to those produced by conventional cooking processes. They result from the effect of heat, not exposure to microwaves.

Any tissue damage that occurs as a result exposure to microwave radiation is caused by localised heating. The problem is that you can't see microwaves, and that even a thin beam that emerges from a leaky seal might penetrate and parboil part of your anatomy without your knowing about it. Your eyes are at the greatest risk.

RF heating degrades protein in exactly the same way as conventional cooking – perhaps the best example is the congealing of albumin in egg white. Eye exposure to

microwaves can result in gradual, cumulative clouding of the cornea and lens, the eventual result being a cataract.

It is this cataract risk that is fuelling one of the current scares over mobile phones. I suppose that it is possible for heat-damaged cells to survive and become cancerous, but this is exceedingly unlikely – otherwise soldering-iron burns could lead to more than just a bit of pain. Microwaving the TV dinner is probably far less risky than sitting in front of the telly eating it – even though X-ray radiation below 30keV is generally regarded as being insignificant medically.

*Pete Roberts,
Runcorn, Cheshire.*

Leakage

While J. LeJeune was technically correct in saying that the level of leakage from a microwave oven should not exceed 5mW/sq cm at a distance of 5cm, personally I wouldn't release an oven from the workshop with a leakage of anything over 1mW/sq cm without first trying to minimise it. Note that the measured leakage depends on the load placed inside the oven cavity: most manufacturers have standardised on this as a glass beaker containing 275 millilitres of water, placed in the centre of the oven.

It should be relatively easy to reduce the leakage significantly by careful adjustment of the door and/or interlock switches. Although you rarely come across an oven with leakage in excess of 0.5mW/sq cm these days, there are exceptions – especially some commercial high-output ovens with up to four magnetrons. I have come across domestic ovens in which the magnetron has begun to 'mode' because of age: in extreme cases the spurious frequencies generated can result in significant leakage, and no amount of adjustment will cure this.

It is essential therefore to check every oven for leakage before servicing (for your own sake) and after servicing, before return to the customer. Do not become blasé about this: one day you may well be caught out, especially with the larger commercial ovens.

I write as someone who has been employed as a

microwave oven servicing engineer for over twelve years. If readers find microwave oven servicing a lucrative sideline, they may be interested to know about my web site. This deals with technical servicing questions and locating parts needed. The web site is at

www.btinternet.com/~jim.bryant

don't forget the ~ that BT uses. I can also be reached by e-mail, and welcome any questions from *Television* readers regarding microwave oven servicing. The e-mail address is

jim.bryant@btinternet.com.

*Jim Bryant,
Portishead, Bristol.*

Monitor Switch and HV Checks

A very important safety interlock, referred to as the monitor switch, was omitted from Fig. 4 in J. LeJeune's article. It usually consists of a 15A microswitch in series with a low-value resistor (typically 0.1Ω, 20W), the combination being connected across the mains input after the oven door switch, see Fig. 1(a). The monitor switch closes to place a short-circuit across the mains input, blowing the fuse, should the oven door switch become defective. Its contacts weld together.

With the oven door open the door switch should be open and the monitor switch closed. When the door is closed the monitor switch should open.

As it should open a split second before the door switch closes, the monitor switch is a common cause of intermittent fuse blowing in microwave ovens. When you have a microwave oven with a blown fuse, break the fuse open. If it's black and the wire has vapourised, this is usually an indication that the monitor switch was closed. If no other cause of the blown fuse can be found, to avoid a callback replace both the oven door switch and the monitor switch. Some Panasonic ovens incorporate a special safety monitor switch whose contacts are designed to weld together after operating, thus necessitating replacement. The door interlock system is a very important part of microwave oven safety and should be checked after a repair of any sort.

On the subject of HV measurement, this is very dangerous and should not be necessary. All the components in this area can be checked cold with a multimeter. The transformer supplies 2kV at around 500mA: touch this and you may not live to tell the tale. The only meter check I consider to be fairly safe is to measure the magnetron's current by disconnecting the cathode of the HV rectifier and connecting in series with it a digital meter set to 500mA. Magnetron current gives a direct indication of output power when, with an oven not conforming to IEC705, multiplied by 2.2: with an oven that conforms to IEC705, multiply by 2.2 and add 100W. For example a magnetron current of 295mA x 2.2 = 649W or 295mA x 2.2 + 100 = 749W. See Fig. 1(b).

When you work on a microwave oven, open the door and place the mains plug inside the cavity. This way there is no possibility that someone else in the workshop can accidentally plug you in.

*Michael Dranfield,
Buxton, Derbyshire.*

Voltage Checks

Any attempt to measure the HV voltage in a microwave oven is, in my opinion, inadvisable. All that you need to know is whether test points are 'cold' (0V), 'warm'

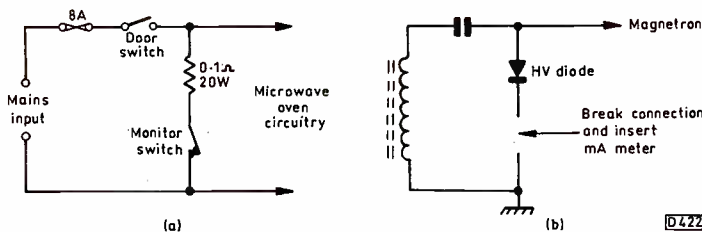


Fig. 1: Position of the monitor switch, which is associated with the oven door switch, in a microwave oven circuit (a). Magnetron current check (b).

(240V), 'hot' (2kV) or 'very hot' (4kV). Measuring such voltages can be awkward and dangerous, and modern DMMs are inclined to go phut at the slightest overload.

For those who are really determined, the time-honoured trick of connecting meters in cascade can be used – but be sure to stand the 'hot' meters on upturned plastic buckets or something similar. If you have the time, an HV probe can be built from a plastic water pipe with a dozen or so resistors inside, but such a probe still needs metallic connections to the measurement points.

It's much faster, easier, cheaper and safer to use an electronic multi-test screwdriver such as the Technotrend Terminator 10 to make such checks, as no physical connection with live parts is required. The Terminator costs about £5 or less and will also check microwave leakage. For further details, apply to Technotrend Ltd., Unit B5 Armstrong Mall, Southwood Summit Centre, Farnborough, Hants GU14 0NR – telephone 01252 373 242, fax 01252 373 440.

*D. Benyon,
Bude, Cornwall.*

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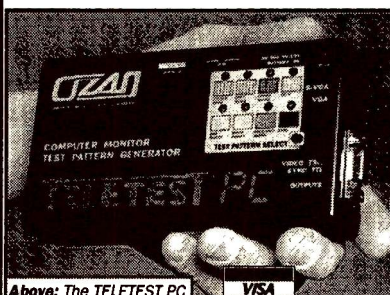
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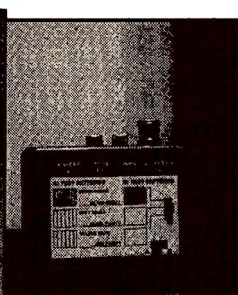
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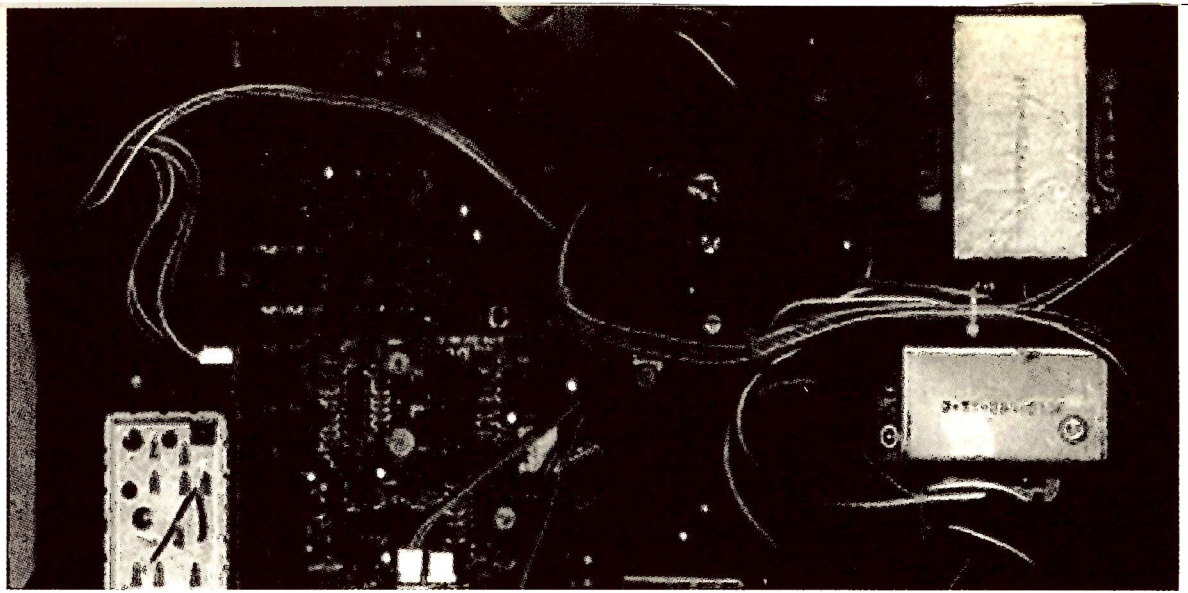
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Satellite Notebook

**Reports from
Pete Gurney, LCGI
Adrian Spriddell
Michael Maurice
and Hugh Cocks**

Pace PRD800

One of these receivers produced an intermittent whine. The cause was traced to C278 (2,200 μ F, 16V) which was going low in value intermittently. I replaced the other electrolytic capacitors on the secondary side of the power supply circuit at the same time as they all showed signs of excessive heat damage. Make sure you use the correct type of capacitor – high temperature, low-ESR. Kits are available. **P.G.**

Grundig GRD300

Apart from the fact that the display had gone out this unit was OK. The manual says that the fluorescent display panel is 'replacement only', no diagram being provided for this section of the receiver. A quick check on the voltages at the connector showed that they were correct, and a scope check on the display showed activity. The filament supply was OK, but the negative voltage at the filament itself was somewhat lower than what would be expected. A check in this area brought me to C102/3, one of which was open-circuit and the other low in value. The correct value is 10 μ F, 50V. **P.G.**

Pace PRD800 – 2GHz

I've had two of these receivers in during the last month with the same fault: the power supply trips because of a short across the 5V rail. In both cases the cause was within the tuner unit. It pays to shop around a little for these units – the price seems to vary a lot. **P.G.**

Pace Prima

This receiver produced a blue screen, with no signal on any chan-

nel. The LNB supply was correct and was being switched between 13V and 17V. Video blanking is applied when U302, which is part of the VideoCrypt section and is therefore not available as a spare part, cannot find a signal. Video should enter at pin 19: the output at pin 7 operates the blanking, high for video and low for none. A quick check showed that video was present, but there was no oscillation at the associated ceramic resonator X301. In fact the voltage at the chip side of the resonator was 0V. Pin 5, which is the 12V supply, was at little more than 1.2V.

Tracing back to the source of the supply, via various chokes, I came to the 12V regulator U3 which was working. The supply disappeared from the 12V line at the first surface-mounted decoupling capacitor, which is about 5mm away from the regulator. A small crack could just be seen with a magnifier. Fitting a small wire link cured the problem. **P.G.**

Tatung Early Bird

There was unstable sound and vision because electrolytic capacitors in the power supply had dried out, in particular C807 (1,000 μ F), C209 and C232 (both 100 μ F), C224 and C225 (both 22 μ F) and C804 and C803 (both 10 μ F). Check the front ribbon cable joints to the main PCB as these tend to crack. **A.S.**

Matsui OP10

The fault was failure to decode when warm. After trying to establish (and failing) exactly which capacitor was the cause of the problem, I eventually upgraded all the electrolytics on the decoder board, using high-temperature,

low-impedance types. This cleared the fault. **A.S.**

Pace PRD800

There was no picture or sound via the UHF output, just a blank screen. The start output was fine. Q105 I hear you say, but it was blameless. What was noteworthy was that the blank screen output was present over a much wider tuning range than usual. A scope check showed that there was huge ripple on the modulator's UHF tuning supply. Replacing C79 (1 μ F, 35V) and C337 (4.7 μ F, 35V) cured the fault. **M.M.**

Pace PRD900

This receiver could pick up only one channel. If you attempted to tune it, the tuning frequency would vary but not the station. I also found that the modulator tuning couldn't be varied. Again it was being changed if you believed the on-screen menu, but there was no difference on the screen. Scope checks showed that there was no PWM output from the Nicky chip U9 for either the tuner or the modulator, just a DC voltage. A replacement Nicky-3 chip cured the fault. **M.M.**

Magic Switch

The owner of a Pace PRD900 satellite receiver phoned to say that some channels couldn't be viewed. When questioned about this he said that with the exception of Discovery, which was weak, the horizontally-polarised channels were non-existent. The receiver is connected to an IF distribution system that uses an 8-outlet magic switch. No one else connected to the system had complained about this problem.

The receiver was OK. It switched between 13V and 17V (for vertical and horizontal polarisation), and reception of the vertically-polarised channels was good. But the horizontally-polarised signals were weak and suffered from vertically-polarised signal breakthrough. Time to head for the dish and the switching equipment.

On the way to the dish I called at another flat to check reception. Everything was OK here. Fortunately the coaxial cables connected to the switch were all marked, so I was able to identify the one to the poor-reception flat and the one to the flat I'd just visited. The easiest thing to do was to swap over the leads then check at the flats. This proved that the magic switch was the cause of the problem, as the good- and bad-reception flats had now changed over. A replacement magic switch cured the fault.

Here in Portugal the horizontally- and vertically-polarised signals from Astra differ quite a lot in level, the horizontal channels being weaker (with the exception of those from Astra 1C and 1E, which have temporarily taken over 1D's services). Some switches, particularly those of

Far Eastern origin, do not provide sufficient isolation. If the horizontal and vertical signals are at similar levels they work all right, but when the vertical signals are stronger you get breakthrough on the horizontal channels. We certainly have to avoid these switches. **H.C.**

Mains Plug

The owner of a Pace PRD800 receiver complained that coded VideoCrypt channels from Astra would disappear once or twice during an evening. The uncoded channels were not affected. Unplugging the receiver from the mains supply for thirty seconds or so, then reconnecting it, would restore the signal. There were no flickering lights when the decoder stopped working, and no other electrical equipment in the house was affected.

I called at the house as I wanted to see if the receiver was being affected by anything locally. It was naturally behaving impeccably. I noticed however that the mains plug, a two-pin Continental type, wasn't of the moulded-on variety. Time to open up the plug to check the state of the connections.

As soon as the case was removed

one of the pins fell on the floor. There had been no positive contact. The other pin wasn't quite as bad, though the screw was far from tight. It was a miracle that the receiver had worked at all, and that its power supply hadn't packed up as a result of the inevitable sparking. Once good, firm connections had been made there were no further complaints about decoding. **H.C.**

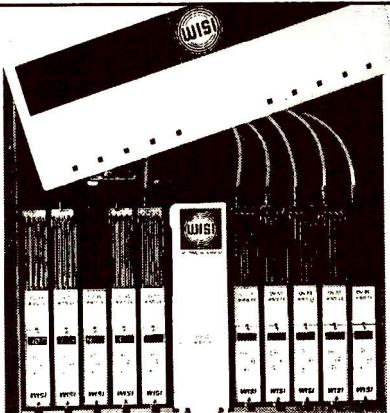
Pace Prima

The customer had brought a Pace Prima here from the UK, but in the course of the move the RC10-type remote control unit had been damaged. I'd not previously come across a Prima: you don't see them in this part of the world.

I installed a dish and supplied a new remote control unit. I was able to download the latest channel listing from the Pacelink via a modified MSS100 file – limit the number of channels in the global options menu to 125 and you have the Pace Prima! The Prima channels can be upped to 131 as an absolute limit – if you increase beyond this the channel number can be entered but not stored (because of the limited memory in the Prima). **H.C.**

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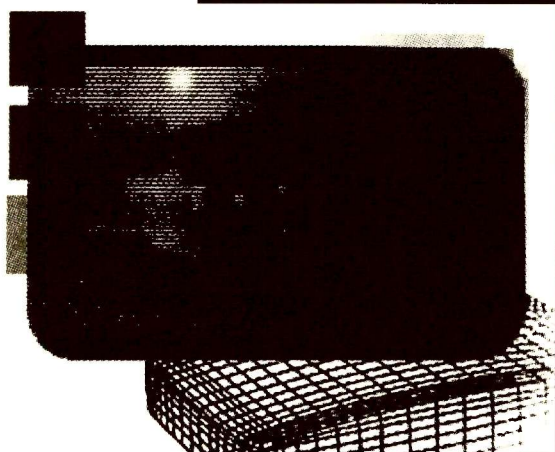
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Monitors



Reports from
Ian Field
Gerry Mumford
and
Roger Burchett

Compaq 420

Despite being old these monitors are still popular: the build quality is high, and they look good! This one had a green-flooded screen. R526 (2.2Ω, 1W fusible) on the CRT panel was open-circuit. There was no obvious cause for its failure.

In a case like this the grey-scale should be set up. Before adjustment I ran a monitor for 24 hours with a peak-white display – to settle the cathodes. Once the grey-scale had been balanced and the monitor had been cased up I gave it a half-day soak test to ensure that all was well. **I.F.**

SAM M152PNLD

This monitor came in dead with the 2SC4531 line output transistor short-circuit. When a replacement failed to restore operation I suspected the line output transformer – I was wrong however.

This model uses the increasingly popular UC3842-based EW chopper circuit. As L401 had a ringing voltage across it I assumed that this part of the circuit was working. In most cases these circuits either work or they don't. Although I had no reason to suspect it, I decided to replace the chip (U401). This cured the fault. **I.F.**

Escom EM1448LR

Line collapse because of failure of C417 (0.68μF, 250V) has been reported before (October 1997, page 878). This was not the first thing I noticed however. As I put the monitor on its side to look for

dry-joints etc. before powering it I saw that two soldered joints near the deflection-yoke connector had blackened flux and discoloured PCB around them. So I righted the monitor and used torchlight to take a closer look.

A generous blob of hot-melt glue secures the deflection-yoke plug. In this case there was a 'melt pool' in the middle, with a very black resistor (R448) at the centre of the pool. Its tracks led me to what was left of C417 in one direction and to pin 5 (output) of the TDA4950 EW correction chip in the other direction. C417 was open-circuit, but had obviously gone short-circuit during its demise.

Once C417 and the chip had been replaced, but not the resistor, the original fault (line collapse) had been cured. But there was instability (line tearing) at about mid-travel of the front-panel mounted width control. When I removed R448 from the pool of hot-melt glue and checked it I got a reading of 22Ω. So, convinced that it had changed value, I tried various values between 4.7Ω and 33Ω (I didn't have the circuit diagram). This failed to cure the instability. In the end I fitted a new 22Ω resistor and added a 1.2kΩ, 3W damping resistor across the lower EW modulator diode. This provided an acceptable compromise between reducing the range of the width control and the instability. As soon as another of these monitors comes in I'll check the correct value for R448! **I.F.**

ASTVision 5V CMC-1505X

It's common to find these monitors dead with the 0.33Ω, 0.5W resistor marked as a link (J567) burnt up. The cause is the CVA2415T RGB output chip IC901, which can fortunately be replaced with the more readily available LM2419T.

For a green picture with flyback lines, fading after a few seconds, replace the MC13081XB video processor chip IC501.

If the contrast is poor and the contrast buttons don't have any

effect, check whether the 0.1μF, 25V filter capacitor C723 is leaky. **G.M.**

CTX 1565D

When one of these is tripping the first thing to do is to check the 2SC4924 line output transistor Q701. As this device isn't cheap, if you find that the original is shorted all round replace C702 (100μF, 50V) in its base drive circuit as well. You will usually find that its value has fallen to about half. **R.B.**

Daytec DTC1564

This is an odd story. The customer was on his third monitor. They had all eventually lost the green drive intermittently. Other makes of monitor had worked perfectly with the PCs (he had two), and the suspect monitor had misbehaved with both of them.

I checked with a test-pattern generator to provide the drive. The monitor performed as intended: nothing would disturb the green drive. I then noticed that there's an IC mounted at right-angles to the tube base PCB: so I desoldered its pins and resoldered them. After that the owner took the monitor away to try again.

He has, after prolonged use, declared the monitor to be OK. Has anyone else come across this sort of problem with this monitor, which is of Daewoo manufacture? **R.B.**

AOC MM413S

Many of these popular mono VGA monitors develop dry-joints at the BU406 line output transistor Q301. The fault is usually described as "intermittent nothing on screen". The main PCB tends to develop a slight sag, which doesn't help. **R.B.**

CTX 1565D

It's common to find one or more of the colours low or missing with this model. The culprits are the 1μF, 50V RGB input coupling capacitors, which dry up. They are on the tube base PCB – C601 (blue), C602 (red) and C603 (green). **R.B.**



Servicing in South Africa presents some different problems from those we are used to in the UK. **Colin Knight** on his day-to-day experiences there

Servicing South African style

Reading *Television* here in South Africa I keep coming across strange names for sets. Fidelity, Hinari and Bush for example – and what exactly is a Baby 10? Doubtless UK readers will find Tedalex, Funai, Pioneer, Barlowvision and Supersonic equally strange names.

In my opinion the servicing trade in South Africa is probably where the UK was in the Eighties, with the occasional “new-fangled monster” coming along. Take a typical day in the shop.

Start of the Day

The shop's not been open for five minutes when in waddles a 67cm Barlowvision attached to a rather out-of-breath customer.

“It's dead” I am told.

“What happened before it went dead?” I ask.

“Well, it hasn't been switched on for a few years. The wife used it as a coffee table. Now the kids want a TV for their games.”

What we call a Barlowvision might well be referred to as a Thorn in the UK. When I open the set up I find a modular chassis with a dirty (literally) great tapped wire-wound resistor on the power supply sub-panel to the right, with the chroma and luminance boards facing me on the left.

This one had clearly suffered greatly before it expired, as the resistor had a scorched appearance and crumbled when touched. Age of the set? Around 1975 probably. Number of them in daily use here in Cape Town? I estimate two-three thousand.

The next set in was a Funai TV-VHS video combination from the local fire sta-

tion. It's apparently used for training videos and the complaint is about reluctance to give the tapes back. I find that a plastic latch that's used for mechanically releasing the forward and rewind brakes has a piece broken off it. No sign of the missing piece in the machine though . . .

“No problem, contact the agent or a good parts supplier to order a new one!” I hear you say. What agent?

Spares

Trying to obtain parts for the myriad of strange Korean, Japanese, Chinese and Malaysian, and even the few sets that were locally assembled in our former so-called “homelands” such as Bophutatswana, is often not just a nightmare – it's usually just plain impossible!

Yes, there are a few spare parts centres that supply the occasional bit of information such as a circuit diagram, and ‘pattern parts’ that often require great ingenuity (and luck) to install, but in general as a servicing technician you are on your own. The greatest aid to servicing here is a really good equivalents book such as Towers and/or Philips ECG.

Laugh if you can

Test gear is often a source of great mirth here. Equipment is available, but its cost is prohibitive. This is because of our lousy rate of exchange with most countries. A test pattern generator that sells in the UK for about £50 would cost some R900 (£410) in South Africa.

Ask the average citizen here about teletext and they'll just look at you. It's been available since 1984, but during my eight-year years in the trade I've yet to see a set

with a teletext decoder!

Nicam stereo is another laugh. We've had it for about a year on one of the four available channels but the cost of a set with Nicam is some R3,000. Not the sort of thing you'd buy when you can get a ‘bare bones’ set with on-screen displays and remote control for R1,250.

No wonder we see so many elderly sets still in daily use.

Repairs

Much has been written about the Sony Trinitron KV191/2 and the difficulty in getting spares for it. I repair on average eight of these sets a month. They usually have GCS (gate-controlled switch) trouble. Now the Sony agents here in South Africa do still carry a large range of spares for these sets – but not the GCSS. So we have to rip them out and discard them. You should see some of the modifications used!

In wanders a typical African mamma. Weighing in at around 150kg, she has no trouble balancing a 36cm Tedalex colour portable on her head. It's wrapped up in a black plastic refuse bag. The problem?

“The bulb's finished Inkozi (sir).”

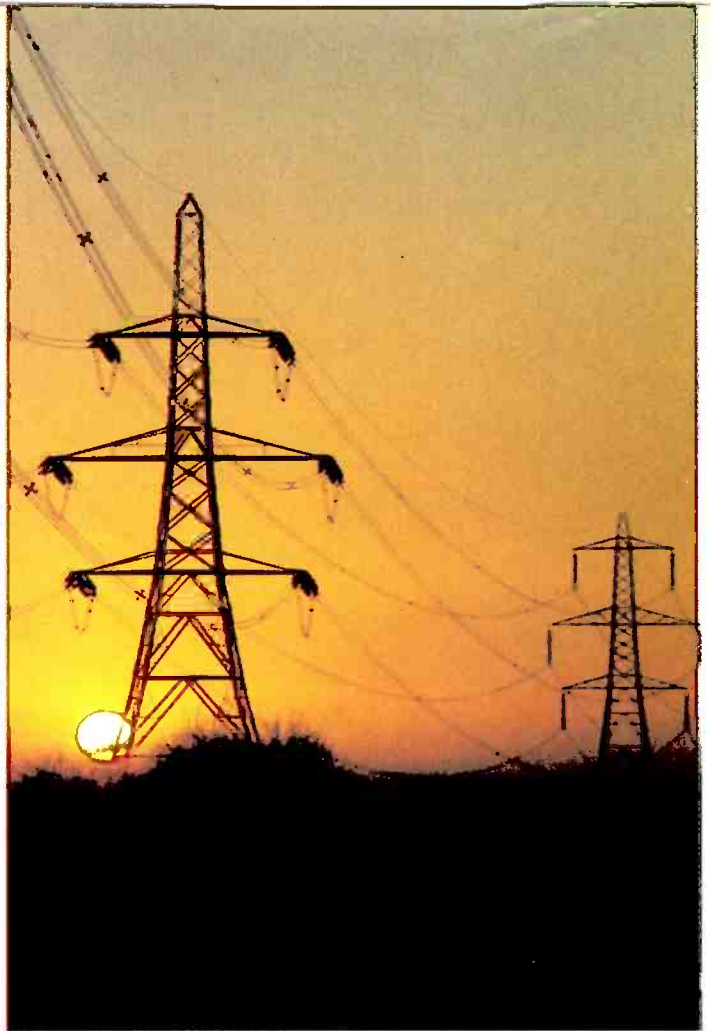
I put it on the bench and immediately hear the rustle. No, not EHT. Cockroaches! Once a liberal dose of bug spray has been applied the carcasses can be removed. I then find that the cause of the trouble is the line output transistor. It's a 2SC5028. Availability? Not a chance!

In goes a 2SD1555 and a load of heatsink compound. Switching, on I'm rewarded with a rustle. EHT this time.

I'll have to get a new can of bug spray tomorrow . . .

We tend to take the mains supply for granted. Plug in and that's it. But it is important to know about the system that presents 230V AC to our mains sockets. Pete Roberts investigates

Power gen



When you open the workshop in the morning, have you ever given a thought to why the lights come on or what's behind the socket into which you've just plugged the kettle? Or to what causes the weird mains faults that can wipe out all those switch-mode power supplies, some of which are probably waiting your attention on the jobs-in rack? As with many essential commodities, we tend to take our reliable (usually!) electricity supply for granted. Time, I think, for a peek behind the 13A socket to see how your friendly local electricity company delivers power to your home and work.

Business End

The business end of the system is the network of power stations that feed electricity direct to the National Grid. Prior to privatisation, power stations and the grid network were both the responsibility of the Central Electricity Generating Board, which sold power to the regional electricity boards. Following privatisation the former CEBG was split into two generating companies, National Power (the larger of the two) and Powergen.

The National Grid network was originally handed over to a consortium made up of all the previous electricity boards, now Regional Electricity Companies (RECs). The RECs sold their interests however, and the National Grid Company (Gridco) is now an independently quoted company.

Since privatisation many small undertakings, including an increasing number of wind farms, contribute to the Grid, usually via their local REC's network. There are many hydro-electric schemes in Wales and the Scottish Highlands, and cheap nuclear-generated power can be imported from France via undersea cable. But the

bulk of our power is produced by large conventional fossil-fuel fired and nuclear power stations.

In a coal-fired station steam is raised in fluidised bed boilers which burn coal that's been pulverised into flour-like dust. Oil-fired power stations are far less common and tend to be used only during periods of unusually high demand. The so-called "dash for gas" has seen the introduction of new, highly efficient combined-cycle gas-fired power stations. Nuclear power plants raise steam by passing the reactor's primary coolant – carbon-dioxide gas, pressurised water or liquid sodium, depending on the type of plant – through heat-exchangers to boil water.

Ex-CEGB stations are generally equipped with three-phase steam turbo-alternators, each typically delivering 500MVA or 600MVA (mega volt-amperes) at 11kV per phase. Power engineers talk in terms of volt-amperes rather than watts, as the load on the system is anything but purely resistive or, put another way, has a power factor (PF) of one. Real power (in watts) = VA x PF: a load that has some inductance or capacitance (in real life that's just about everything) always has a PF of less than unity.

The outputs from the generators are stepped up to 275kV or 400kV by transformers and are then fed to the nearest Grid substation, which is usually on an adjacent site. These big generators take several hours to run up to speed and synchronise with the Grid. Accurate synchronisation is vital, as connecting an alternator to the Grid when it's more than a couple of degrees or so out of phase could result in serious damage – as well as presenting a severe risk to life and limb. Some years ago a friend of mine who worked at a power station described what happened when a generating set was switched on load while out of phase: apparently the alternator and

turbine both tore themselves from their mountings then exited via the roof. Miraculously no one was hurt, but the guy responsible got promoted to a desk job!

Demand

Gridco is the middleman between the power stations and the Regional Electricity Companies. Its job is to provide enough power at the right voltage and frequency to meet the immediate demands of the country's RECs. Grid engineers have the unenviable task of predicting demand, then ensuring that the power stations are alerted in time so that they can bring enough capacity on line just when it's needed. Too early wastes fuel and causes unnecessary pollution, too late could lead to voltage reductions in the network or, in extreme cases, load shedding – in other words power cuts.

Industrial demand is usually fairly easy to forecast, and some industrial customers with large demands get power at heavily discounted prices on the understanding that they accept possible disconnection during any power emergency. Domestic consumption can, unfortunately, be wildly unpredictable.

There are the expected peaks at breakfast and tea time, but sudden changes in the weather can mean an equally sudden demand for extra heating. As well as weather forecasts, TV programme schedules are required reading in Grid control rooms as major sports fixtures such as the World Cup can mean millions of TV sets and VCRs on at unusual times. There's also a heavy surge in demand, equivalent to the full output of a large power station, when millions of electric kettles are switched on at the end of any of the popular soaps. Incidentally the water industry has a similar problem, when millions of toilets are flushed at the same time.

After midnight, when most of us are getting our heads down, the Grid ends up with a lot of spare capacity. As running generators up to speed and the attendant problems are a load of hassle and a waste of expensive fuel, power station managers are reluctant to shut down plant overnight.

Generator Control

Each generating set has its own boiler, which in a coal-fired station can be put on the back-burner by switching from coal to fuel oil, producing just enough steam to keep the generator spinning ready for use when required. A closed-loop feedback system controls the speed (frequency) of the alternator, whose revolutions are sensed by a Watt governor (the classic mechanical regulator with twirling balls that move outwards as the revolutions increase) or some kind of electronic sensor. The speed control system's output is transmitted via hydraulic actuators to operate continuously-variable steam valves, or water valves in a hydro-electric installation.

Generator output power is controlled by adjusting the field excitation current. When the generator is at speed, synchronised and connected, all that's needed is to bring up the steam pressure and it's ready for action. To encourage us to even out the load a bit, the industry dangles the carrot of cheap power at night with an assortment of off-peak tariffs.

Off Peak

Unfortunately we don't have a way of storing megawatts of electrical energy in its original form – storage batteries using current technology are out of the question. The nearest we've got so far is pumped-storage using an installation such as the specially-designed hydro-electric station at Dinorwic in Snowdonia, North

Wales. The alternators here are operated as motors during off-peak periods, driving their turbines to pump water from a natural lake, Llyn Padarn near Llanberis, up to a man-made reservoir. Next day, or when otherwise needed, they just let the water flow back down again, this time driving the turbines to return most of the original power to the Grid. By the way, if you are in the area I understand that the Museum of Wales at Llanberis arranges visits to the site.

You don't need water and mountains for pumped storage however. One novel idea is to use underground voids to store compressed air from compressors that run on off-peak surplus power. When required, the compressed air would drive gas turbines to recover the stored energy – a supercharged gas turbine can deliver about twice the power of a normally-aspirated unit for the same amount of fuel. Not far from where I live in Cheshire, salt is recovered by pumping hot water down into salt beds then pumping it back up again as strong brine: the huge underground voids left behind could well be suitable for pumped-air storage – possibly helping to reduce the area's chronic subsidence problems as a bonus.

Power Transmission

The National Grid provides long-haul transmission at 400kV or 275kV. At Grid switching stations, which are usually sited near large centres of population and/or industry, huge transformers step the Grid voltage down to 132kV for supply to the RECs.

The reason why such exotic voltages are used is to keep the current and associated resistive line losses down to a reasonable level while transporting terrawatts of power. Higher currents would lose more power by heating the cables, and heavier cables would need larger pylons to carry them – remember that, for a conductor of a given cross-sectional area, the resistive losses increase by the square of any current increase. As it is, as much as 100V can be lost along each length of conductor between pylons.

The overhead cables are made of aluminium which, although much lighter than copper, is almost as good a conductor. As aluminium on its own would stretch and break, the cables have steel cores for strength. Grid cables are usually bunched in groups of two or four, because bunching reduces the likelihood of corona discharge and the accompanying risk of electromagnetic interference. Why use overhead transmission? Because underground cabling is extremely expensive at Grid

A 132kV substation transformer with forced cooling.



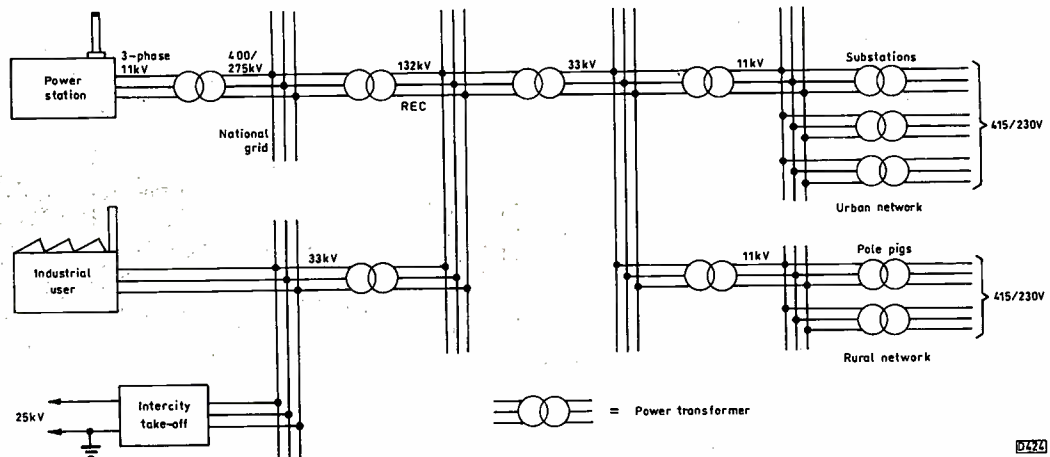


Fig. 1: A very basic representation of the electricity distribution system, from the power station to local substations and "pole pigs". For clarity, the metering, isolating and protective arrangements associated with substation transformers have been omitted. Don't be confused by the transformer symbol, which is correct for electrical circuits: it's unfortunate that the symbol is similar to the current-source symbol we use in electronic circuits.

voltages – anything from ten to twenty times the cost of overhead transmission – and is lossy because of the relatively high parasitic capacitance between closely bundled conductors and the earthed outer sheath. Even modest cable capacitance can absorb a lot of power at high AC voltages.

DC Transmission

Capacitive losses can be overcome by transmitting power as direct current. DC is used for the undersea link between France and the UK. Disregarding cable losses, a cross-Channel AC link couldn't be used anyway. Synchronising a power station's generators to the Grid is difficult enough: attempting to synchronise the entire power grids of two countries would be out of the question.

The cross-Channel link is bi-directional, so the equipment at each end has to be able to rectify or 'unrectify' as required. It's done by using basic, familiar power-control techniques, but on a really grand scale. Each end of the link has a three-phase bridge rectifier array ingeniously designed to enable it to work as both rectifier and inverter. The rectifier devices themselves are large, forced-cooled thyratrons: mercury-vapour rectifier valves with control grids that act in the same way as the gate in their solid-state cousins. And, like thyristors, thyratrons can be switched off by capacitive commutation techniques – like those that were used in thyristor line output stages. The firing sequence for rectification is obviously different from that used for inversion: the complex pattern of grid-firing pulses is computer generated.

These thyratrons are the very big brothers of the gas-filled triode thyratrons that were used as timebase generators in the TV sets of yesteryear. They rely on a combination of air and water cooling. Power conversion on this scale is still very much a job for valves, though semiconductor rectifier stacks have proved useful at more modest power levels – one DC link in the USA is reputed to use ten thousand thyristors!

DC power transmission is now under consideration for use in new underground cable links planned for areas where overhead cables are impractical or unwelcome. DC links also allow easy interchange of power between otherwise incompatible 50 and 60Hz AC systems.

It's ironic when you think about it. DC was the norm in the very early days of electricity, when voltage changing could be done only with very inefficient motor-generator sets. The main reason for the universal adoption of AC mains supplies was the ease of voltage changing with reliable, efficient transformers. Now that modern power electronics makes conversion from AC to DC and back to AC easy, we seem to have gone full circle! This is especially so when you consider that future power generation may involve large solarvoltaic power projects, magnetohydrodynamic generators and fuel cells, all of which are DC sources.

Nuclear Fusion

A lot of the power industry's hopes are pinned on nuclear fusion. Present indications are that conventional turbo-generator sets, running on steam produced by reactor heat-exchangers similar to those in today's nuclear fission reactors, will be used when fusion power does eventually become practicable. The European Union's fusion programme, the Joint European Torus (JET), is based at Culham Laboratories, Abingdon, Oxford. Britain had a world first with the 1957 ZETA (Zero Energy Torus Apparatus) fusion reactor: we could well have had fusion power by now had this project not been abandoned. The Culham machine is of Russian design, known as a tokamak.

Superconductors

The need for cheap, effective underground power transmission is the main push behind research into room-temperature superconductors. If resistive losses could be eliminated from the electricity distribution system such high voltages would no longer be required. Transmission at low voltages would involve astronomi-

cal currents, but this wouldn't matter in superconducting circuits. In theory at least, losses would be zero and there would be no possibility of cables overheating, despite the astronomical currents.

Unfortunately room-temperature superconductivity is a long way off with the present state of the art. Scientists have been playing with all manner of exotic materials, the latest being compounds of certain metals with 'Bucky-balls' (Buckminsterfullerene – a newly discovered form of carbon with a football-shaped molecule that contains sixty atoms). There have been experiments with superconducting power cables using conventional technology, but the cryogenics required to cool them to liquid helium temperatures (under 4°K, or -270°C) are prohibitively expensive. So it looks as if we will have to put up with our high-voltage, overhead transmission system for the foreseeable future.

HV Sites

High-voltage sites are a mass of insulators, thick copper conductors and some sinister-looking pipes and tanks. Routine connection and disconnection of various parts of the transmission system is done by using powerful hydraulic or pneumatic actuators to open overhead isolator sections physically. Rapid disconnection under fault conditions is undertaken by circuit breakers.

Breaking hundreds of thousands of volts at thousands of amperes results in the granddaddy of arcs that need to be quenched within milliseconds, otherwise the contacts will be destroyed. At Grid voltages (400kV or 275kV) quenching is usually done by air-blast or with silicon-fluoride gas. At 132kV and below, oil-quenched breakers are used – the contacts are immersed in insulating oil. When a large, high-voltage arc is oil-quenched, gaseous oil-breakdown products form at the speed and intensity of an explosion. So oil-breaker tanks need to be built like the proverbial brick privy. When a heavy fault current has been disconnected, the oil may need decontamination or even renewal.

HV Transformers

High-voltage transformers are also oil-filled: the oil serves as an insulator and coolant. It's not your average 20/50 engine oil either. Transformer oil is very highly refined and needs to be thoroughly dry. Any moisture in the oil – one part in 10,000 is enough – can lead to insulation breakdown, with a real risk of the transformer exploding. I've never seen this happen, but those who have tell me that a large, high-voltage transformer going ballistic is a spectacular sight that's best viewed from a considerable distance!

The largest transformers have cooling systems in which the oil is circulated to and from the transformer tank through large radiator arrays. These are force-cooled by thermostatically-controlled fans. Should the transformer overheat because of unusual conditions, for example heavy loading during exceptionally hot weather, it can be automatically disconnected.

Really serious faults, such as internal flashover, usually result in rapid expulsion of the oil from the transformer tank up to the conservator, the reservoir tank that's always visible above a large transformer. Special flow switches in the conservator pipe trigger immediate disconnection in the event of any rapid backflow of oil. These switches are critically adjusted to ignore the small flow in and out of the conservator caused by temperature changes – after all, that is what it's there for.

Small transformers don't usually have all this paraphernalia. Their fault protection is provided by fuse and/or circuit breaker. The oil circulates by natural con-



vection through some simple form of radiator – commonly nests of tubes that sprout from the tank.

A Warning

Take care should you have to handle any older 'oil-filled' electrical apparatus, as the 'oil' may be polychlorinated biphenyls (PCBs or askarels). Industrial power-factor correction capacitors, motor start and run capacitors and the high-voltage capacitors and transformers in old CRT EHT generating circuits were often filled with the stuff. Be very suspicious should any leakage have become sticky.

PCBs are highly dangerous materials. They are known as carcinogens, and are thought to be teratogenic – capable of causing birth defects by damaging both sperm and female reproductive cells. They can be absorbed through the skin, and skin contact with them can lead to chloracne, a particularly nasty, disfiguring and so far incurable skin disease. Don't try sniffing any suspect fluid, and wear rubber gloves. Never chuck anything suspected of containing PCBs in the bin – it's illegal, because of the serious risk to public health. Stick it in a strong poly bag and contact your local council's environmental health department for advice.

As far as I know, most countries have now banned the use of polychlorinated biphenyls. You may wonder why they ever came to be used in the first place. Basically, because the stuff is more resistant to breakdown under the extreme heat of an arc than ordinary mineral oil, and the breakdown products that do form are generally non-flammable and non-explosive. This heat stability also led to the use of PCBs in some hydraulic fluids. Electrolytic capacitors don't, incidentally, contain PCBs.

Local Distribution

Back to the basic story then. The local electricity company takes its supply from the Grid at 132kV (and pays at the check-out!), then drops the voltage to 33kV for feeding into its primary distribution system – see Fig. 1. Major users are supplied at 33kV, as are the various sections of the 25kV InterCity rail network. Large industrial estates are often fed from a 33kV substation. These substations supply the 11kV secondary transmission system, which in urban areas is mostly underground.

The final step is down to the domestic 230V single-phase and the 415V three-phase supplies for commercial premises. The usual allocation is one substation/transformer for every 300 dwellings.

As it's not feasible to run 11kV via underground cables to outlying villages and remote farms, the 11kV supply is carried to them by the wooden poles that are a familiar sight in the country. Each village is usually supplied

The 275kV transformer at the Frodisham Grid substation. Note the oil pipes to the radiator and the oil header tank.

A three-phase pole transformer for rural distribution.

by a pole transformer – the Americans call them “pole pigs” – as are individual farms and isolated houses.

The Phases

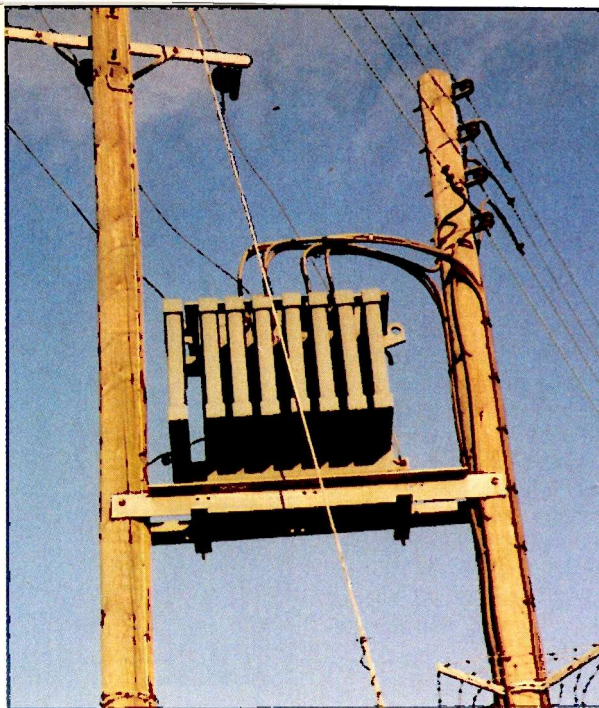
Most pylons carry six sets of cables. Some carry three. There’s no neutral as such – the wire strung between the very tops of the pylons acts as a common earth conductor and lightning catcher. It’s also used as a catenary to support the fibre-optic cables that provide Gridco’s new telecoms network.

AC power is generated in three phases, i.e. the generator provides three outputs with a phase difference of 120° between each of them, a system first proposed and developed by Nikola Tesla. Each group of three distribution wires comprises a single circuit, with this phase difference of exactly 120° between them. Why? For a given loading, a three-phase generator is smaller and more efficient than would be the equivalent single-phase machine.

Even the humble vehicle alternator is a three-phase unit. The same goes for electric motors: a 1HP three-phase induction motor is less than half the size of its single-phase equivalent – and once you get above 5HP or so, a single-phase motor is out of the question. Three-phase circuits also have the very useful ability to supply two different voltages (230/425V) from the same set of wires.

Typical Urban Distribution System

A typical urban distribution system is depicted in Fig. 2. The incoming 33kV or 11kV supply is fed to the delta-wound primary of a step-down transformer that’s typically rated at 1.5MVA. The secondary winding is star-



connected, with the star centre the common neutral connection that’s earthed at the substation. The high-voltage side of the system has no neutral connection as such, but is earth-referenced elsewhere using an earthing transformer. By the way, when dealing with matters electrical you may come across the terms wye and mesh. Wye means star and mesh delta. In Britain the three phases are colour coded red, yellow and blue, with the sequence R-Y-B indicating clockwise

phase rotation. Black is neutral.

Domestic consumers are usually provided with a single-phase supply which, between any phase and neutral, delivers 230V. To even out the load as far as possible, adjacent houses are connected to a different phase.

A single-phase 415V supply is available across any two phases, but anyone needing 415V will be supplied via the full three-wire circuit. It’s not just heavy industry that uses a three-phase supply. Motor-driven equipment that needs more than 5HP will almost certainly have a three-phase induction motor. Examples are garage air compressors, laundry plant, farm machinery, bakeries and the restaurant, hotel and canteen kitchens that are full of heavy catering equipment.

To Follow

Between the power station and your mains socket there is an awful lot of wire and gubbins. Mostly outdoors and exposed. So there is plenty of opportunity for gremlins to wreak havoc with today’s often over-engineered equipment, which is stuffed to the gills with vulnerable silicon. In a following article I’ll be taking a look at the things that can go bang in the night.

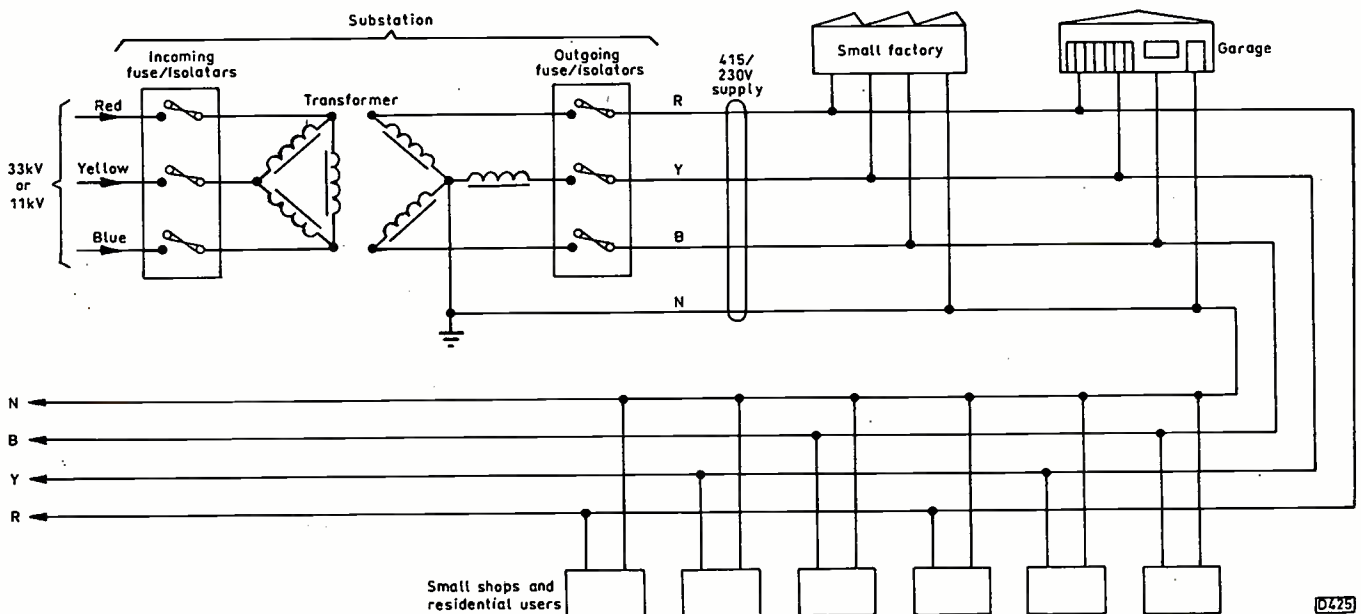


Fig. 2: A typical urban distribution system.

Books to buy -

domestic security systems

Build or improve your own intruder alarm system

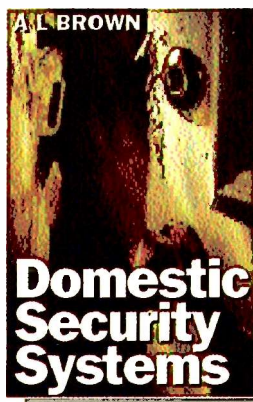
House break-ins have increased threefold in the UK over the last 20 years. Few have not been touched by the affects, even if only through the experience of family and friends who have suffered a burglary. There is a way to reduce significantly the chances of being targeted by thieves: fit an alarm. But isn't that expensive and complicated? Not if you build your own system. This book shows you how, with common sense and basic DIY skills, you can protect your home.

Every circuit is clearly described and illustrated, and contains components that are easy to source. Advice and guidance are based on the real experience of the author who is an alarm installer, and the designs themselves have been rigorously put to use on some of the most crime-ridden streets in the world.

To illustrate the principles, Tony Brown uses two examples of houses, one a typical semi-detached home and one an average

three-bedroomed detached bungalow (for which designs would also suit an apartment). Working systems are shown in operation. Designs include all elements, including sensors, detectors, alarms, controls, lights, video and door entry systems.

- *build your own security system
- *practical guide to domestic security, including basic systems
- *includes all elements including sensors, alarms and lights



CONTENTS: Input sensors; System control architecture; Output signalling devices; Installation; Testing and maintenance; Existing systems; Security lighting; Video camera and door entry systems; Suggested tooling; Index

ISBN 0 7506 3235 6 : 192pp : 216 x 138 mm : 70 line illustrations : Paperback :

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Intruder Alarms

Specification, installation and maintenance. Gerard Honey

This book covers Intruder Alarm Systems (C+G 1851 syllabus) as well as providing the underlying knowledge required to achieve a level 2 NVQ (National Vocational Qualification) in Understanding, Specifying, Installing and Maintaining Intruder Alarms (C+G 1863, 1864 and 1865). Familiarity with the contents of this book are required before an award will be made.

Gerard Honey is an experienced installer and writer and has used that experience to produce a book that not only provides essential information in a way that is easy to follow and learn, but also makes the book a fine practical source of advice. Each chapter contains summaries, self-tests and other features designed to help the student to understand and gain knowledge easily. Intruder Alarms has been published with the help of SITO, the Security Industry Training Organisation, who design courses and organise training for security installers and professionals.

- *Only course book written for syllabus for Security NVQ
- *Comprehensive study of intruder alarms
- *Author is a practising international security systems expert

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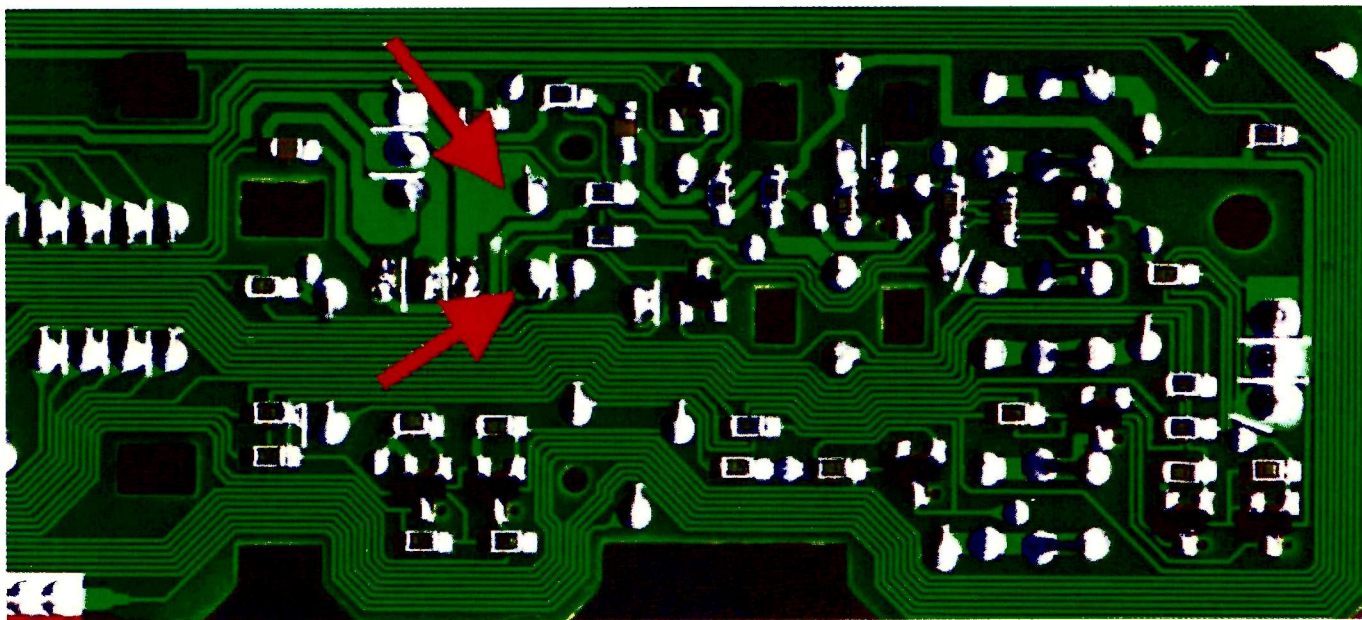
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Satellite WORKSHOP

**Jack
Armstrong**

Dabblers

In every town there's a dabbler. Ours is no exception. A dabbler is someone who likes to 'fix' things but hasn't a clue. All the dabblers I know have a car registration number after their names, like "G0ZZZ".

Geoff up Castle Street had to pass an exam to get his registration number. Apparently he's now qualified: not only to practice morse code, but to repair anything remotely associated with electricity!

He told a neighbour and unfortunately she believed him, which is why Mrs Smith's Pace PRD800 was sitting on my bench looking very sad. Luckily the damage was not too severe. Initially it seemed that the tuner might be dead, because there was no sound and no picture. There was no LNB voltage either however, and it soon became obvious that none of the video circuitry was working because the 12V supply was missing. Usually the cause of this is broken tracks at the input to REG1, but in this case the regulator's input was less than 5V. I would normally assume that one of the silver 'via holes' had gone high-resistance, as sometimes happens, but the knowledge that someone had dabbled made me look more closely.

In fact the cause of the problem was D14. Normally this is a BYW98 or an EPG30. In this case it was neither and had failed because 'somebody' had fitted a completely wrong type. I'll never

know what the original fault had been. The power supply had had a home-made junkbox 'kit' fitted. It worked, but it wasn't safe. So I had to replace every component using the correct type.

As with most cowboy repairs, the BUT11A chopper transistor was the underrated plastic version and was mounted on 'stilts'. Why do people think it will run cooler if they mount it like this? The correct method is to push the transistor down until the shoulders of its pins touch the PCB, then bend the pins beneath the board to form a mechanical joint before soldering. If the transistor is not fixed mechanically in this way knocks and vibration can break the copper tracks.

Parcel Farce

Now and again I receive units for repair by post. They usually arrive intact but quite often don't. People do not seem to realise that a precious receiver might travel beneath a hundred mail sacks, imposing a ton of weight on it. I always recommend packing a receiver in a box within a box.

The other day I received a package that contained a Pace SS9000 receiver in its original display box but with no other outer packing. It had stickers on it to say that it had been "resealed by" a well-known parcel carrier.

I repaired the cracked PCB and replaced the faulty tuner then found the customer's letter and cheque, which was dated 1996.

"Silly sod" I thought to myself. So I phoned the office number on the letter.

"Sorry, Mr Smith left the company eighteen months ago" said a puzzled voice.

I was puzzled too. The date on the letter was the same as that on the check. I can understand damage that occurs in transit, but surely the parcel had not been on its way here for nearly two years? I looked at the date mark on the stamps. It had!

Another dealer told me of a similar problem. A receiver he'd returned to a customer in France had gone missing. So he filled in a claims form. Two months later the parcel company contacted him to say that the package had been found and would be returned to him.

"But I don't want it returned! My customer in France is still waiting for it."

"Sorry, sir. Company policy. Lost and found parcels must be returned to sender. Oh, and there'll be an £18 charge for return carriage."

Pace MSS1000 Pro-Logic Board

Power supply failure naturally occurs from time to time with the Pace MSS1000. Sometimes however I've had a power supply that appears to be dead but produces a faint ticking noise. In each case disconnecting the Dolby Pro-Logic Sound board has brought the unit back to life, and the cause of the trouble has been traced to one of

Top photograph: Position of the troublesome filament supply electrolytic coupling capacitor C2, viewed from the back of the fluorescent display PCB, in the Pace Models MSS500/1000.

the 4280 power amplifier chips on this board.

Very occasionally replacement of the 4280 ICs has not provided a complete cure and other, surface-mounted devices have had to be replaced as well – D1 (4.7V zener diode), Q3, Q4 (both type BC848B) and Q6 (BC856B). It's also worth checking the FES8FT high-current diode D54, which is just in front of the main power supply transformer: it can go short-circuit to produce the same symptoms. In addition, as mentioned previously, I usually replace all the electrolytics as supplied in the SatCure RELKIT 10 – for details phone 01270 753 311 or check at SatCure's web site, see following section (CTU900).

If the power supply remains dead after disconnecting the sound board you'll need SATKIT 10. But don't assume that the power supply is dead just because the front panel fails to light up. There could be several different causes of this. Always check the voltages on the secondary side of the power supply.

CTU900

This D2MAC decoder seems to be "flavour of the month". The prob-

lems stem from the fact that it's not a true D2MAC decoder: it's a cable box which produces grainy and/or flickering pictures when used with some receivers and TV sets. It also needs a modification to work with some smart cards.

I've had numerous letters and e-mail enquiries about the CTU900. Most of the time I direct people to the free information at SatCure's web site

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

or, if they want an upgrade done professionally, to Satfix in Swansea (01792 781 673).

Pace MSS1000 etc Display

Early versions of the Pace MSS500/1000, also a few MSS300 receivers, used a 22 μ F electrolytic capacitor (C2) to couple the 22kHz filament supply to the vacuum fluorescent display. After a few years this capacitor can fail, going open-circuit: the display becomes dim and eventually winks out completely.

Pace recommends that a 1 μ F, 50V multilayer ceramic capacitor is used as the replacement – this

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.

type is better able to cope with the current. The MSS300 is easy to fix, but the expensive front panel in an MSS500/1000 is easily damaged – the instructions in the service manual must be followed to the letter.

Over the months I've learnt to recognise the position of C2. Nowadays I simply solder the new capacitor on the back of the board, leaving the 22 μ F electrolytic capacitor in place. Done this way it's a two-minute job, as the accompanying photo (opposite page) shows.

Test Case 426

"It won't come on – just bonks" said the voice on the phone. Pam's eyebrows shot up. In her ten years as receptionist and general factotum at Test Case Repairs Ltd. she had heard of many things, but not a bonking TV set. "Bonks and goes back to sleep" insisted the voice. So that's what Pam wrote on the job card. Doc Colin was duly despatched, with a smirk on his face and the Mitsubishi service manual file on the van seat beside him – the set was a Mitsubishi Model CT25A5STX (Euro 14SF chassis).

On arrival Doc switched the set on. Sure enough it went bonk-bonk-bonk, then shut down completely. Some sort of overload problem no doubt. But Colin could feel, on the back of his hand, the effect of EHT voltage in the picture tube. He also heard, from the speakers, a series of plonks (as opposed to bonks!). He put the service manual back in its file, flexed his muscles and, with the help of Mark – manager of the shop, which wasn't far away – got the set into the van and away to the workshop. He labelled it "rental, Smith, bonking", and Pam came to look at it out of curiosity. Finally it reached the service bay, where it was examined by TechnoCrat.

A protection circuit was clearly in operation. But why was a bit of a mystery. Some EHT voltage was certainly being generated during the half dozen or so power supply pump cycles before the set would shut down, and an oscilloscope check at the HT supply's smoothing capacitor C953 showed that the voltage here was bouncing up and down, so there was no short-circuit across this line. In fact all the power supply's outputs were pulsing in time with the pump action, eliminating the possibility of shorts in the circuitry they sup-

ply. There may however have been a heavy load or leakage across one of them, so the most likely items were disconnected: the 30V audio amplifier chip, the switched 12V regulator IC951 and so on. None of these actions stopped the set's bonking!

Attention was next turned to the line output stage, where various secondary circuits, including the scan coils, were disconnected from the LOPT as a test. This again had no effect on the fault. The line output transformer itself could have been the culprit, with shorted turns or something – but could a faulty LOPT produce EHT energy? Maybe. Certainly there wasn't one in stock!

TC decided to check other things. The rectifier diodes on the secondary side of the chopper transformer showed no sign of reverse leakage when tested: neither did the chopper transistor or the line output transistor. Despite this both were replaced – because they were in stock! The new devices did no better than the originals however, as the set continued to bonk and plonk.

Could it be that all these tests and trial replacements were a bit pointless in view of the basic symptoms? Might it have been better to have studied the circuit diagram and thought about the operation of the power supply section and its protection arrangements? In a word, yes! This Mitsubishi set required no major repair: in fact a couple of inexpensive components put it to rights. What were they, where were they, and what had happened to them? Was there in fact an excess-current situation at all? The solution will be found on page 595 – but don't go there until you've given some thought to the problem!

This is no ordinary meter: it has been designed to check the ESR of electrolytic capacitors in circuit – a basic test of the goodness of these notorious components. It can also do other things, as **Martin Pickering** explains

The ICHE Capacitor



A week or two ago one of my trade customers phoned me for help with a BT SVS250 satellite receiver. "I replaced all the parts included in RELKIT 17" he said, "but it still doesn't give any on-screen decoder messages."

I suggested that he used his wife's hairdryer on the main PCB, since the electrolytic capacitors in the video section are notorious as a cause of this symptom, also streaky pictures.

An hour later he phoned back. "Your hairdryer idea didn't get me anywhere" he said, "waste of time. But I found the fault right away when I used my Capacitor Wizard."

"Huh?"

"It was C232, and I found it with my Wizard."

"Ummm, sorry. What's this wizard thing?"

"It's advertised in *Television*. Bought one. Wonderful. You should buy one."

Now I confess that although I write the occasional piece for the mag I don't often read the adverts. So this recommendation came as something of a surprise. Then there's the fact that your reviewer doesn't usually buy things. I mean, it wouldn't be right somehow to actually pay for something to review, would it?!

Anyway I sent an e-mail to ICHE and ordered one. It arrived next day, and I posted my cheque by return.

First Impressions

My first impressions were that the meter was 'chunky' and maybe on the expensive side. It's housed in what is obviously a proprietary moulded black box, with brown feet glued to the underside. The meter movement seemed to have been fitted as an afterthought: it stands a centimetre proud of the box. The unit is large in comparison with a modern multimeter. This was not going to fit in my pocket.

But first impressions can be misleading. This is an

instrument that has been designed for a specific purpose, and part of that purpose is to sit on a workbench without wandering about with every draught from the window. The chunky box makes sure of that, and the brown feet are functionally perfect!

The face of the meter is colourful and easy to read. The unit's controls are simple: an on/off switch and two recessed preset adjusters that, so far, I've not had need to touch. The bright, yellow-painted cover might be chunky, but it's the sort of Morris 1000 type chunkiness you learn to love. And the probes – I just love to hold those probes!

Not a Capacitance Meter

"But," I hear you say, "I already have a capacitance meter."

Well this isn't a capacitance meter. What it measures is the effective series resistance (ESR) of electrolytic capacitors, and it does so with the capacitor in circuit.

You will, of course, remember Ray Porter's excellent articles on the subject of ESR back in the January and April 1993 issues of *Television*. To recap, with an electrolytic capacitor the ESR is a much better guide to the capacitor's state of health than its actual value. In a chopper power supply, to take one application, the electrolytics take a continual hammering from fast rise-time, high-current pulses. These can degrade a capacitor in such a way that it is no longer able to smooth the pulses. Its capacitance value might still be all right, but its effective series resistance may be far too high. This is what the Capacitor Wizard measures.

In Use

How, I wonder, could I have managed without this instrument for so long? For years I've treated electrolytic capacitors with suspicion. I have replaced without testing them any that were discoloured or ooz-

ing, and have continually been surprised when the culprit turned out to be other than the one(s) I suspected. Then been even more surprised to find out that its capacitance value was almost correct.

Now, with the Wizard, I simply ensure that the big electrolytics are discharged, then prod each one with those wonderfully long-pointed probes. If the Wizard bleeps, the capacitor is OK: no need even to look at the meter. If it doesn't bleep, I look at the meter and make a judgement. If the meter's needle comes to rest in the 'compare' region, I do the test again with a new capacitor of the same value in order to provide a comparison. If the needle comes to rest in the 'bad' region, the capacitor goes in the bin and a replacement is fitted.

This works fine with electrolytics of value down to 10µF. With practice, you can make a considered judgement down to 1µF. Above 100µF, the meter always bleeps unless the capacitor is bad.

How it Works

The Capacitor Wizard generates a 100kHz sine wave test signal of only 5mV RMS. This is insufficient to switch on any semiconductor device present, so the meter is not affected by other components in the circuit. As it measures reactance, it will happily ignore even a 100Ω resistor across the capacitor being tested. In fact the only times when it's fooled are when the capacitor under test is short-circuit - check with an ordinary meter if in doubt - or there's a good capacitor in parallel with a bad one. You soon get to spot these.

User Instructions

The Capacitor Wizard was designed by an American engineer who actually uses it himself. It shows! The instruction booklet is clear and concise, and even includes tables to enable you to check capacitors with values as low as 0.1µF and small-value inductors as well. There's also an explanation of how to check for leaky or short-circuit semiconductor devices. This meter is more versatile than you might think!

Conclusion

The total price of the Capacitor Wizard, including carriage and VAT, is around £169 - but see this month's special offer (page 539).

"You thought long and hard before committing yourself of course" I hear you say. Well no, actually, I didn't! Once I realised what the Wizard would do and how much time and money it was going to save me, I ordered one straight away.

Like an Apple G3 PowerMac, it does the job faster and more efficiently than anything else available. And, like the G3 PowerMac, I simply had to have one.

You can obtain the Capacitor Wizard from ICHE, PO Box 142, Nottingham NG9 3RX. The phone number is 0115 932 0152, fax 0115 944 4004, or e-mail

tony@iche.com

or consult the ICHE web site at

http://www.iche.com

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What a Life!

Recollections on how we were. Customers, their problems – and their videos and TVs. Donald Bullock's world

It was a lovely Spanish day. We'd been up in the mountains for a great big meal with wine, and had lashed out over four quid each on it. Now I was lolling in the sun by the pool with a very large whiskey. Greeneyes was in the pool. It was nice to be away from TV sets and people who say silly things. I closed my eyes and slumbered.

Recollections

What was it that fat woman said to me the other day?

Ah, yes. "It can't be the tube 'cos our Vera was eight when Grandad died . . ."

And that chap who kept turning up his nose. "It's either the valve or the condenser . . ."

Silly old fools.

How nice life was when there was only the wireless, and they never let prats near the microphones . . . Those accumulators that used to light up the valves . . . The man would get a newly-charged one every week . . . Pity accumulators never lasted the week . . . Wonder why the newer fellows don't know about the Skin Effect and Litz wire?

"This is Henry Hall speaking . . ."

"The day war broke out . . ."

"Mah missus isn't a woman, she's a place . . ."

"I wouldn't say she drinks, but she came home sober last night and the dog bit her . . ."

"Hey, is that the time? They've been open two minutes . . . What will Charlie Evans think?"

Hmmm. Those service calls. "It's a heavy set, isn't it, Mr Bullock? Hold on now . . . Don't put it on the table in the corner. Perhaps over there . . ."

"Stop annoying Mr Bullock, Bonzo. Why are you jumping about like that, Bonzo?"

Nice whiskey this. I'll have another.

That chattering Mrs Blabber . . . I ran from her house one day late for my next call and jumped into the ancient Jag Mk 10. What, no steering wheel? Nothing on the dashboard? Oh God, I'm in the back seat . . . Did they see me? What'll they think? Better crouch about, pretend to be looking for something . . .

In the paper . . . Buckingham Palace ceiling falls in as Queen honours Weights and Measures big-wig. Should bloody well think so . . .

Oh, it's gone cold. Sun's gone in. Oh, my head.

Mrs Swarf's Video

Mrs Swarf plodded in as I was drinking a cup of Paul's Bisto tea. "My old video's gone again, Mr Bolter" she sighed. "It's the one my husband gave me out of the goodness of his heart. He's a gentleman Mr Bolter. And he'll be back, you know."

"Er . . . Right" I said. "I'll get the recorder in for you Mrs Swarf."

She had not worn well, and didn't seem to bother about her appearance. Her husband had left her for someone else, but still paid the odd bill. All very unfortunate.

Steven pulled the machine over – it was a Toshiba V204B.

"If it ticks at plug-in it'll be the capstan motor" I said.

"Or the 10µF, 50V electrolytic CP007" he said.

He was right of course. It was CP007 in the chopper drive circuit:

its value had fallen to about 5µF.

As we boxed the machine up Mrs Swarf smiled wanly and searched about in her big coat for her purse.

"Can't give you any of my ten pence pieces" she said. "I keep them to phone my husband."

We waved her purse away, and Steven took the VCR out to her old car.

John Berryman and the Sony TV

As she went John Berryman drove up in his van – the one with the painted windows. John's the local undertaker, though he looks like a big, ruddy farmer.

"How you keeping, Don?" he bawled. "OK? No aches or pains?"

"I'm perfectly OK" I said, "but thanks nevertheless for your professional interest. What have you got in the van?"

"A nice old fellow and my neighbour's Sony TV. Which shall I bring in?"

"Better make it the Sony" I said.

It was a KV2090UB. When we switched the set on it was all right for five minutes. After that the picture became grainy, then disappeared as the set began to squeal.

"That'll be the 2SD1398 line output transistor" Steven said. "When they get a bit long in the tooth they tend to become leaky under load."

"I can vouch for that" said Berryman.

"But why does the picture go grainy?" I asked.

"Dunno" Steven replied. But a new DU508D cured the trouble.

"Want us to fix the old fellow, John?" I asked.

A Matsui TV

Then a Matsui 1436XA 14in. portable was brought in by an odd cove who laughed loudly.

"Dead" he declared. "Oddie's the name. It banged like the blazes. Made the missus jump out of her skin." He continued to laugh.

"Call us tomorrow" I said.

When we opened the set we found that the 4AT fuse was a fragile tube of soot. So we checked the STK7348 chopper chip which was full of shorts. R651 (27 Ω , 3W) and R653 (1.5 Ω , 3W) were both open-circuit, and C655 (0.47 μ F, 50V electrolytic) was short-circuit. After replacing these items we switched the set on with some confidence. It came on in standby and wouldn't do anything else. The 390k Ω start-up resistor R652 was open-circuit.

When Oddie came back he had his wife with him. She seemed to be back in her skin. His face was full of mirth, and when we gave him the bill he laughed still more. He took the set out to the car while his wife paid the bill.

"Seems to be a very happy man" I commented.

"He's miserable as hell, dear" she said. "It's a faulty nerve makes him laugh like that. For heaven's sake don't rile him!"

Oddie called from the car.

"Hurry up" he bawled, "I'm getting fed up!"

Daewoo Portables

Greeneyes was in the shop when Mr Flighty bounced in. He fancies her, and she thinks he's quite a nice man. I can't stand him.

"Hello dear" he beamed, "you're looking very well!" Then he looked at me. "Pensioner now, I s'pose" he said.

He was carrying a modern Daewoo 14in. colour portable, Model T140 (CP330 chassis). I reached for a card and wrote down his name. "Trouble?" I asked.

"Oh no" he said, "none at all. I'm fine."

I pointed to the set.

"Oh, that. Dead."

Steven opened it up. This one also had a 4A mains fuse that had blown. The cause was obvious: the small disc posistor in the degaussing circuit, type 180A, had gone up in smoke. When he'd fitted a more substantial replacement and a new fuse all was well.

Then Mr and Mrs Trew parked their shiny new car outside and shuffled in with an identical

Daewoo colour portable.

"Sorry we've had to come here with this, Mr Buster" he said.

"Costs money having sets mended, don't it?"

"Such is life" I smiled, wishing they'd gone to Snoddys.

"We're only pensioners" added Mrs Trew, "do you do cheap repairs for pensioners?"

"We've not been too well lately either" said her husband.

"Sometimes my thumb aches cruel, and my wife had toothache twice in April." He looked at the set. "Dead" he said, "I wish it was on hire purchase - we wouldn't go on having it."

I waved them off and pulled the set on to the bench. It was dead all right - and ticking. I checked the voltage across the mains bridge rectifier's 120 μ F, 400V reservoir capacitor C807 and found that it was low at 180V. So I took it out, discharged it and checked its value with a capacitance meter: 0.05 μ F! The set worked when a replacement had been fitted.

But we noticed that both sets had thin, poor sound, with little bass. The speakers are very small.

When the Trews came back we handed them the set and the bill.

"Ten pounds?!" he exclaimed, looking at his wife.

She bit her lip. "Will you take eight?" she asked.

He eventually took out his wallet and paid us. It was thick with loot.

Norman's Sony TV

Short, wide and casual Norman Glutton drew up with a Sony KV27VX1PH in his van. It took two of us to get it into the workshop. He pushed his finger out and drew a line across the air.

"Picture's like that" he said. Then he looked across at the food shop opposite. "Won't be long" he said.

As he waddled out we got his set on to the bench. It's fitted with a chassis we'd not seen before, but we soon found the field output chip and established that its supply, which is derived from pin 12 of the line output stage, was missing. We replaced the 0.47 Ω safety resistor here, R854, then examined the line output transformer for dry-joints. There were several, so we resoldered them all. When we switched on an excellent picture came up.

Meanwhile Norman had returned. He stood there carving at a huge pork pie with his pocket



"Don't put it on the table in the corner . . ."

knife, eating slice after slice.

"Good bit of pie" he said, "I likes pies."

Victor's VCR

Victor Smallpiece is a thin-faced, timid chap who hails from the land of the leeks. He brought in a newish GoldStar GSEQ121 VCR and piped at us in his very high voice.

"This 'un is dead, can't it? Not very old either, does it?"

"Is it under guarantee anywhere?" I asked.

"No, we won it at a fête a year ago" he piped.

The VCR has a separate power board and, unusually, the output voltages are printed on it. Checks revealed that the 6V supply was low at 3.5V. We found that the KIA7806P 6V regulator IC101 was the cause of the trouble. A replacement restored the machine to life.

As seems to be the case with most centre-deck machines, this one is not too well made. The power supply runs hot, and had scorched the board black within the year, drying out the electrolytic capacitors. To prevent the job bouncing we replaced the lot.



Reports from
Philip Blundell, AMIEEIE
Maurice Kerry
Graham Colebourn
Glyn Dickinson
John Trimmer
Brian Storm
C.J. Guy
Chris Watton
Michael Dranfield
and Chris Avis

Philips G90AE Chassis

The BUT11AF chopper transistor was short-circuit. After fitting a power supply kit (part no. 4822 310 20496) I found that the 95V line was at 12V. This is its voltage in the standby mode, but the LED didn't say that it was in standby.

Cold checks on the secondary side of the power supply revealed that R3668 (150Ω) was open-circuit. This would result in the HT line being high, and was probably why the BUT11AF transistor had failed. Further checks showed that the overvoltage protection diodes D6655/7/8/9 were all short-circuit. After replacing these everything was OK. But I usually give these sets nine hours in standby and nine in the picture mode before return to the customer. P.B.

Toshiba 258T7B

If the line output transistor appears to be short-circuit, check the tuning capacitor C464 (2,700pF, 2kV) first. It tends to crack and go short-circuit. The part no. is 24092037. P.B.

Grundig G1000 Chassis

For reduced width with a folded over picture, check that the line frequency is correct at 15,625Hz. If the line oscillator is running at almost twice this speed, the micro-controller chip IC500 (part no. 75990-200-63) is probably faulty. You will be supplied with an updat-

TV Fault Finding

ed type and a modification sheet that tells you to replace one capacitor and one resistor. To make these changes you will require a 1.5nF, 63V or 100V capacitor and a 47kΩ surface-mounted resistor. P.B.

Philips 2A Chassis

Flyback lines in one colour visible on dark scenes are caused by an open-circuit resistor on the tube base PCB. Check R3447 for red, R3427 for green or R3407 for blue lines. They are all 300kΩ resistors. P.B.

JVC AV21SXLEK

A high-pitched buzz could at times be heard from this set. The culprit turned out to be the line linearity coil L521. I've also known the line output transformer cause this problem. M.K.

Panasonic Euro 1 Chassis

Failure of the TDA8175 field output chip IC561 was the cause of partial or complete field collapse. I replaced IC561 and fitted an MA2100 diode in place of link B51, with its cathode towards D562 and R566. Kit part no. TZ55EK001. M.K.

Sony KVM1410U (BE2A Chassis)

There was very intermittent tuning drift – changing channels would often restore the picture and sound. After a long search the cause of the problem was traced to the VIF coil L501. A replacement cured the fault. M.K.

Samsung CI5070AN (US60A Chassis)

There was intermittent loss of audio and a blank raster. We've had similar faults, sometimes very intermittent. The cause always turns out to be one or other of the 1N4003 diodes D801/2, which diodes sup-

ply the 12V regulators IC801 and IC802 and go high-resistance.

When the 1N4003 diode D503 develops leakage you get no or a very dark picture. Check the output from IC802: it will probably be low.

Our policy is to replace all three diodes when one of these sets suffers from intermittent faults. M.K.

Bush/Alba 2857NTX/A

This set came on with a blank screen and the front panel keys inoperative. A check on the 5V supply showed that it was correct at switch-on but dropped to 3.4V when the set was brought out of standby. The cure was to replace IC103. M.K.

JVC C14ET1

This portable suffered from lack of height, which varied at random sometimes declining to field collapse. The 0.68Ω fusible resistor R431 in the field scan supply line was to blame: its resistance varied wildly when the leads were stressed. There was no other fault in the field scan circuit, which drew 140mA from the restored 24V supply.

A week later the set came back with the complaint that it had "failed again". And so it had: there was nothing on the screen and no sound, just the pilot light glowing. This time R434 in the 14V supply had failed. G.C.

Sony KVM1421/ KVM1621 (BE2A Chassis)

There was no picture or sound with these two teletext sets. The screens were blank except for the channel number etc. displays, so at least the power supplies and timebases were working. The only fault I could find on the main board was absence of the sync signal. With a teletext set this comes from the text board (V), so I checked here.

The 12V supply at pin 16 of IC02 was very low because R04, a 470 Ω , 0.5W chip resistor, was open-circuit. This was odd, because the resistor has to dissipate only 10mW – unless the 13V zener diode it feeds goes short-circuit, which it hadn't. New resistors in both sets restored normal operation and didn't get hot. Perhaps the wrong value had been fitted originally. G.C.

Tatung 190 Chassis

The picture and sound both showed signs of going out of tune and pulsed for two seconds after a channel change. This happened on all channels. The fault was cured by adjusting the vision detector coil L102, which is labelled "tank" on the PCB. G.C.

Hitachi G6P Chassis

One of these sets had a very unusual picture fault. At switch-on the picture would be normal for a minute or two. It would then shrink away from the right-hand side of the screen, leaving a black area with a wavy, irregular border. As the symptoms became worse the picture would narrow, lose all colour and shift to the left until the whole screen was blank.

Prime suspects were the line output transformer and the colour decoder/timebase generator chip IC501, but both proved to be blameless. The cause of the trouble was one of the line output stage tuning capacitors, C782. It's one of a series-connected pair: their junction supplies a feedback pulse to the line sync circuit in IC501.

Incidentally the tuning capacitors in the set concerned had much higher values than those shown in the circuit diagram: C782 was 2.2nF, 2kV, C785 15nF, 400V and C781 7.5nF, 1.6kV. G.C.

Tatung D Chassis

There was a small but perfectly formed picture. After rebuilding the entire field output stage to no avail, and seriously thinking about telling the customer that it was a wide-screen set, I decided to have a word with Tatung.

"Aha" said the nice man, "check R504 (3.3M Ω) and that the 33V line isn't low." He was quite right. The 33V line provides, via R504, a voltage source for the field ramp generator circuit. It was at less than 10V. Replacing the TAA550 33V stabiliser IC001 and its feed resistors R015/6 (both 6.8k Ω) restored full height. Pity that the customer hadn't mentioned having to retune his set! G.D.

Philips CP110 Chassis

After fitting the power supply service kit and replacing the main reservoir and the HT electrolytics I still had a dead set. I was about to delve into the power supply again when I remembered that I'd had this fault before. The nicad back-up battery voltage had fallen to 1.7V. A replacement restored the sound and picture. It seems that a dubious pattern part was the problem: the battery had obviously only recently been changed. G.D.

Sony K VX2152U

The fault symptoms ranged from shimmering on-screen graphics and changes in volume level to a blank raster with a strange high-pitched noise through the speakers. After a lot of searching – the faults were very intermittent – I found dry-joints at IC604 and D612. Unfortunately they can't be seen until the plastic chassis support has been removed. J.T.

Hitachi C2846TN

If one of these sets appears to be dead, with only the standby light showing, check for dry-joints at IC952. J.T.

Panasonic Alpha 4 Chassis

A blank screen greeted me when I switched this set on. The on-screen graphics were still displayed, which indicated that the RGB circuitry was OK, and further checks proved that audio and video outputs were available via the scart connector. Checks around the IF processor chip IC101 revealed that the 9V supply at pin 41 was low. This supply comes via R170 (56 Ω) which had increased in value. Once this item had been replaced there was a perfect picture. B.S.

Ferguson TX100 Chassis (Stereo)

Although the sound from both speakers was very distorted there was nothing wrong with them or with the TA7227P dual power amplifier IC3 on the rear PCB. The cause of the fault was associated with the TA7630P stereo analogue sound control chip IC2.

Left and right sound signals are fed into this IC at pins 2 and 15, along with a 5.8V bias that's obtained from pin 16. As the 330 μ F, 16V decoupling capacitor connected to pin 16 was short-circuit there was no bias. Despite this gross DC error, some sound still emerged.

In addition to replacing this capacitor I found it necessary to increase the audio gain by adding a

100 Ω resistor across R37 (left channel) and R38 (right channel). These resistors are near IC3. G.C.

Goodmans 2170

This six-year old set suddenly became stone dead without any prior warning. The mains rectifier system was working all right, but there were no outputs from the power supply because R108 (270k Ω) was open-circuit. As usual we upgraded it to a larger 1W type. G.C.

Sony KVM1440U (BE4 Chassis)

This three-year old portable produced a dark screen with faint, unsynchronised hash instead of a picture. Its owner had discovered that the picture would appear if the aerial plug was pushed in very hard. So all we had to do was "to mend the aerial socket".

In fact in the no picture condition there was still a video output at pin 19 of the scart socket, so the receiver was still working. The chroma processing chip IC301 sits half-way up the PCB: off-air video enters at pin 40. A blue wire added on the print side also took the signal at pin 40 to a front panel socket, J1401. The cause of the fault was the fact that pin 40 was soldered to the blue wire but not to the PCB pad – the good joint obscured the bad one. G.C.

Salora M Chassis

This set was OK in standby, but at start-up there was a horrible, rasping, tripping noise. It took me some time to trace the cause of the trouble – DB521 (1N4148) was leaky. This diode is in the standby switching circuit. You will find it next to the connector that supplies heater current to the CRT base.

The set was a Finlandia Model C66GZ7. C.J.G.

Boots Portable (Onwa Chassis)

This portable produced a small picture because the HT was low. The cause of the problem was R608 in the set-HT potential divider network – at the earthy end. It had risen in value from 3.3k Ω to 4.35k Ω .

The resistor has different reference numbers (including R403, R903 and R904) in other Onwa chassis. C.J.G.

Hitachi NP83CQ Chassis

There was no teletext operation. I found that transistor Q142 (BC548) on the remote control panel was short-circuit emitter-to-base. It

buffers the clock feed to the text panel.

The set was a GEC Model C2287. C.J.G.

Philips CP90 Chassis

This set produced a very dull picture – but only when connected to the mains supply directly. When the set was connected via our isolated supply the picture was fine. When the chassis was removed from the cabinet the cause of the fault became obvious: the connection to the CRT's Rimband had come adrift. Reconnection cured the fault. Any ideas on why the set worked correctly with an isolated supply? C.J.G.

Salora M Chassis

With this set in standby there was a loud whistling noise. The cause of the fault was the TDA8172 field output chip ICB570 which was short-circuit between the $\pm 13V$ rails but not to chassis. C.J.G.

Panasonic Z5 Chassis

This set was dead with no power supply activity though the 300V supply was present across the mains bridge rectifier's reservoir capacitor. The cause of the trouble was the STR51424 chopper chip which had an internal short between pins 2 and 4. C.J.G.

Philips K40 Chassis

Note that the orientation of the TDA3576B sync chip IC7200 is marked incorrectly on the component side of the PCB. Guess how I found out! Fortunately the chip wasn't damaged. C.J.G.

Finlux 3000 Series

If the problem with one of these sets is that the EW modulator diodes Dz7 and Dz8 are faulty, the scan coupling capacitor Cz19 (value depends on tube type) should also be checked. It tends to overheat, and you may not notice a small amount of EW correction error when the set is working. Also check the BD241A EW modulator driver transistor Tk4 which may be leaky. C.W.

Philips 2A Chassis

Two of these sets came in together with similar symptoms. They would both go off after a while. One would come back on by itself while the other one had to be switched off then on again to restart it. The first set had an intermittently open-circuit line driver transformer winding. The second set had

a crack in the line output transistor's insulation pad. C.W.

Finlux 5000 Series

This set worked perfectly when switched on using the mains switch. But if it was put into standby then asked to come back on by remote control it made an odd noise and remained in standby. The 7V supply rectifier Du4 (BYS27-45) was faulty. C.W.

Grundig TVR5504

The complaint was "intermittently dead", though the VCR section continued to operate. The latter is a separate unit in this combi model. On test the TV section worked for hours: no amount of thrashing, heating or cooling instigated the fault. When it did eventually appear, no such efforts would restore normal operation. The cause was nevertheless a dry-joint in the line output stage.

On close inspection the LOPT's joints looked perfect. But when an iron was applied to the connection to the line output transistor's collector it splattered and solder wouldn't run on to the PCB copper, though it flowed on to the pin. Cleaning the PCB track and resoldering cured this awkward fault. C.W.

Hitachi CAP162

This very old 16in. set had a dark picture and the CRT seemed to be very sad. A few checks were made before we condemned the set to the skip. This revealed that the first anode supply was very low at only 160V. C714 (2,200pF, 1kV) was open-circuit. A replacement produced very good results. C.W.

Toshiba 2539DB (C2DB Chassis)

This Dolby Pro-Logic set came in with the complaint "no 16:9 switching". My first thought was that a huge chip at a huge price would be required. But no, Q305 (2SC1815-GR) in the switching circuit was short-circuit base-to-emitter. It costs only a few pennies. C.W.

Finlux 5000 Series

One of these sets was dead but made funny noises. The mains bridge rectifier's reservoir capacitor Cu34 (220 μ F, 385V) was open-circuit. C.W.

Amstrad CTV280N

This large set had a width problem: the picture was about two inches in at each side of the screen. The pin-cushion control worked but the

width control had no effect. R423 (2.2k Ω), which is connected to one end of the width control, was open-circuit. M.Dr.

Mitsubishi CT29A4STX (Euro 12 Chassis)

When this set came on it produced a burst of EHT then tripped out. Checks showed that the HT rose to 200V before the trip. The culprit was C906 (47 μ F, 50V) in the chopper transistor's base drive circuit: its value had dropped to about 20 μ F. As it is mounted next to a hot heatsink, a replacement should be rated at 105°C. M.Dr.

Matsui 2899N

When standby was requested the LED channel display went off and the sound muted but the picture was still there. The culprit was relay RY101 on the power PCB. Its contacts were welded together. M.Dr.

Amstrad CTV1410 (Onwa 8214 Chassis)

If there's reduced height, check the voltages at R302 (6.8k Ω , 5W). There should be 112V at one end and 9V at the other. In this particular case the 9V supply was low at 5.98V because R302's value had risen to 9.35k Ω . This resistor provides the supply for pin 21 of the TA8718N colour decoder/timebase generator chip. It usually goes open-circuit – the result is then a dead set. M.Dr.

Mitsubishi CT21A3STX (Euro 12 Chassis)

This set had no teletext and the picture had shifted to one side horizontally. The cause of the problem was the EEPROM (IC702). Purchase of a service manual turned out to be a better proposition however as it's about the same price as a ready-programmed EEPROM and describes in detail EEPROM reprogramming. This is usually all that's required. M.Dr.

Goodmans 1430R (Onwa 8214 Chassis)

This set was dead though the power supply was OK and the standby light worked. A check at pin 21 of the TA8718N colour decoder/timebase generator chip IC301 showed that the 9V supply was missing. R302 (6.8k Ω , 5W) in the feed was open-circuit. M.Dr.

Tatung 195 Chassis

This set worked after the usual control membrane replacement, but the picture was very plastic and lacked contrast. The grey-scale tracking,

the RGB drive voltages and the tube's first anode supply were all correct. When the 0.33Ω resistor R903 in the heater supply on the tube base panel was checked the reading was 8Ω. Problem solved. When it was removed and inspected however the marked value was 8.2Ω – and it was the original resistor!

Presumably the tube had been underrated from new, but it was non-the-worse for that: the correct-value heater ballast resistor produced an as-new picture. The set was actually a Boots Model CTV1411R. C.A.

Mitsubishi CT25A4STX (Euro 12 Chassis)

Hum in standby and no degaussing were the reported symptoms, which had an unexpected common cause. In this chassis the 24V supply powers the audio amplifier and, unusually, provides auto-degaussing via a relay. The supply's reservoir capacitor C960 (1,000μF, 35V) had dried up. A replacement cured both symptoms.

We also replaced the chopper transistor's base coupling capacitor C906, using a 47μF, 63V type rated at 105°C. This reduces the likeli-

hood of high HT developing, with destruction of the line and/or field timebase. C.A.

Philips GR1-AX Chassis

This set wouldn't come on – there was just buzz. The power supply was OK, but there was no feed to the transistors in the line driver stage (Tr7521 and Tr7523) because coil L5524 was open-circuit. C.A.

Ferguson TX99 Chassis

After replacing a faulty on/off switch we found that there was excessive width and the HT was only 100V. The line scan coil plug PL/SK23 can be fitted either way round to PL/SK4 on the main PCB: at some previous time it had been reversed. When we fitted it correctly the width was dramatically reduced. It became normal when the HT had been reset to 115V. C.A.

Finlandia C59HZ6 and similar (Salora M Chassis)

Here's something to add to Michael Dranfield's useful information (page 492, May 1997) on the apparent failure of some Granada sets to memorize on channel positions 1-4 only. This particular

model requires a special remote-control button sequence to store on these positions – presumably to reduce call-outs from renters playing with the search/store buttons and loosing stored channels.

To store channels on positions 1-4, find the required signal then press A/RED, 0/AV, STEP and STORE in sequence. My thanks to an unknown but helpful Granada engineer on the end of a phone in Exeter for this valuable piece of inside information. C.A.

Alba CTV10

This almost Nikkai Baby 10 type set had an intermittent, fluctuating picture that would sometimes disappear into a faint red raster with flyback lines. The source of a voltage variation consistent with the random fault was eventually traced to the collector of Q301, which is part of the on-screen display drive circuitry.

When this 2SC1815 transistor was removed, a tiny spot of board contamination was seen underneath. We cleaned the area and, as a precaution, fitted a replacement BC546 transistor. This cleared the fault permanently. C.A.

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

Is it worthwhile?

I have recently completed my annual assessment of income against outgoings. This is a depressing ritual I put myself through each year. It has nothing to do with tax returns and suchlike but is purely for my own benefit, to help me gauge how well or otherwise I'm doing. To be honest, it's usually a time of reflection and heart-searching as to whether to continue or seek other work.

It is easy, when you are self-employed, to lose track of how your income and thus living standard compares with engineers on PAYE or in other trades that require equivalent skills. Mind you, it's hard to think of many trades as technical as ours where so many are self-employed and work from home. So, after being brutally honest with myself and deducting *all* expenses, i.e. petrol, phone, paperwork, workshop upkeep etc. and not just the obvious ones such as parts against each job, I am left with the actual in-pocket profit earned from each job, and thus a weekly wage packet figure. That's the depressing bit!

I then use this information not only to compare real profit with previous years but also to enable me to see at a glance which products, i.e. TV sets, VCRs, monitors, Hi-Fis, camcorders etc., earn the most money. Not surprisingly, as in all previous years the first two topped the list as the most common repairs and the most profitable. At the bottom of the list came Hi-Fi, which is

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profitable but for which there is a much reduced demand. The reason for this is probably that £99 midi systems most often require repair, and customers consider a quote over £25 including parts to be too high. Many engineers don't touch Hi-Fi jobs because the modern, ultra-compact designs mean that they can be a pain to work on and take ages to repair. However, on the odd occasion when a quote that takes this into account is accepted the job can make a useful contribution to income.

At various times during the year I try different approaches to boost my work load. I might advertise free estimates, home calls etc. for a couple of months, though I do begrudge doing anything for free. I may then try altering call out/estimate charges etc. for a set period, or offer a free collection/delivery service. You name it, during the year I try it. All this jiggery-pokery with work practices is carefully assessed and analysed.

One thing which stuck out like a sore thumb during this year's assessment was the fact that there was a marked drop in the conversion of phone enquiries into actual jobs no matter how much the call-out charge, estimate charge, minimum charge – call it what you will – was increased or lowered: only during the 'free this and that' period did the work load increase – but so did the number of time-wasters and therefore the losses. It seems, on balance, that offering free services in an attempt to generate work wins me popularity but doesn't increase my earnings.

Lately I've noticed an increased demand for phone quotations, which I don't give. I long ago learnt that no matter how cheap your guess (sorry, I mean quote) you still won't get the job. They just continue to phone around. There's no doubt about it: despite politicians telling us that we live in such a rich country, the people living in it are as broke as ever.

My conclusion this year, as far as the repair trade is concerned, is that profits are continuing to fall year-on-year. At the current rate, by the year 2005 I'll be paying the customer to repair his equipment. Perhaps I'm fortunate in that, over twenty five years, I've built up a large customer base. Yes, I know, there's no such thing as a loyal customer: but at least I stand a chance of quoting for the job first.

When I attended a course on digital TV recently I noticed that the age group of the trade audience was thirty-fifty. It consisted almost entirely of small-shop traders and those working from home. The course was very informative, delving into the transmission systems etc. and, in block diagram form, receiver theory. All the time the lecturer was speaking I was waiting for some indication as to how the trade was going to cope with the servicing and repair problems, what with densely-packed miniaturised components mounted on two-three layers of circuit board! After a while it became obvious that others felt the same way. During a pause while the lecturer caught his breath, the audience pounced, firing question after question at him – all relating to fault diagnosis and repair problems.

He had a stock answer – "with great difficulty" – and explained that very expensive specialised test equipment, not yet in production, will be needed. He emphasised that we would have to "throw away" our present-day theory and practical methods, then went on enthusiastically about this exciting challenge. Needless to say, this didn't go down too well – the audience seemed even more disturbed! Some mumbled amongst themselves, others out loud, questioning what the course was for: they are in the repair business and, with limited manufacturers' back-up, falling income, more expensive test gear and a whole new ball game to learn, they won't be able to fix these things. We all departed somewhat depressed. I

guess it's a sign of the times.

I always seem to have my head buried in a technical book or *Television*: the study time required in our trade must, I'm sure, be comparable to the highest academic professions. Shame the rewards aren't.

I've often wondered why brown goods manufacturers seem to be hell bent on shooting themselves in the foot and ruining the service industry as well. No other industry spends millions on research and development to create products known to be wanted by everyone, then sells them as cheaply as possible, occasionally even giving them away! The industry knows that sophisticated, high-quality products with an assured market could sell at premium prices. But no.

Please someone tell me if I'm wrong, that it's not the beginning of the end. But do explain why.

*John Edwards,
Welling, Kent.*

Preparing for Digital TV

I read with interest your leader, under the above heading, in the April issue. The second half criticised manufacturers of digital prod-

ucts for not providing relevant training for the trade. I would like to set out Pace Micro Technology's record in this respect.

Pace is well known in the industry for providing first-class, free-of-charge technical training and technical support. We try to work closely with the trade to encourage excellence in the field. We have already manufactured over a million and a quarter digital satellite receivers that have been distributed in fifteen countries throughout the world, and have conducted countless training courses for those who provide servicing facilities. We are now offering the same expertise and level of support in the UK.

In fact our UK support started as far back as 1995, when we held a successful series of digital seminars at venues ranging from Aberdeen to Plymouth. These were designed to explain the basics of digital technology, and over 600 delegates attended.

This year we have intensified our digital awareness campaign. We recently distributed over 3,000 copies of the latest edition of our technical newsletter, *Service*

Matters, which was largely devoted to digital television and in which we pledged to support dealers as comprehensively as possible through the digital era.

Now that BSkyB digital satellite transmissions will shortly be available, we've decided that it is time to announce a series of 'Product Knowledge' courses. These will be held at Saltaire, West Yorkshire in late May/early June. They will be semi-technical, the main objectives being to explain the digital satellite transmission system, familiarise those attending with the operation of a digital satellite receiver, and explore servicing issues such as equipment requirements. Full details, including dates and how to apply for places, will be published at our Web site shortly - where, incidentally, a wealth of other service information can be found. Alternatively, details are available from our service department.

Finally, as always, the members of our technical support team - all well-versed in digital technology - are at the end of a phone, fax or e-mail line and can be relied on to provide specific and on-going sup-

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port. As manufacturers we are looking forward to sharing our expertise and playing our part in making this new era in UK television history a success.

*Bill Fraser,
General Manager, Service,
Pace Micro Technology plc.,
Saltaire, West Yorkshire.*

Fraud

I think I can beat Rex Webb's experience (Letters, March, page 367). Late last year I was called out to repair a 28in. Toshiba TV set which was dead. During the course of our conversation the owner mentioned that it had been looked at by someone else who had told her it would need major repairs and had got her to sign a form that allowed him to carry out repairs up to £200. He then took the set to his workshop. Having ascertained that the customer's household insurance included accidental damage, the repairer suggested that he should keep the set and give her a report to say that there had been liquid spillage. He said that the insurance company would then supply her with a brand new set. Fortunately the customer by now didn't trust the engineer, and after threatening to go to the police managed to get her set back. This is where I became involved. The fault was simply a blown mains fuse because the degaussing posistor had gone short-circuit. A new fuse and posistor restored the set to working order.

A couple of weeks later I received a call from another customer whose Akai TV set (ITT chassis) was dead apart from a squealing noise that came from the power supply. The same repairer had called, told the customer that the tube had failed, and said that he would provide a report to enable the customer to make an insurance claim. The customer had the good sense to throw him out and sought a second opinion, from me. The fault was in the power supply to the audio output chip. Repair cost to the customer: £68.

This engineer has been deliberately trying to obtain TV sets by deception, and is enticing his customers to make, unwittingly, fraudu-

lent claims on their insurance. Although I contacted my insurance broker to tell him about the scam, he told me that unless a claim was made nothing could be done. If the customer had made such a claim and was found out, he/she could be blacklisted by the insurance companies and could possibly face a criminal charge for fraud.

*Michael Maurice,
Wembley, Middx.*

Americanisms

I have always enjoyed reading each month's leader. Sometimes I feel that it is tongue-in-cheek, sometimes I find it informative, sometimes it's just what I would have said, and sometimes it's absolute blather – but it's always interesting enough to read right through to the end. I wonder why it doesn't bring in more comments?

The May leader touched on a subject that has annoyed me for years – Americanisms. When I was young I was employed by a large American company to repair the then latest electromechanical equipment at very great cost to the customer. This cost was almost obscene, and often included a flight to and from the repair, car hire from the airport, meals, and an overnight stay at a good hotel. Some of the repairs simply consisted of replacing a fuse (thermal overload cutout device), bending a relay lever back into position (rebias electrical relay), or even banging a nail in (fit percussion-driven friction fastener). When I queried the terminology, I was told that the customer would far more happily pay for something that seemed to be complicated than something that sounded as if he could have done it himself.

There are hidden languages in the UK. For example "without resiling" is a term used only by solicitors. Roughly speaking, it translates as "we are going to charge you for a call-out to the Bahamas, a two-week soak test and expenses to replace your fuse".

*John Hopkins,
Felixstowe, Suffolk.*

Watch this space: more blather soon – Editor.

Service Manuals

I share Shane Humphrey's disgust (letters, April) about the so-called service manuals now being sold. A TV serviceman needs more than the original handbook supplied with the set. The minimum requirements for a manual should be: circuit diagrams

for the prototype; a list of all subsequent modifications; a parts list; and a brief description of the model. I consider it fraudulent to sell as a service manual something that doesn't contain these features.

The finest TV manual I ever came across was that for the Rank A823 series chassis.

*K.J. Treeby,
Plymouth, Devon.*

Drive Belts

Drive belts are often the cause of faults and require replacement. But selecting a replacement is usually a matter of guesswork if you don't have a spare parts manual that specifies the diameter.

I thought I would try a slightly more scientific approach. Assume (see Fig. 1) that there are two pulleys. Measure the radii R1 and R2 and the distance C between the two centres. The approximate overall length of the drive belt path is then given by

$$\pi R1 + \pi R2 + (2 \times C).$$

This assumes that the belt goes exactly half way round each pulley, which is near enough for practical purposes though it goes more than half way round the large one and less than half way round the smaller one.

Excluding any allowance to keep the belt in tension, this path length is the circumference of the drive belt needed as a replacement. To find its diameter, divide by π . Thus the formula becomes

$$[\pi R1 + \pi R2 + (2 \times C)]/\pi$$

$$= R1 + R2 + (2C/\pi)$$

$$= R1 + R2 + (C/1.57).$$

For example, if R1 is 20mm, R2 is 10mm and C is 45mm, the calculation is

$$20 + 10 + 28.6\text{mm} = 58.6\text{mm}.$$

What I don't know, and perhaps someone more knowledgeable could tell us, is how much smaller the drive belt needs to be to provide a good grip on the pulleys without straining the bearings. If a 10 per cent reduction is appropriate, the new drive belt would be 52.7mm or say 53mm.

All this is very rough and ready. Can anyone explain the correct way to work out the diameter?

*David Martin,
Bishop's Stortford, Herts.*

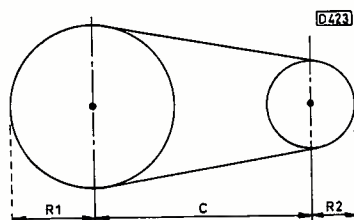


Fig. 1: Drive belt calculation.

TRANSISTORS/LINEAR ICs

Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price
BC107	8p	BD434	30p	BU126	65p	BUV484F	325p	MJ4502	300p	4N35	50p	LINEAR ICs		AN6340	600p	BA335	55p
BC108	8p	BD435	31p	BU128	125p	BUV48F	250p	MJ10012	300p			AN203	210p	AN6341	200p	BA338	80p
BC109	8p	BD436	30p	BU133	125p	BUV50	425p	MJ11015	250p			AN203	210p	AN6342	325p	BA340	75p
BC109C	10p	BD437	28p	BU137	150p	BUV61	1000p	MJ11016	250p	RECTIFIER DIODES		AN211	150p	AN6344	440p	BA343	60p
BC140	20p	BD438	36p	BU180	100p	BUV70	205p	MJ11033	800p			AN214Q	170p	AN6345	400p	BA336	175p
BC142	20p	BD439	40p	BU184	100p	BUV90	175p	MJ11033	800p			AN217P	95p	AN6346	350p	BA401	60p
BC143	20p	BD440	40p	BU204	65p	BUV93	375p	MJ15003	250p			AN227	280p	AN6350	610p	BA502	60p
BC147	8p	BD441	40p	BU205	70p	BUW11A	200p	MJ15004	250p			AN228	150p	AN6352	450p	BA511	145p
BC149	8p	BD533	50p	BU206	100p	BUW11AF	225p	MJ15015	250p			AN229	150p	AN6356	300p	BA514	160p
BC154	8p	BD534	38p	BU207	150p	BUW12A	150p	MJ15016	350p			AN232	150p	AN6359	500p	BA516	150p
BC160	30p	BD535	38p	BU208	70p	BUW12F	250p	MJ15023	400p			AN237	230p	AN6362	300p	BA518	150p
BC171	10p	BD536	38p	BU208A	75p	BUW13A	200p	MJ15024	400p			AN240	250p	AN6363	375p	BA524	240p
BC172	10p	BD537	40p	BU208AT	200p	BUW32A	200p	MJ15025	700p			AN277B	400p	AN6367NK	400p	BA526	180p
BC177	14p	BD645	50p	BU208D	200p	BUW48	550p	MJE340	25p			AN277B	450p	AN6368	275p	BA527	95p
BC178	14p	BD646	50p	BU209	90p	BUW49	550p	MJE350	80p			AN301	330p	AN6371	50p	BA532	100p
BC182	7p	BD647	50p	BU225	120p	BUW81A	150p	MJE355T	65p			AN302	650p	AN6387	480p	BA534	220p
BC182L	7p	BD649	50p	BU226	120p	BUW81A	150p	MJE355T	65p			AN303	250p	AN6388	100p	BA536	150p
BC183	7p	BD675	90p	BU227	90p	BUW81A	150p	MJE355T	65p			AN304	360p	AN6390	50p	BA546	160p
BC183L	7p	BD676	40p	BU228	55p	BUW81A	150p	MJE355T	65p			AN315	250p	AN6392	45p	BA612	120p
BC184	7p	BD677	40p	BU229	75p	BUW81A	150p	MJE355T	65p			AN316	350p	AN6393	80p	BA614	70p
BC184L	7p	BD678	40p	BU230	75p	BUW81A	150p	MJE355T	65p			AN317	600p	AN6394	150p	BA617	120p
BC212	7p	BD679	40p	BU406D	85p	BUX1	150p	MJE13009	100p			AN318	100p	AN6395	35p	BA631	250p
BC212L	7p	BD680	40p	BU407	55p	BUX20	350p	MJE15028	200p			AN319	140p	AN6396	60p	BA656	110p
BC213	7p	BD681	45p	BU407D	75p	BUX21	450p	MJE15029	200p			AN320	150p	AN6397	45p	BA658	350p
BC213L	7p	BD682	45p	BU408	60p	BUX22	450p	MJE15030	250p			AN321	150p	AN6398	45p	BA681A	350p
BC214	7p	BD683	45p	BU408D	75p	BUX23	450p	MJE15031	250p			AN322	150p	AN6399	45p	BA682A	300p
BC214L	7p	BD707	50p	BU409	85p	BUX24	220p	MJE18004	125p			AN323	300p	AN6400	425p	BA683A	300p
BC237	7p	BD711	50p	BU412	175p	BUX25	220p	MJE18004	125p			AN324	300p	AN6401	425p	BA684	400p
BC238	7p	BD712	50p	BU413	175p	BUX26	220p	MJE18004	125p			AN325	300p	AN6402	425p	BA685	400p
BC239	7p	BD736	50p	BU414	250p	BUX27	220p	MJE18004	125p			AN326	300p	AN6403	425p	BA686	400p
BC300	20p	BD825	25p	BU415A	170p	BUX28	200p	OC28	350p			AN327	300p	AN6404	425p	BA687	400p
BC301	20p	BD826	25p	BU423A	70p	BUX29	200p	OC29	350p			AN328	300p	AN6405	425p	BA688	400p
BC302	20p	BD827	25p	BU426	70p	BUX30	200p	OC35	350p			AN329	300p	AN6406	425p	BA689	400p
BC303	20p	BD828	25p	BU433	120p	BUX31	200p	OC36	350p			AN330	300p	AN6407	425p	BA690	400p
BC303	20p	BD829	25p	BU436	120p	BUX32	200p	OC36	350p			AN331	300p	AN6408	425p	BA691	400p
BC304	25p	BD899	50p	BU500	100p	BUX33	200p	S2000A3	175p			AN332	300p	AN6409	425p	BA692	400p
BC304	25p	BD899	50p	BU500D	225p	BUX34	200p	S2000AF	130p			AN333	300p	AN6410	425p	BA693	400p
BC327	7p	BD977	7p	BU505	90p	BUX35	200p	S2055A	175p			AN334	300p	AN6411	425p	BA694	400p
BC328	7p	BDX33	60p	BU505D	90p	BUX36	200p	S2055AF	175p			AN335	300p	AN6412	425p	BA695	400p
BC337	7p	BDX37	100p	BU505DF	90p	BUX37	200p	S2530A	100p			AN336	300p	AN6413	425p	BA696	400p
BC338	7p	BDX44	100p	BU506	100p	BUX38	200p	TIP29	25p			AN337	300p	AN6414	425p	BA697	400p
BC341	28p	BDX47	100p	BU506D	70p	BUX39	200p	TIP29A	25p			AN338	300p	AN6415	425p	BA698	400p
BC446	28p	BDX54C	75p	BU506DF	100p	BUX40	200p	TIP29C	25p			AN339	300p	AN6416	425p	BA699	400p
BC471	12p	BDX62C	125p	BU507	90p	BUX41	200p	TIP29D	25p			AN340	300p	AN6417	425p	BA700	400p
BC516	28p	BDX63C	175p	BU508AF	95p	BUX42	200p	TIP30	25p			AN341	300p	AN6418	425p	BA701	400p
BC537	25p	BDX64C	175p	BU508APH	80p	BUX43	200p	TIP30C	25p			AN342	300p	AN6419	425p	BA702	400p
BC546	25p	BDX66C	175p	BU508D	75p	BUX44	200p	TIP31A	25p			AN343	300p	AN6420	425p	BA703	400p
BC547	25p	BDX68C	175p	BU508DF	85p	BUX45	200p	TIP31C	27p			AN344	300p	AN6421	425p	BA704	400p
BC548	25p	BDX67C	175p	BU508DR	130p	BUX46	200p	TIP32	27p			AN345	300p	AN6422	425p	BA705	400p
BC549	25p	BDX71	70p	BU508V	110p	BUX47	200p	TIP32A	27p			AN346	300p	AN6423	425p	BA706	400p
BC550	25p	BDX77	175p	BU508VF	100p	BUX48	200p	TIP32C	28p			AN347	300p	AN6424	425p	BA707	400p
BC556	8p	BDX87C	175p	BU526	75p	BUX49	200p	TIP33	28p			AN348	300p	AN6425	425p	BA708	400p
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BC559	8p	BDW5	90p	BU563	125p	BUX52	200p	TIP34C	60p			AN351	300p	AN6428	425p	BA711	400p
BC560	8p	BDW9	50p	BU566D	225p	BUX53	200p	TIP35C	65p			AN352	300p	AN6429	425p	BA712	400p
BC567	20p	BDY29	225p	BU608D	120p	BUX54	200p	TIP36C	65p			AN353	300p	AN6430	425p	BA713	400p
BC569	20p	BDY56	225p	BU626	120p	BUX55	200p	TIP41A	22p			AN354	300p	AN6431	425p	BA714	400p
BC639	20p	BDY90	500p	BU706F	100p	BUX56	200p	TIP41C	22p			AN355	300p	AN6432	425p	BA715	400p
BC640	200p	BDY90	500p	BU706F	100p	BUX57	200p	TIP42A	22p			AN356	300p	AN6433	425p	BA716	400p
BCY34	200p	BDY92	100p	BU724A	150p	BUX58	200p	TIP42C	22p			AN357	300p	AN6434	425p	BA717	400p
BCY70	16p	BF137	35p	BU724A	100p	BUX59	200p	TIP42	22p			AN358	300p	AN6435	425p	BA718	400p
BCY71	16p	BF167	35p	BU801	70p	BUX60	200p	TIP48	40p			AN359	300p	AN6436	425p	BA719	400p
BCY72	16p	BF175	35p	BU806	70p	BUX61	200p	TIP50	60p			AN360	300p	AN6437	425p	BA720	400p
BD115	30p	BF183	20p	BU807	80p	BUX62	200p	TIP51	60p			AN361	300p	AN6438	425p	BA721	400p
BD124P	50p	BF195	7p	BU807F	75p	BUX63	200p	TIP52	80p			AN362	300p	AN6439	425p	BA722	400p
BD131	25p	BF199	8p	BU808DF	210p	BUX64	200p	TIP53	80p			AN363	300p	AN6440	425p	BA723	400p
BD132	25p	BF200	16p	BU810	110p	BUX65	200p	TIP102	70p			AN364	300p	AN6441	425p	BA724	400p
BD133	25p	BF225	30p	BU824	60p	BUX66	200p	TIP105	65p			AN365	300p	AN6442	425p	BA725	400p
BD134	25p	BF230	30p	BU826	120p	BUX67	200p	TIP106	65p			AN366	300p	AN6443	425p	BA726	400p
BD136	20p	BF245	25p	BU826A	160p	BUX68	200p	TIP107	65p			AN367	300p	AN6444	425p	BA727	400p
BD137	20p	BF254	15p	BU902	110p	BUX69	200p	TIP110	65p			AN368	300p	AN6445	425p	BA728	400p
BD138	20p	BF255	12p	BU903	110p	BUX70	200p	TIP111	65p			AN369	300p	AN6446	425p	BA729	400p
BD139	20p	BF256	12p	BU910	80p	BUX71	200p	TIP112	35p			AN370	300p	AN6447	425p	BA730	400p
BD140	20p	BF257	12p	BU911	100p	BUX72	200p	TIP115	35p			AN371	300p	AN6448	425p	BA731	400p
BD144	90p	BF259	18p	BU920	100p	BUX73	200p	TIP115H	30p			AN372	300p	AN6449	425p	BA732	400p
BD157	30p	BF															

LINEAR ICs/JAPANESE TRANSISTORS

Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price		
TA8164P	100p	TD1A180	120p	TD1A270	400p	TD1A461	225p	TD1A8391	675p	UPC1004C	130p	25A771	90p	25A1177	25p	25B561	30p	25C738	15p
TA8184P	350p	TD1A185A	190p	TD1A270	600p	TD1A4670	475p	TD1A8395	360p	UPC1009	950p	25A773	50p	25A1179	20p	25B562	20p	25C739	150p
TA8189P	130p	TD1A185B	80p	TD1A271	270p	TD1A4680	350p	TD1A8405	550p	UPC1018	170p	25A777	35p	25A1182	20p	25B564	15p	25C771	150p
TA8200AH	100p	TD1A200B	180p	TD1A275	150p	TD1A4700	275p	TD1A8415	850p	UPC1020	200p	25A778	100p	25A1184	100p	25B566	10p	25C782	150p
TA8201AK	220p	TD1A210	80p	TD1A282M	80p	TD1A4700A	75p	TD1A8416	625p	UPC1023	60p	25A781	150p	25A1185	200p	25B568	50p	25C783	85p
TA8205	220p	TD1A235	300p	TD1A282A	85p	TD1A4714C	350p	TD1A8417	550p	UPC1024H	27p	25A786	25p	25A1186	500p	25B569	30p	25C790	50p
TA8207K	175p	TD1A236	240p	TD1A2840	200p	TD1A4716C	450p	TD1A8421	600p	UPC1025	230p	25A794	50p	25A1198	40p	25B600	500p	25C792	380p
TA8210	260p	TD1A251	150p	TD1A3047	100p	TD1A4718A	250p	TD1A8425	600p	UPC1026	95p	25A798	30p	25A1201	40p	25B601	60p	25C805	225p
TA8211AH	240p	TD1A270	150p	TD1A3048	130p	TD1A4725	750p	TD1A8432	550p	UPC1028	90p	25A812	15p	25A1202	25p	25B605	25p	25C828	20p
TA8214K	260p	TD1A270	150p	TD1A3082	200p	TD1A4800	300p	TD1A8433	600p	UPC111H	150p	25A817	150p	25A1204	225p	25B631	40p	25C831	150p
TA8215	300p	TD1A405	50p	TD1A3083	200p	TD1A4810	300p	TD1A8440	300p	UPC1032	60p	25A816	70p	25A1206	60p	25B632	45p	25C839	20p
TA8216H	300p	TD1A410	220p	TD1A3190	100p	TD1A4814A	500p	TD1A8442	200p	UPC1035C	110p	25A817	20p	25A1207	25p	25B633	80p	25C867	900p
TA8217P	100p	TD1A412	35p	TD1A3301B	1600p	TD1A4850	475p	TD1A8443	350p	UPC1043C	125p	25A825	20p	25A1208	70p	25B641	12p	25C870	100p
TA8220AH	120p	TD1A506	275p	TD1A3310	120p	TD1A4851	325p	TD1A8444	200p	UPC1588H	70p	25A836	20p	25A1209	100p	25B642	20p	25C877	175p
TA8221AH	100p	TD1A508	175p	TD1A3410	150p	TD1A4852	325p	TD1A8451	325p	UPC1161	110p	25A837	200p	25A1210	120p	25B644	45p	25C900B	30p
TA8225H	100p	TD1A510	170p	TD1A3420	200p	TD1A4853	200p	TD1A8452	200p	UPC1175	125p	25A839	30p	25A1215	600p	25B649	35p	25C930	15p
TA8225L	475p	TD1A512	140p	TD1A3501	300p	TD1A4866	275p	TD1A8453	300p	UPC1170	150p	25A841	20p	25A1216	550p	25B673	100p	25C936	300p
TA8227	250p	TD1A514A	325p	TD1A3502	360p	TD1A4881	200p	TD1A8461	95p	UPC1173	200p	25A844	20p	25A1217	100p	25B676	85p	25C941	15p
TA8229K	200p	TD1A515A	200p	TD1A3504	300p	TD1A4935	300p	TD1A8490	225p	UPC1176C	120p	25A847	25p	25A1220	75p	25B688	90p	25C944	140p
TA8400P	200p	TD1A519G	350p	TD1A3505	275p	TD1A4940	200p	TD1A8490	250p	UPC1178H	250p	25A854	40p	25A1221	75p	25B703	90p	25C945	10p
TA8410K	200p	TD1A519	150p	TD1A3506	260p	TD1A4942	200p	TD1A8512	250p	UPC1182	200p	25A859	45p	25A1222	50p	25B705	100p	25C955	40p
TA8410P	200p	TD1A519	200p	TD1A3507	250p	TD1A4943	175p	TD1A8703	500p	UPC185H2	60p	25A872	25p	25A1226	20p	25B707	200p	25C959	225p
TA8432	200p	TD1A519A	200p	TD1A3510	200p	TD1A4950	100p	TD1A8708	70p	UPC1186	80p	25A872A	50p	25A1227	250p	25B716	20p	25C980	40p
TA8605N	350p	TD1A520	275p	TD1A3520	250p	TD1A5030A	100p	TD1A8730	225p	UPC1187	150p	25A879	30p	25A1232	180p	25B718	60p	25C982	20p
TA8606N	350p	TD1A521	210p	TD1A3530	250p	TD1A5100A	200p	TD1A8732	300p	UPC1188H	350p	25A884	100p	25A1237	25p	25B727	70p	25C983	120p
TA8607P	320p	TD1A522	110p	TD1A3540	200p	TD1A5330T	300p	TD1A8735	175p	UPC1191	300p	25A885	35p	25A1238	30p	25B733	75p	25C1001	20p
TA8614	375p	TD1A543	200p	TD1A3563	350p	TD1A5331T	200p	TD1A8740	625p	UPC1197	110p	25A886	45p	25A1248	50p	25B734	150p	25C1020	150p
TA8615N	480p	TD1A526	225p	TD1A3560	260p	TD1A5332T	150p	TD1A8741	550p	UPC1198H	200p	25A887	25p	25A1249	45p	25B737	30p	25C1008	20p
TA8628N	350p	TD1A534	2000p	TD1A3561	300p	TD1A5500	400p	TD1A8808T	80p	UPC1210	150p	25A893	15p	25A1242	80p	25B739	22p	25C1010	225p
TA8631	500p	TD1A540	420p	TD1A3561A	300p	TD1A5600	450p	TD1A8909T	350p	UPC1215V	125p	25A896	25p	25A1244	120p	25B744	55p	25C1012	75p
TA8632N	500p	TD1A541	500p	TD1A3562	260p	TD1A5660P	250p	TD1A9045	300p	UPC1222	130p	25A899	40p	25A1245	55p	25B750	100p	25C1013	170p
TA8644N	425p	TD1A542	250p	TD1A3562TF	300p	TD1A5700	200p	TD1A9080	400p	UPC1225H	220p	25A900	45p	25A1246	80p	25B753	100p	25C1014	140p
TA8645	375p	TD1A543	200p	TD1A3563	350p	TD1A5701	200p	TD1A9120C	250p	UPC1227	225p	25A904	60p	25A1248	75p	25B756	110p	25C1029	950p
TA8653N	1500p	TD1A552Q	350p	TD1A3564	350p	TD1A5708	275p	TD1A9403	120p	UPC1228HA	40p	25A907	650p	25A1249	100p	25B760	90p	25C1046	250p
TA8659AN	900p	TD1A553AQ	325p	TD1A3565	220p	TD1A5709	375p	TD1A9500	750p	UPC1230	200p	25A909	500p	25A1252	20p	25B765	70p	25C1047	20p
TA8690N	700p	TD1A555Q	375p	TD1A3566	280p	TD1A5800	850p	TD1A9503	550p	UPC1237HA	70p	25A912	70p	25A1253	30p	25B772	25p	25C1050	280p
TA8691N	700p	TD1A557Q	300p	TD1A3567	350p	TD1A5820	370p	TD1A9513	225p	UPC1238	120p	25A913	30p	25A1256	30p	25B774	50p	25C1051	250p
TA8701AN	275p	TD1A558Q	300p	TD1A3569	300p	TD1A5832	120p	TD1A9800	225p	UPC1241H	150p	25A914	90p	25A1257	30p	25B775	100p	25C1061	35p
TA8718N	550p	TD1A560Q	675p	TD1A3570	375p	TD1A5850	175p	TD1A9821	225p	UPC1242H	150p	25A915	30p	25A1258	75p	25B776	150p	25C1069	85p
TA8720	550p	TD1A561	300p	TD1A3580	300p	TD1A5852	150p	TD1A9852	150p	UPC1245V	300p	25A916	30p	25A1261	150p	25B788	15p	25C1070	65p
TA8735P	450p	TD1A572	175p	TD1A3586	75p	TD1A6100Q	150p	TEA0653T	80p	UPC1270H	250p	25A921	160p	25A1262	110p	25B791	30p	25C1079	30p
TA8727N	450p	TD1A574	125p	TD1A3590	250p	TD1A6110Q	120p	TEA0655	300p	UPC1274V	250p	25A928A	25p	25A1263	280p	25B794	40p	25C1080	225p
TA8730	25p	TD1A576	170p	TD1A3591	360p	TD1A6111C	225p	TEA0665	300p	UPC1277	240p	25A933	30p	25A1264	200p	25B795	45p	25C1096	40p
TA81295	70p	TD1A578A	210p	TD1A3592A	300p	TD1A6200	750p	TEA1002	650p	UPC1278	240p	25A934	30p	25A1265	200p	25B810	15p	25C1098	120p
TA8130P	40p	TD1A579	150p	TD1A3601Q	375p	TD1A6900-2	700p	TEA1007	120p	UPC1289V	50p	25A935	40p	25A1283	50p	25B811	160p	25C1106	60p
TA8132	120p	TD1A581	300p	TD1A3610	300p	TD1A6911	100p	TEA1009	100p	UPC1297CA	325p	25A937	60p	25A1284	60p	25B817	175p	25C1114	415p
TA8133	100p	TD1A591	275p	TD1A3611	450p	TD1A6912-2	900p	TEA1015P	110p	UPC1298	320p	25A939	140p	25A1286	60p	25B819	60p	25C1115	280p
TA8134	90p	TD1A596	200p	TD1A3640	350p	TD1A7000	170p	TEA1017	280p	UPC1313H	40p	25A940	50p	25A1289	50p	25B822	40p	25C1116	20p
TA8135	90p	TD1A598	160p	TD1A3645	400p	TD1A7010T	120p	TEA1019	130p	UPC1316C	70p	25A942	60p	25A1290	150p	25B824	60p	25C1124	270p
TA8136	90p	TD1A600	200p	TD1A3651	200p	TD1A7020T	175p	TEA1024	150p	UPC1318	300p	25A949	70p	25A1293	110p	25B825	135p	25C1161	110p
TA8137AS	100p	TD1A602A	400p	TD1A3652	500p	TD1A7021T	200p	TEA1035	200p	UPC1320A	90p	25A950	18p	25A1294	45p	25B826	75p	25C1162	30p
TA8138	35p	TD1A603A	500p	TD1A3652TX	1080p	TD1A7021V	100p	TEA1039	100p	UPC1325V	300p	25A951	60p	25A1295	50p	25B827	200p	25C1164	600p
TA8139M	35p	TD1A675	200p	TD1A3653	85p	TD1A7025	120p	TEA1045	30p	UPC1350	115p	25A952	30p	25A1301	260p	25B828	200p	25C1165	750p
TA8140	100p	TD1A701	500p	TD1A3654	80p	TD1A7053	200p	TEA1060	225p	UPC1352C	450p	25A953	60p	25A1302	300p	25B829	200p	25C1166	100p
TA8141	100p	TD1A717	200p	TD1A3654Q	85p	TD1A7056	200p	TEA1061	175p	UPC1360C	200p	25A954	30p	25A1303	400p	25B835	75p	25C1170	180p
TA8142	60p	TD1A780A	200p	TD1A3710	300p	TD1A7057Q	225p	TEA1062	250p	UPC1362C	250p	25A957	185p	25A1304	110p	25B837	50p	25C1172	150p
TC5020	400p	TD1A782A	275p	TD1A3720	175p	TD1A7072	100p	TEA1064	250p	UPC1363H	350p	25A958	60p	25A1307	110p	25B838	220p	25C1173	20p
TC5021AF	170p	TD1A783	100p	TD1A3724	100p	TD1A7077	160p	TEA1067	150p	UPC1363C	300p	25A959	60p	25A1307	100p	25B883	220p	25C11	

JAPANESE TRANSISTORS

Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price
2SC1675	90p	2SC2261	700p	2SC2271	25p	2SC3263	280p	2SC3798	120p	2SD257	195p	2SD880	40p	2SD1327	150p	2SD1763A	80p	2SK312	750p
2SC1678	80p	2SC2267	90p	2SC2272	120p	2SC3264	390p	2SC3807	220p	2SD287	250p	2SD882	25p	2SD1328	60p	2SD1764	70p	2SK315	70p
2SC1683	100p	2SC2270	60p	2SC2274	15p	2SC3269	50p	2SC3808	70p	2SD291	250p	2SD889	35p	2SD1330	50p	2SD1765	70p	2SK320	120p
2SC1684	300p	2SC2271	25p	2SC2278	200p	2SC3270	50p	2SC3811	80p	2SD313	25p	2SD892A	75p	2SD1347	70p	2SD1769	110p	2SK323	130p
2SC1685	200p	2SC2274	15p	2SC2279	350p	2SC3271	75p	2SC3831	250p	2SD315	75p	2SD894	35p	2SD1348	65p	2SD1773	100p	2SK332	175p
2SC1729	900p	2SC2275	50p	2SC2275	300p	2SC3272	280p	2SC3832	135p	2SD325	30p	2SD895	100p	2SD1350	150p	2SD1776	70p	2SK359	40p
2SC1730	10p	2SC2278	70p	2SC2275	270p	2SC3279	30p	2SC3833	250p	2SD330	65p	2SD896	200p	2SD1376	60p	2SD1783	70p	2SK363	50p
2SC1735	70p	2SC2283	700p	2SC2275	75p	2SC3280	200p	2SC3851	100p	2SD348	300p	2SD898	225p	2SD1378	60p	2SD1785	160p	2SK369	40p
2SC1740	10p	2SC2290	1800p	2SC2276	300p	2SC3281	200p	2SC3852	80p	2SD350	320p	2SD900	400p	2SD1379	100p	2SD1789	210p	2SK364	40p
2SC1741	35p	2SC2291	40p	2SC2276	400p	2SC3284	600p	2SC3853	220p	2SD357	40p	2SD905	450p	2SD1380	100p	2SD1796	120p	2SK367	40p
2SC1755	90p	2SC2298	35p	2SC2277	700p	2SC3293	85p	2SC3855	220p	2SD358	40p	2SD916	130p	2SD1382	60p	2SD1802	75p	2SK369	30p
2SC1756	35p	2SC2307	300p	2SC2274	500p	2SC3298	50p	2SC3857	500p	2SD359	50p	2SD917	300p	2SD1384	50p	2SD1806	75p	2SK373	40p
2SC1758	30p	2SC2308	10p	2SC2275	40p	2SC3299	120p	2SC3858	550p	2SD361	100p	2SD921	320p	2SD1390	350p	2SD1812	45p	2SK374	45p
2SC1760	70p	2SC2312	300p	2SC2276	20p	2SC3300	400p	2SC3866	275p	2SD362	100p	2SD923	360p	2SD1391	250p	2SD1815	50p	2SK386	600p
2SC1775	10p	2SC2314	70p	2SC2277	10p	2SC3303	100p	2SC3868	100p	2SD371	240p	2SD946	120p	2SD1392	85p	2SD1825	60p	2SK389	115p
2SC1781	20p	2SC2316	150p	2SC2279	500p	2SC3306	130p	2SC3870	200p	2SD380	650p	2SD947	100p	2SD1395	85p	2SD1827	120p	2SK400	700p
2SC1789	100p	2SC2320	10p	2SC2279	220p	2SC3307	200p	2SC3884	25p	2SD381	50p	2SD950	300p	2SD1396	120p	2SD1843	70p	2SK405	450p
2SC1808	40p	2SC2324	120p	2SC2279	700p	2SC3309	150p	2SC3883	210p	2SD382	75p	2SD951	200p	2SD1397	120p	2SD1846	350p	2SK414	550p
2SC1810	250p	2SC2328A	50p	2SC2808	40p	2SC3310	125p	2SC3884A	200p	2SD386	70p	2SD957A	520p	2SD1398	120p	2SD1847	275p	2SK415	500p
2SC1815	10p	2SC2310	25p	2SC2810	360p	2SC3316	280p	2SC3885	250p	2SD388	150p	2SD958	60p	2SD1399	300p	2SD1849	280p	2SK423	75p
2SC1819	70p	2SC2315	175p	2SC2812	40p	2SC3317	350p	2SC3885A	290p	2SD389	60p	2SD965	35p	2SD1400	280p	2SD1850	325p	2SK427	50p
2SC1826	60p	2SC2329	40p	2SC2814	40p	2SC3326	50p	2SC3886A	275p	2SD400	14p	2SD970	170p	2SD1402	120p	2SD1853	40p	2SK430	200p
2SC1827	60p	2SC2330	300p	2SC2824	75p	2SC3327	60p	2SC3890	150p	2SD401	50p	2SD972	40p	2SD1403	225p	2SD1854	75p	2SK430	200p
2SC1829	500p	2SC2331	50p	2SC2825	900p	2SC3328	50p	2SC3892A	250p	2SD402	120p	2SD973	60p	2SD1405	80p	2SD1857	75p	2SK430	200p
2SC1833	27p	2SC2333	200p	2SC2826	200p	2SC3330	20p	2SC3893	325p	2SD414	45p	2SD973A	70p	2SD1406	60p	2SD1858	40p	2SK430	200p
2SC1834	50p	2SC2334	80p	2SC2827	130p	2SC3331	25p	2SC3895	225p	2SD415	55p	2SD982	90p	2SD1407	60p	2SD1863	35p	2SK430	200p
2SC1841	12p	2SC2335	55p	2SC2832	300p	2SC3333	120p	2SC3896	400p	2SD424	350p	2SD985	120p	2SD1408	125p	2SD1864	85p	2SK430	200p
2SC1844	50p	2SC2336A	125p	2SC2834	280p	2SC3345	100p	2SC3897	400p	2SD426	150p	2SD986	120p	2SD1409	175p	2SD1867	175p	2SK430	200p
2SC1845	15p	2SC2344	150p	2SC2837	250p	2SC3346	130p	2SC3907	250p	2SD427	350p	2SD988	70p	2SD1411	80p	2SD1877	175p	2SK430	200p
2SC1846	35p	2SC2347	35p	2SC2839	40p	2SC3352	200p	2SC3927	250p	2SD438	35p	2SD1010	40p	2SD1412	75p	2SD1878	160p	2SK430	200p
2SC1847	45p	2SC2353	120p	2SC2853	70p	2SC3353	280p	2SC3940	40p	2SD467	15p	2SD1012	40p	2SD1413	60p	2SD1880	360p	2SK430	200p
2SC1855	80p	2SC2360	120p	2SC2873	60p	2SC3355	50p	2SC3943	75p	2SD468	15p	2SD1020	40p	2SD1415	190p	2SD1881	350p	2SK430	200p
2SC1856	25p	2SC2361	150p	2SC2877	120p	2SC3356	120p	2SC3944	75p	2SD471	20p	2SD1021	120p	2SD1417	75p	2SD1884	300p	2SK430	200p
2SC1855	700p	2SC2362	80p	2SC2878	20p	2SC3358	50p	2SC3950	120p	2SD476	100p	2SD1022	250p	2SD1425	260p	2SD1886	300p	2SK430	200p
2SC1870	700p	2SC2365	280p	2SC2879	320p	2SC3376	300p	2SC3955	120p	2SD476	100p	2SD1022	250p	2SD1426	135p	2SD1887	225p	2SK430	200p
2SC1871	425p	2SC2369	100p	2SC2882	60p	2SC3377	300p	2SC3955	120p	2SD476	100p	2SD1022	250p	2SD1426	135p	2SD1887	225p	2SK430	200p
2SC1875	220p	2SC2371	25p	2SC2883	60p	2SC3378	120p	2SC3955	120p	2SD476	100p	2SD1022	250p	2SD1426	135p	2SD1887	225p	2SK430	200p
2SC1881	70p	2SC2373	25p	2SC2888	200p	2SC3379	120p	2SC3972	250p	2SD499	120p	2SD1031	70p	2SD1430	280p	2SD1890	300p	2SK430	200p
2SC1880	150p	2SC2383	50p	2SC2889	50p	2SC3381	130p	2SC3973	210p	2SD501	300p	2SD1036	600p	2SD1431	200p	2SD1911	300p	2SK430	200p
2SC1885	50p	2SC2389	60p	2SC2909	60p	2SC3383	80p	2SC3975	210p	2SD504	225p	2SD1046	200p	2SD1432	400p	2SD1913	50p	2SK430	200p
2SC1895	125p	2SC2407	110p	2SC2910	25p	2SC3393	80p	2SC3987	160p	2SD505	500p	2SD1047	180p	2SD1433	300p	2SD1929	80p	2SK430	200p
2SC1904	15p	2SC2408	120p	2SC2911	60p	2SC3397	20p	2SC3996	60p	2SD506	225p	2SD1051	130p	2SD1438	60p	2SD1930	50p	2SK430	200p
2SC1906	125p	2SC2408	120p	2SC2912	120p	2SC3398	50p	2SC3997	1250p	2SD508	200p	2SD1055	60p	2SD1439	165p	2SD1933	45p	2SK430	200p
2SC1907	20p	2SC2412K	60p	2SC2912	650p	2SC3400	35p	2SC3998	800p	2SD510	50p	2SD1060	130p	2SD1441	220p	2SD1939	60p	2SK430	200p
2SC1909	250p	2SC2440	200p	2SC2922	480p	2SC3401	50p	2SC4006	100p	2SD517	20p	2SD1062	150p	2SD1442	80p	2SD1941	350p	2SK430	200p
2SC1913	90p	2SC2458	10p	2SC2923	75p	2SC3402	40p	2SC4006	100p	2SD517	20p	2SD1062	150p	2SD1442	80p	2SD1941	350p	2SK430	200p
2SC1914	30p	2SC2459	50p	2SC2923	75p	2SC3402	40p	2SC4006	100p	2SD517	20p	2SD1062	150p	2SD1442	80p	2SD1941	350p	2SK430	200p
2SC1921	15p	2SC2466	55p	2SC2928	550p	2SC3405	130p	2SC4023	325p	2SD519	25p	2SD1064	200p	2SD1446	300p	2SD1958	80p	2SK430	200p
2SC1922	175p	2SC2486	275p	2SC2929	280p	2SC3409	400p	2SC4029	350p	2SD596	25p	2SD1065	160p	2SD1450	60p	2SD1959	210p	2SK430	200p
2SC1923	10p	2SC2492	50p	2SC2934	75p	2SC3416	30p	2SC4043	45p	2SD600	30p	2SD1069	150p	2SD1451	200p	2SD1978	50p	2SK430	200p
2SC1929	180p	2SC2470	65p	2SC2937	250p	2SC3417	90p	2SC4046	40p	2SD601	40p	2SD1073	350p	2SD1452	275p	2SD1984	60p	2SK430	200p
2SC1940	110p	2SC2481	120p	2SC2939	400p	2SC3419	120p	2SC4056	200p	2SD602	60p	2SD1088	150p	2SD1453	140p	2SD1991	50p	2SK430	200p
2SC1941	27p	2SC2482	20p	2SC2944	300p	2SC3420	80p	2SC4059	400p	2SD612	50p	2SD1094	375p	2SD1455	250p	2SD1994	200p	2SK430	200p
2SC1942	350p	2SC2483	120p	2SC2958	50p	2SC3421	45p	2SC4064	140p	2SD613	70p	2SD1110	225p	2SD1457	165p	2SD1996	45p	2SK430	200p
2SC1944	350p	2SC2484	185p	2SC2962	800p	2SC3422	75p	2SC4106	150p	2SD617	300p	2SD1111	20p	2SD1458	50p	2SD2006	75p	2SK430	200p
2SC1945	350p	2SC2485	400p	2SC2979	160p	2SC3423	60p	2SC4107	175p	2SD633	70p	2SD1113	225p	2SD1459	60p	2SD2010	250p	2SK430	200p
2SC1946	1600p	2SC2491	200p	2SC2987	250p	2SC3425	65p	2SC4123	230p	2SD636	15p	2SD1128	200p	2SD1468	40p	2SD2011	60p	2SK430	200p
2SC1947	450p	2SC2498	50p	2SC2988	150p	2SC3446	150p	2SC4124	200p	2SD637	15p	2SD1133	65p	2SD1487	225p	2SD2012	50p	2SK430	200p
2SC1953	45p	2SC2500	25p	2SC2995	60p	2SC3447	130p	2SC4125	275p	2SD638	15p	2SD1135	75p	2SD1494	150p	2SD2018	65p	2SK430	200p
2SC1957	70p	2SC2502	140p	2SC2999	50p	2SC3456	200p	2SC4137	40p	2SD639	20p	2SD1138	40p	2SD1496	300p	2SD2033	80p	2SK430	200p
2SC1959	10p	2SC2503	600p	2SC3001	1400p	2SC3457	125p	2SC4138	200p	2SD640	350p	2SD1140	40p	2SD1497	230p	2SD2061	100p	2SK430	200p
2SC1962	175p	2SC2512	20p	2SC3019</															

REPLACEMENT VIDEO HEADS

Model	Price	Model	Price	Model	Price	Model	Price	Model	Price
AKAI		VHSAN3	800p	HRD750, HRD830, HRD860	3300p	NVFS 100	5000p	TL51100	3100p
VS105, 112, 115, 116, 120, 125, 126, 201, 202, 205, 220, 240, 244, 245, 247, 248, 250, 301, 303, 304, VSP8, VSP82, VSP82	1000p	VHSAY3	1200p	HRD250, HRD257	2200p	NVFS1	4850p	VHR120, 130, 14, 141, 143G, 145P, 151, 15, 16, 17, 210, 223, 244, 274, VHR310, 320, 4100, 4105, 4200, 430, 4300, 4400, 4500, 5080, 5100	4500p
VP7100, VS9300, VS9500	650p	VHSB13, VHSCH1	2100p	HRD180, 190, 230, 810, 3V59, FV12	2200p	N.E.C.		VHR5200, 5600, 6800, 7100, 7200, 7250, 7300, 8070, 8100, 8101, 8120, VHR7800, 7810, 8000SP, 8801SP, VHRD4400, 4410, 4500, 4600, 4700, 4800	3100p
VP7200, VS9700, VS9800	1200p	VHSB3	2600p	FV208, 26, 30, 32, 33, VC111L	2050p	N916, 9012, 9013E, 9014E, 9014G, 9015, 9016, 9024, 902A, 9033, N9034, 9040, 902, 9054, 9055, 9056, 9063, 9065, 9066, 906, 9077	1150p	VHR120, 130, 14, 141, 143G, 145P, 151, 15, 16, 17, 210, 223, 244, 274, VHR310, 320, 4100, 4105, 4200, 430, 4300, 4400, 4500, 5080, 5100	4500p
V51	1250p	VHSD2	1600p	HRD530, HRD700, HRD840, HRD870, HRD910, FV147, FV578	3100p	N9096, DX1000, 1600, PX1200	1150p	VHR5200, 5600, 6800, 7100, 7200, 7250, 7300, 8070, 8100, 8101, 8120, VHR7800, 7810, 8000SP, 8801SP, VHRD4400, 4410, 4500, 4600, 4700, 4800	3100p
V52	1250p	VHSE12, VHSDD2	2600p	HRD1, GR2, 3, 3V41	2200p	NP11A, 914C, 915A, 916A, 917, 9110, 9120, 9150, 9200	2400p	VHR120, 130, 14, 141, 143G, 145P, 151, 15, 16, 17, 210, 223, 244, 274, VHR310, 320, 4100, 4105, 4200, 430, 4300, 4400, 4500, 5080, 5100	4500p
V53	1350p	VHSEY1, VHSF2	1400p	BR9060, HRD330, 337, 440, 441, 637, 641, 660, 670, 720, 730, 740, 810, 812L	2200p	DX4000, N9610, NS7000	3100p	VHR5200, 5600, 6800, 7100, 7200, 7250, 7300, 8070, 8100, 8101, 8120, VHR7800, 7810, 8000SP, 8801SP, VHRD4400, 4410, 4500, 4600, 4700, 4800	3100p
V510	1350p	VHST3	1300p	HRF3100, SR3300MS, FV44L	2100p	N9850, N9530, DX2000	3400p	VHR3500E	2150p
VSP1	2100p	VHSTJ1, VHSF4, VHSF63, VHSF3	1400p	HRD950, HRD960, HRD980, HRD980, FV46	5000p	PVC2300, 2400, 740, 744, 760, 764	1700p	VHR161	4250p
VS32, 35, 37, 38, 38EOG MKII, 53, 55, 66, 785, 766, 767, 768, 885, 887, VSF30, 33, 4, 400, 410, 420, 430, 440, 441, 450, 455, 480, 490, 497, VSG51, 54, 55, VXS450, VXS470	2250p	VHSTJ3, VHSWJ3, VHSYJ2, VHSYH4, VHSWH1, VHSXH1, VHSYH2	700p	HR55000, HR55500, 5800, 9000, FV295, BR5600, SR5368E	5550p	N830, N831, N830, N831, N832, N833, N834, N835, N836	3000p	VHR3500E	2150p
VSG21, 211, 212, 215, 216, 217, 225, 245, 411, 415, VSG127EOG, 23, 24, 25, 405, 411, 415, V417, VSP100, 100EM, 110, VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSR400	2500p	VHSTJ3, VHSWJ3, VHSYJ2, VHSYH4, VHSWH1, VHSXH1, VHSYH2	700p	HR55000, HR55500, 5800, 9000, FV295, BR5600, SR5368E	5550p	82611AH1 (FOR MODEL DX3000), DX4000, N9610, NS7000	3100p	VHR3500E	2150p
VSG22, 211, 212, 215, 216, 217, 225, 245, 411, 415, VSG127EOG, 23, 24, 25, 405, 411, 415, V417, VSP100, 100EM, 110, VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSR400	2500p	GRUNDIG	4600p	HR55000, HR55500, 5800, 9000, FV295, BR5600, SR5368E	5550p	N9850, N9530, DX2000	3400p	VHR3500E	2150p
VSG23, 211, 212, 215, 216, 217, 225, 245, 411, 415, VSG127EOG, 23, 24, 25, 405, 411, 415, V417, VSP100, 100EM, 110, VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSR400	2500p	V5410, 415, 435, 450, 456, 460, 500, 505, 510, 520, 521, 530, 545	1400p	HR55000, HR55500, 5800, 9000, FV295, BR5600, SR5368E	5550p	PVC2300, 2400, 740, 744, 760, 764	1700p	VHR3500E	2150p
VSG24, 211, 212, 215, 216, 217, 225, 245, 411, 415, VSG127EOG, 23, 24, 25, 405, 411, 415, V417, VSP100, 100EM, 110, VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSR400	2500p	BA, RCELONA, MV55400, 440, 500, 600, SE5100, 6100, 6110, 9100	3000p	HR55000, HR55500, 5800, 9000, FV295, BR5600, SR5368E	5550p	N830, N831, N830, N831, N832, N833, N834, N835, N836	3000p	VHR3500E	2150p
VSG25, 211, 212, 215, 216, 217, 225, 245, 411, 415, VSG127EOG, 23, 24, 25, 405, 411, 415, V417, VSP100, 100EM, 110, VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSR400	2500p	TVR4500, 4510, 5510, VS400, 440, 441, 500, 505, 510, 518, 600, 610, VS5180, VS6190, 700, 900, 901, 902, 9091, GV200, 201, 2092, SE2100, 5110	1400p	HR55000, HR55500, 5800, 9000, FV295, BR5600, SR5368E	5550p	82611AH1 (FOR MODEL DX3000), DX4000, N9610, NS7000	3100p	VHR3500E	2150p
VSG26, 211, 212, 215, 216, 217, 225, 245, 411, 415, VSG127EOG, 23, 24, 25, 405, 411, 415, V417, VSP100, 100EM, 110, VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSR400	2500p	MADRID, SE5140, VS540, VS5480	3000p	HR55000, HR55500, 5800, 9000, FV295, BR5600, SR5368E	5550p	N9850, N9530, DX2000	3400p	VHR3500E	2150p
VSG27, 211, 212, 215, 216, 217, 225, 245, 411, 415, VSG127EOG, 23, 24, 25, 405, 411, 415, V417, VSP100, 100EM, 110, VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSR400	2500p	MVS550, 620, VS550, 620, 630, 640, 790, 930, 940	2400p	HR55000, HR55500, 5800, 9000, FV295, BR5600, SR5368E	5550p	PVC2300, 2400, 740, 744, 760, 764	1700p	VHR3500E	2150p
VSG28, 211, 212, 215, 216, 217, 225, 245, 411, 415, VSG127EOG, 23, 24, 25, 405, 411, 415, V417, VSP100, 100EM, 110, VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSR400	2500p	VS120, VS120	2300p	HR55000, HR55500, 5800, 9000, FV295, BR5600, SR5368E	5550p	N830, N831, N830, N831, N832, N833, N834, N835, N836	3000p	VHR3500E	2150p
VSG29, 211, 212, 215, 216, 217, 225, 245, 411, 415, VSG127EOG, 23, 24, 25, 405, 411, 415, V417, VSP100, 100EM, 110, VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSR400	2500p	VS180, VS6190, 700, 900, 901, 902, 9091, GV200, 201, 2092, SE2100, 5110	1400p	HR55000, HR55500, 5800, 9000, FV295, BR5600, SR5368E	5550p	82611AH1 (FOR MODEL DX3000), DX4000, N9610, NS7000	3100p	VHR3500E	2150p
VSG30, 211, 212, 215, 216, 217, 225, 245, 411, 415, VSG127EOG, 23, 24, 25, 405, 411, 415, V417, VSP100, 100EM, 110, VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSR400	2500p	MVS660, SE6160, VERONA, VS660, VS6690	3500p	HR55000, HR55500, 5800, 9000, FV295, BR5600, SR5368E	5550p	N9850, N9530, DX2000	3400p	VHR3500E	2150p
VSG31, 211, 212, 215, 216, 217, 225, 245, 411, 415, VSG127EOG, 23, 24, 25, 405, 411, 415, V417, VSP100, 100EM, 110, VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSR400	2500p	HINARI	1000p	HR55000, HR55500, 5800, 9000, FV295, BR5600, SR5368E	5550p	PVC2300, 2400, 740, 744, 760, 764	1700p	VHR3500E	2150p
VSG32, 211, 212, 215, 216, 217, 225, 245, 411, 415, VSG127EOG, 23, 24, 25, 405, 411, 415, V417, VSP100, 100EM, 110, VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSR400	2500p	VXL2, 3, 4, 20, 25, 35	1000p	HR55000, HR55500, 5800, 9000, FV295, BR5600, SR5368E	5550p	N830, N831, N830, N831, N832, N833, N834, N835, N836	3000p	VHR3500E	2150p
VSG33, 211, 212, 215, 216, 217, 225, 245, 411, 415, VSG127EOG, 23, 24, 25, 405, 411, 415, V417, VSP100, 100EM, 110, VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSR400	2500p	VXL5, V20H	1050p	HR55000, HR55500, 5800, 9000, FV295, BR5600, SR5368E	5550p	82611AH1 (FOR MODEL DX3000), DX4000, N9610, NS7000	3100p	VHR3500E	2150p
VSG34, 211, 212, 215, 216, 217, 225, 245, 411, 415, VSG127EOG, 23, 24, 25, 405, 411, 415, V417, VSP100, 100EM, 110, VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSR400	2500p	VXL7	1200p	HR55000, HR55500, 5800, 9000, FV295, BR5600, SR5368E	5550p	N9850, N9530, DX2000	3400p	VHR3500E	2150p
VSG35, 211, 212, 215, 216, 217, 225, 245, 411, 415, VSG127EOG, 23, 24, 25, 405, 411, 415, V417, VSP100, 100EM, 110, VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSR400	2500p	VXL8, 9, 10, 11, 19, 90, VCR34H, VTV 100, 200	1100p	HR55000, HR55500, 5800, 9000, FV295, BR5600, SR5368E	5550p	PVC2300, 2400, 740, 744, 760, 764	1700p	VHR3500E	2150p
VSG36, 211, 212, 215, 216, 217, 225, 245, 411, 415, VSG127EOG, 23, 24, 25, 405, 411, 415, V417, VSP100, 100EM, 110, VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSR400	2500p	HITACHI	1400p	HR55000, HR55500, 5800, 9000, FV295, BR5600, SR5368E	5550p	N830, N831, N830, N831, N832, N833, N834, N835, N836	3000p	VHR3500E	2150p
VSG37, 211, 212, 215, 216, 217, 225, 245, 411, 415, VSG127EOG, 23, 24, 25, 405, 411, 415, V417, VSP100, 100EM, 110, VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSR400	2500p	VT11, 14, 15, 16, 30, 33, 34, 330, 340, 503, 640, 5030, VTP10, 30	1000p	HR55000, HR55500, 5800, 9000, FV295, BR5600, SR5368E	5550p	82611AH1 (FOR MODEL DX3000), DX4000, N9610, NS7000	3100p	VHR3500E	2150p
VSG38, 211, 212, 215, 216, 217, 225, 245, 411, 415, VSG127EOG, 23, 24, 25, 405, 411, 415, V417, VSP100, 100EM, 110, VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSR400	2500p	V77, V77T, V77B, V77S	1000p	HR55000, HR55500, 5800, 9000, FV295, BR5600, SR5368E	5550p	N9850, N9530, DX2000	3400p	VHR3500E	2150p
VSG39, 211, 212, 215, 216, 217, 225, 245, 411, 415, VSG127EOG, 23, 24, 25, 405, 411, 415, V417, VSP100, 100EM, 110, VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSR400	2500p	V77, V77T, V77B, V77S	1000p	HR55000, HR55500, 5800, 9000, FV295, BR5600, SR5368E	5550p	PVC2300, 2400, 740, 744, 760, 764	1700p	VHR3500E	2150p
VSG40, 211, 212, 215, 216, 217, 225, 245, 411, 415, VSG127EOG, 23, 24, 25, 405, 411, 415, V417, VSP100, 100EM, 110, VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSR400	2500p	V77, V77T, V77B, V77S	1000p	HR55000, HR55500, 5800, 9000, FV295, BR5600, SR5368E	5550p	N830, N831, N830, N831, N832, N833, N834, N835, N836	3000p	VHR3500E	2150p
VSG41, 211, 212, 215, 216, 217, 225, 245, 411, 415, VSG127EOG, 23, 24, 25, 405, 411, 415, V417, VSP100, 100EM, 110, VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSR400	2500p	V77, V77T, V77B, V77S	1000p	HR55000, HR55500, 5800, 9000, FV295, BR5600, SR5368E	5550p	82611AH1 (FOR MODEL DX3000), DX4000, N9610, NS7000	3100p	VHR3500E	2150p
VSG42, 211, 212, 215, 216, 217, 225, 245, 411, 415, VSG127EOG, 23, 24, 25, 405, 411, 415, V417, VSP100, 100EM, 110, VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSR400	2500p	V77, V77T, V77B, V77S	1000p	HR55000, HR55500, 5800, 9000, FV295, BR5600, SR5368E	5550p	N9850, N9530, DX2000	3400p	VHR3500E	2150p
VSG43, 211, 212, 215, 216, 217, 225, 245, 411, 415, VSG127EOG, 23, 24, 25, 405, 411, 415, V417, VSP100, 100EM, 110, VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSR400	2500p	V77, V77T, V77B, V77S	1000p	HR55000, HR55500, 5800, 9000, FV295, BR5600, SR5368E	5550p	PVC2300, 2400, 740, 744, 760, 764	1700p	VHR3500E	2150p
VSG44, 211, 212, 215, 216, 217, 225, 245, 411, 415, VSG127EOG, 23, 24, 25, 405, 411, 415, V417, VSP100, 100EM, 110, VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSR400	2500p	V77, V77T, V77B, V77S	1000p	HR55000, HR55500, 5800, 9000, FV295, BR5600, SR5368E	5550p	N830, N831, N830, N831, N832, N833, N834, N835, N836	3000p	VHR3500E	2150p
VSG45, 211, 212, 215, 216, 217, 225, 245, 411, 415, VSG127EOG, 23, 24, 25, 405, 411, 415, V417, VSP100, 100EM, 110, VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSR400	2500p	V77, V77T, V77B, V77S	1000p	HR55000, HR55500, 5800, 9000, FV295, BR5600, SR5368E	5550p	82611AH1 (FOR MODEL DX3000), DX4000, N9610, NS7000	3100p	VHR3500E	2150p
VSG46, 211, 212, 215, 216, 217, 225, 245, 411, 415, VSG127EOG, 23, 24, 25, 405, 411, 415, V417, VSP100, 100EM, 110, VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSR400	2500p	V77, V77T, V77B, V77S	1000p	HR55000, HR55500, 5800, 9000, FV295, BR5600, SR5368E	5550p	N9850, N9530, DX2000	3400p	VHR3500E	2150p
VSG47, 211, 212, 215, 216, 217, 225, 245, 411, 415, VSG127EOG, 23, 24, 25, 405, 411, 415, V417, VSP100, 100EM, 110, VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSR400	2500p	V77, V77T, V77B							

VIDEO SERVICE KITS

<p>AMSTRAD VCR700 <i>Contents</i> BELT SET, PINCH ROLLER, REEL IDLER, VIDEO LAMP Order Code: SK41</p> <p style="text-align: right;">£5.50</p>	<p>HITACHI VT11/V733 <i>Contents</i> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK08</p> <p style="text-align: right;">£5.00</p>	<p>NV600/NV688 <i>Contents</i> BELT SET, PINCH ROLLER, PLAY IDLER, FF/REW IDLER, TENSION BAND Order Code: SK25</p> <p style="text-align: right;">£12.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, PLAY IDLER TYRE, FF/REW IDLER TYRE Order Code: SK26</p> <p style="text-align: right;">£6.00</p>
<p>FERGUSON & JVC 3V42/43 HRD455/HRD725 <i>Contents</i> BELT SET, PINCH ROLLER, CLUTCH MECHANISM, TENSION BAND Order Code: SK37</p> <p style="text-align: right;">£16.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, SUPPLY CLUTCH, TAKE UP CLUTCH Order Code: SK38</p> <p style="text-align: right;">£9.00</p>	<p>VT11/V733 <i>Contents</i> BELT SET, T/U REEL TABLE TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, FF/REW IDLER, CLUTCH PLATE, TENSION BAND Order Code: SK45</p> <p style="text-align: right;">£13.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, FF/REW IDLER Order Code: SK46</p> <p style="text-align: right;">£3.75</p>	<p>NV730/NV770 <i>Contents</i> SLOT IN BELT LOADING BELT PINCH ROLLER, IDLER UNIT, TENSION BAND Order Code: SK19</p> <p style="text-align: right;">£5.50</p> <p style="text-align: right;"><i>Economy Kit Contents</i> SLOT IN BELT LOADING BELT PINCH ROLLER, IDLER TYRE Order Code: SK20</p> <p style="text-align: right;">£3.00</p>
<p>3V58/59/64/65 HRD170/180/210/230/300/320/370/400/430/530/700/750 HRS5000 <i>Contents</i> BELT SET, PINCH ROLLER, IDLER ARM, TENSION BAND Order Code: SK44</p> <p style="text-align: right;">£7.00</p>	<p>VT52/61/62/63/64/65/85/86/640 <i>Contents</i> BELT SET, PINCH ROLLER, FF/REW ARM, CLUTCH PLATE, TENSION BAND Order Code: SK49</p> <p style="text-align: right;">£14.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, FF/REW IDLER Order Code: SK50</p> <p style="text-align: right;">£3.00</p>	<p>NV370/NV380/480/630/780/830/850/AG2100PK/AG2200PK <i>Contents</i> BELT SET, PINCH ROLLER, IDLER, TENSION BAND Order Code: SK21</p> <p style="text-align: right;">£5.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE Order Code: SK22</p> <p style="text-align: right;">£2.75</p>
<p>3V29/3V30 HR7200/7300/7350 <i>Contents</i> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK05</p> <p style="text-align: right;">£5.00</p>	<p>VT400/405/410/13/14/15/18/420/25/26/28/430/31/35/48/450/498/510/520/25/26/530/35/36/540/545/46/48/570/75/76/580/85/88 <i>Contents</i> TIMING BELT, PINCH ROLLER, FF/REW ARM, CLUTCH BASE, TENSION BAND Order Code: SK52</p> <p style="text-align: right;">£9.75</p>	<p>NV777/NV788 <i>Contents</i> BELT SET, PINCH ROLLER, IDLER UNIT, TENSION BAND Order Code: SK17</p> <p style="text-align: right;">£6.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE Order Code: SK18</p> <p style="text-align: right;">£4.00</p>
<p>3V35/36, 38/39/49 HRD110/111/120/225 <i>Contents</i> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK04</p> <p style="text-align: right;">£5.00</p>	<p>VT100/110/111/13/115/118/120/125/128/130/135/138/145/150/175/220/225/250/255/258/260/VTL30 <i>Contents</i> BELT SET, PINCH ROLLER, FF/REW ARM, CLUTCH PLATE, TENSION BAND Order Code: SK51</p> <p style="text-align: right;">£14.00</p>	<p>SHARP VC381 <i>Contents</i> BELT SET, PINCH ROLLER, REEL IDLER, TENSION BAND, VIDEO LAMP Order Code: SK47</p> <p style="text-align: right;">£8.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, REEL IDLER TYRE Order Code: SK48</p> <p style="text-align: right;">£3.25</p>
<p>3V31/3V42 HR7600/7610/7650/7655 <i>Contents</i> BELT SET, T/U REEL TABLE TYRE, PINCH ROLLER, REEL IDLER, T/U CLUTCH, T/U IDLER, TENSION BAND, VIDEO LAMP Order Code: SK33</p> <p style="text-align: right;">£11.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, T/U REEL TABLE TYRE, PINCH ROLLER, REEL IDLER TYRE, T/U IDLER TYRE, T/U CLUTCH Order Code: SK34</p> <p style="text-align: right;">£5.00</p>	<p>PANASONIC NV2000/NV2010/NV7000/NV7200/NV7800 <i>Contents</i> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK03</p> <p style="text-align: right;">£5.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK02</p> <p style="text-align: right;">£5.00</p>	<p>VC500/VC571/VC582/VC583/VC584/VC5F3 <i>Contents</i> BELT SET, PINCH ROLLER, REEL IDLER, TENSION BAND Order Code: SK60</p> <p style="text-align: right;">£9.50</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, REEL IDLER Order Code: SK61</p> <p style="text-align: right;">£5.00</p>
<p>3V35/36/38/39/49 HRD110/111/120/121/225 <i>Contents</i> BELT SET, T/U REEL TABLE TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, T/U CLUTCH, T/U IDLER, REEL IDLER, TENSION BAND Order Code: SK35</p> <p style="text-align: right;">£10.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, T/U REEL TABLE TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, T/U CLUTCH, T/U IDLER TYRE, REEL IDLER TYRE Order Code: SK36</p> <p style="text-align: right;">£5.50</p>	<p>NV300/NV330/NV333/NV340/NV366 <i>Contents</i> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRE Order Code: SK01</p> <p style="text-align: right;">£5.00</p>	<p>VC781/VC7810/VC7822/VC785/VC786/VC793/VC800/VC100/VC102/VC104/VC202 <i>Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT, TENSION BAND Order Code: SK64</p> <p style="text-align: right;">£13.50</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT TYRE Order Code: SK65</p> <p style="text-align: right;">£3.75</p>
<p>3V29/3V30 HRD7200/7300/7350 <i>Contents</i> BELT SET, T/U REEL TABLE TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, REEL IDLER, T/U CLUTCH, T/U IDLER, TENSION BAND, VIDEO LAMP Order Code: SK31</p> <p style="text-align: right;">£10.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, T/U REEL TABLE TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, REEL IDLER TYRE, T/U IDLER TYRE, T/U CLUTCH Order Code: SK32</p> <p style="text-align: right;">£5.00</p>	<p>NV2000/NV2010 <i>Contents</i> BELT SET, PINCH ROLLER, FF IDLER, PLAY IDLER, TENSION BAND, VIDEO LAMP Order Code: SK13</p> <p style="text-align: right;">£6.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE, PULLEY TYRE Order Code: SK14</p> <p style="text-align: right;">£3.50</p>	<p>VC681/VC682/VC684/VC685/VC693/VC699/VC6F3/VC700 <i>Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT, TENSION BAND Order Code: SK62</p> <p style="text-align: right;">£13.50</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT TYRE Order Code: SK63</p> <p style="text-align: right;">£5.00</p>
<p>3V44/45/48/53/54/55/57 HRP50/HRD140/150/158/160 HRD250/251/565/566/755 <i>Contents</i> BELT SET, PINCH ROLLER, CLUTCH MECHANISM, TENSION BAND Order Code: SK39</p> <p style="text-align: right;">£15.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER Order Code: SK40</p> <p style="text-align: right;">£9.50</p>	<p>NV7000/NV7200/NV7800 <i>Contents</i> BELT SET, PINCH ROLLER, IDLER UNIT, PLAY IDLER, TENSION BAND Order Code: SK11</p> <p style="text-align: right;">£8.50</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE, CLUTCH TYRE Order Code: SK12</p> <p style="text-align: right;">£3.25</p>	<p>VC881/VC882/VC884/VC885/VC893/VC899/VC8F3/VC700 <i>Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT, TENSION BAND Order Code: SK62</p> <p style="text-align: right;">£13.50</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT TYRE Order Code: SK63</p> <p style="text-align: right;">£5.00</p>
<p>FISHER FVHP905/906/907/908/910/911/916/918 <i>Contents</i> BELT SET, PINCH ROLLER, IDLER, GEAR IDLER UNIT, TENSION BAND Order Code: SK57</p> <p style="text-align: right;">£13.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE Order Code: SK58</p> <p style="text-align: right;">£5.00</p>	<p>NV332 <i>Contents</i> BELT SET, PINCH ROLLER, PLAY IDLER, FF/REW IDLER, TENSION BAND, FF/REW TYRE Order Code: SK29</p> <p style="text-align: right;">£12.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, PLAY IDLER TYRE, FF/REW IDLER TYRE Order Code: SK30</p> <p style="text-align: right;">£5.10</p>	<p>VC881/VC882/VC884/VC885/VC893/VC899/VC8F3/VC700 <i>Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT, TENSION BAND Order Code: SK62</p> <p style="text-align: right;">£13.50</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT TYRE Order Code: SK63</p> <p style="text-align: right;">£5.00</p>
<p>3V44/45/48/53/54/55/57 HRP50/HRD140/150/158/160 HRD250/251/565/566/755 <i>Contents</i> BELT SET, PINCH ROLLER, CLUTCH MECHANISM, TENSION BAND Order Code: SK39</p> <p style="text-align: right;">£15.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER Order Code: SK40</p> <p style="text-align: right;">£9.50</p>	<p>NV230/250/260/280/430/450/460/470/650/810/890/AG1200PK/AG1500PK <i>Contents</i> BELT SET, PINCH ROLLER, IDLER, TENSION BAND Order Code: SK23</p> <p style="text-align: right;">£6.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE Order Code: SK24</p> <p style="text-align: right;">£3.25</p>	<p>VC881/VC882/VC884/VC885/VC893/VC899/VC8F3/VC700 <i>Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT, TENSION BAND Order Code: SK62</p> <p style="text-align: right;">£13.50</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT TYRE Order Code: SK63</p> <p style="text-align: right;">£5.00</p>

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

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

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

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

REPLACEMENT VIDEO CASSETTE HOUSINGS

Name	Models	Code	Price	Name	Models	Code	Price	Name	Models	Code	Price
AKAI	VS35, VS53, VS55, VS56, VS75	CH18	3200p		FV31R	CH19	4300p		VCA103, 103GV, 106, 106GVM, 254GVM	CH23	2500p
GRANADA	VHSDP1, VHSYJ2	CH05	1100p		HRD515, 520, 527, 540, 550, 580, 600, 610, 620, 660, 670, HRO830, 840, 850, 860, 4050, 6600, FV37H, HRD540, 580, 830, 860, 910, 960, HRO970, HROX20, FV57H	CH27	2400p		VCS211, 244, 5055, 605, VCB230, VCD806G, 810G, VCT212, 310, 410G, 610	CH24	2500p
GOLDSTAR	GHV1290P, 1291P, 1295P, 9400, 73401, GSE1295P, GSE1891P, 20001Q, 20051Q, VCP4200, 4300, 4301, 4305, VCP4306, 4311, 4315, 4316, 4320, 4321, 4325	CH25	2000p	FERGUSON	VR3916, 3926, 3946, 3948, 3976, 3986, 3995, 3997, 6948	CH02	2800p	TELEFUNKEN	VR2970	CH02	2800p
	GHV51, 1221, 1232, 1240, 1241, 1242, 1244, 1246, 1248, GHV8000, 8200	CH26	2900p	I.T.T.	VR3916, 3926, 3946, 3948, 3976, 3986, 3995, 3997, 6948	CH01	2800p	THOMSON	V342, 343, 352, 353, 360, 364, 368, 4210, 4230, 4280, 4400, V5500, 6000, 8540	CH01	2800p
FERGUSON & J.V.C.	3V38, 3V39, 8943, 8944, 8951, 3V35, 3V36, 3V49, HRD 110, 111, 120, 121, 225	CH01	2800p	NATIONAL PANASONIC	VR3916, 3926, 3946, 3948, 3976, 3986, 3995, 3997, 6948	CH02	2800p	TOSHIBA	V55, V57, V65, V66	CH01	2800p
	3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V57, 8945, 8947, 8948, HRD 140, 141, 150, 157, 158, 160, 250, HRD257, 455, 565, 566, 725, 755	CH02	2800p		VR3916, 3926, 3946, 3948, 3976, 3986, 3995, 3997, 6948	CH02	2800p			CH02	2800p
	8948, 8950, FV10B, 12L, 13M, 14T, 20B, 21R, 22L, 26, 395, HRD230, 430, 530	CH03	2800p	PHILIPS	CASSETTE LIFT ASSEMBLY (69120366)	CH06	4300p				
	3V58, 3V59, 3V64, 3V65, FV11R, 8950, 8951, HRD170, HRO180, HRO370	CH04	2800p		DV186, 190, 286, 471, 562, 761, VR6180, 6182, 6185, 6285, VR6290, 6291, 6293, 6362, 6367, 6393, 6467, 6468, 6470, VR6561, 6670, 6760, 6761, 6870, 6970	CH05	1100p				
					VR6443	CH22	2900p				
					VR6444	CH23	2500p				
					49SB6	CH24	2500p				
					SHARP	VCA100, VCH851, VCH852	CH22	2900p			

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AMSTRAD MOD KIT
 ☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆
 FITS :
 VCR 4500 , 4600 , 4700 , 5200 , TVR 1,2,3
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PRICE : £2.25 + VAT each
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MODE SWITCH

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

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

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

Replacement Audio Control Video Sound Head for National Panasonic

PART NUMBER	MODELS	PRICE
VBR 0091	NVG7 etc	875p
VBR0050	NV300, NV340 etc	875p
VBR0061	NV777 etc	875p
VBR0103A	NV250, NV450 etc	625p
VBR0125		625p

VIDEO TOOLS

VIDEO CLEANING STICKS

Price 17p each 15p each pack of 10pcs
 13p each pack of 25pcs
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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

SET OF 8 ALLEN KEYS

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

CIRCLIP PLIERS
MICRO SCREWDRIVER

VCR HEAD EXTRACTOR

Order code: TOOL 10, Price 2900p

TRANSPARENT REPAIR/ADJUSTMENT CASSETTE

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

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BACK UP BATTERIES

PHILIPS

Part Nos: 138 - 101138, 138 - 10313 1.2v 90mAH

Order Code: BB01

Part Nos: 138 - 10229, 2.4v 100mAH

Order Code: BB02

Price: 75p

Price: 135p

FERGUSON

Part No: 00E6 - 067 - 001 1.2V 100mAH

Order Code: BB03

Part Nos: 00E6 - 606 - 8001 2.4V 100mAH

Order Code: BB04

Price: 90p

Price: 150p

SATELLITES

MAKE & MODEL	CODE	PRICE
PACE PRD800, PRD900	SATPSU1	600p
PACE SS9000, 9200, 9010, 9210, 9220	SATPSU2	550p
AMSTRAD SRD510, SRD520	SATPSU3	600p
AMSTRAD SRD500	SATPSU4	600p
AMSTRAD SRX340, SRX345, SRX350	SATPSU5	600p
PACE D100/150	SATPSU6	650p
CHURCHILL D2MAC	SATPSU7	650p
PACE MSS100	SATPSU8	730p

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

SATELLITE TUNERS

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

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

SWITCH MODE TRANSFORMERS

PACE 9000
ORDER CODE: PACE9000 PRICE: 800p

PRD800/PRD900
ORDER CODE: PRD800 PRICE: 550p

SATMETER

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

Through operation with satellite RX powering the LNB.

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

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

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

* Max. input signal: -10 DBM

ORDER CODE: TOOL22

PRICE: 8500p

REPLACEMENT TV SWITCHES

GRUNDIG

PART No: 29703, 29102

USED ON:

C7500, C8500, C8502, C8712 ... ETC

Order Code: SW1 Price: 140p

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: 150p

USED ON:

KV1400, KV1440, KV2040, KV2060

(POWER SWITCH 26mm)

Order Code: SW12 Price: 125p

SONY

USED ON:

KV2020

(POWER SWITCH 21mm +Remote)

Order Code: SW6 Price: 200p

SONY 2 PIN FUNCTION SWITCH

Order Code: SW9

Price: 35p

FUSES

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

CERAMIC PLUG TOP

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

20mm CERAMIC TIME LAG

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

38mm CERAMIC TIME LAG

CURRENT RATING	ORDER CODE	PRICE
10A	FUSE48	825p

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

VOLTAGE TESTER

A terminal screwdriver incorporating continuity & voltage with Euroslot

ORDER CODE: TOOL11

PRICE: 220p

SPRING HOOK

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

ORDER CODE: TOOL20

PRICE: 265p

FAULT FINDING / COMPARISON BOOKS

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

Order Code: BOOK05.

Price £8.50 - No VAT.

TELEVISION Edition 6

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

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

SEMICONDUCTOR COMPARISONS 1997/8

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

Price: £15.50 - No VAT. Order Code: B00K04

Satellite Repair Manual Edition 4

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

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

SEMICONDUCTOR COMPARISONS 1997

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

Price: £40.00 only - No VAT (+ £5 Postage).
Order Code: B00K06

Video Recorders Edition 5 1997

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

Price £15.00 - No VAT. Order Code: B00K01

SERVICE AIDS

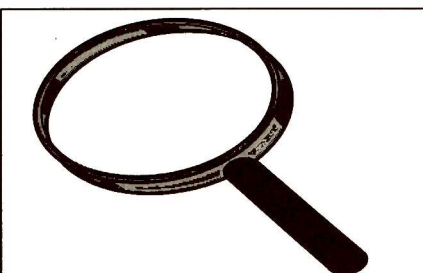
DESCRIPTION	VOLUME	CODE	PRICE
VIDEO HEAD CLEANER	75ML	SP01	145p
SWITCH CLEANER	176ML	SP02	155p
SILICONE GREASE	200ML	SP03	180p
FREEZE IT	170ML	SP04	295p
FREEZE IT	400ML	SP16	580p
FOAM CLEANER	400ML	SP05	180p
ANTI-STATIC	200ML	SP06	180p
AEROKLEANE	200ML	SP07	200p
AERO DUSTER	200ML	SP08	340p
AERO DUSTER	400ML	SP17	580p
PLASTIC SEAL	200ML	SP09	250p
GLASS CLEANER	250ML	SP10	170p
COLDKLENE	250ML	SP13	235p
EXCEL POLISH 80	250ML	SP18	1180p
ADHESIVE 120	400ML	SP19	225p
LABEL REMOVER 130	200ML	SP20	260p
REFURB 140	400ML	SP21	260p
TUBE SILICON GREASE	50 GRAMMES	SP11	225p
TUBE SILICON SEALANT WHITE	75ML	SP22	250p
TUBE SILICON SEALANT CLEAR	75ML	SP23	250p
TUBE HEAT SINK COMPOUND	25 GRAMMES	SP12	150p
DRIVE CLEANER	200ML	SP24	150p
SCREEN CLEANER	200ML	SP25	145p
COMPUTER CARE KIT	-	SP26	2100p

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15 WATT 240 VAC (XS15W 240V)	S102	900p
25 WATT SPARE ELEMENT	S103	450p
15 WATT SPARE ELEMENT	S104	450p
SOLDERING STAND & SPONGES		
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SPARE SPONGE	S109	55p
SOLDER		
18 SWG 500 GRAMMES	S110	500p
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22 SWG 500 GRAMMES	S112	700p
DESOLDERING AIDS		
SOLDER MOP STANDARD GAUGE 1.2MM X 1.5M	S107	100p
SOLDER MOP 1.2MM X 10M	S113	420p
DESOLDERING PUMP	S105	320p
SPARE NOZZLE	S106	60p



I.C. PROTECTORS

ICPF10, ICPF15, ICPF20,
ICPF25, ICPF38, ICPF50,
ICPF75

ICPN5, ICPN10, ICPN15,
ICPN20, ICPN25, ICPN 38,
ICPN50, ICPN75

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MINI HEAD	150p
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CD PICK UPS

Models & Description	Order Code	Price
AIWA		
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DX-990A, DX-DIA	KSS152A	1600p
CX150, CX166G, CX180, CXN3100, CXN320, CXN3300, CXN360, CXN400, CXN430, CXN540, CXN550G, CXN990, CXN999, CXNV20, CXSL70, DXZ3100M, FDN636, FDN6636, FDN939, LCX60, LCX66G, LCX70M, LCX80, M7400, M75, NSX320, NSX360, NSX400, NSX430, NSX990, NSX992, NSX999, NSXD636, NSXD638, NSXV70, SXFN650, SXFN650, XC300, XC650, XC750, XC900, XC950, XCN992, XG320, XG360, XG400, XG990, ZD3000M, ZD3100M	KSS152A	1600p
CXAP1, CX17, CX18G, CX1C50G, CXZ68, DXM740, DXM75, DXM76, DXM77, LCX50, LCX7, LCX8G, LCXAP1, XC002, XC004, XC005, XC777	KSS210B	2000p
XP31, XP33, XP55, XP80G	KSS20A	2500p
XP6.XP7	KSS331A	3400p
AKAI		
CD73, DC33	KSS151A	1900p
CD25, CD26, CD27, CD32, CD36, CD37, CD52, CD55, CD57, CD650, CD670, CD69, CD750, CD79, CDM480, CDM600, CDM670, CDEM770, CDM999, MX550, MX570, MX650, MX670, MX750, MX950	KSS210A	1800p
DENON		
DCD1500H, DCD1520, DCDE3520	KSS151A	1900p
DCD1400, DCD600, DCD800	KSS152A	1600p
DCD1420, DCDS20, DCDS610, DCDS620, DCD660, DCD810, DCD820, DCD880, DCD910, DCD920	KSS210A	1800p
DCD1015, DCD1290, DCD2060, DCD2060G, DCD315, DCD480, DCD580, DCD615, DC0715, DCD825, DCD990, DCD995, DM200F	KSS240A	3000p
GOLDSTAR		
CDP52A, CDP52AJ, CD952L, CD952LJ, FFH101KL, FFH101WL, FFH222A, FFH272L, FFH333, FFH373K, FJ606, FR806L	KSS210A	1800p
CD320AL, CD3635G, FFH212AL, FFH212E	KSS210B	2000p
GRUNDIG		
CD360, CD435	HOPM3	2150p
CCD300, CD101MCD904, MC10, NEW ORLEANS CD	KSS210A	1800p
KRC0100, RR1900CD, RR3100CD, RR4000CD, RR610CD, RR700CD	KSS210B	2000p
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HITACHI		
DAW560	HOPM3	2150p
FX-10	KSS210A	1800p
AXC10	KSS210B	2000p
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CORDIO CASSETTE - MINI SYSTEMS - MODELS 1890-192	OPTIMA4S	5000p
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1994 ONWARDS - CAE48BK, CAMC67, CAMXG9, CAS20BK, CAS30BK, VAS50, CAS60RBK, MXS20, MXS30, MXS60, PCX105, PCX130, PCX95, RCX230, RCX320, RCX520, RCX620, RCX720, UXA4, UXA5, UXA55, UXC7, UXT1, UXT3, XLF115, XLF116, XLF215, XLF216, XLMC100ML, XLMXG7, XLMXG9, XLV163TN, XLV164BK, XLV174, XLV263TN, XLV264BK, XLV274BK, XLZ463TN, XLZ464BK, XLZ574, XLZ674, XTMXG7, XTMXG9, XTS60	OPTIMA6S	3300p
KENWOOD		
DP47, DP66SG, DP820, DP87, L1000D	KSS152A	1600p
DP1030, DPF110, DP2010, DP2030, DP3010, DP3030, DP3050, DP4030, DP491, DP5010, DP5030, DP5040, DP520, DP7030, DP7040, DP7050, DP730, DP920, DP930, DP950, DPM650, DPM6630, DPM730, DPM850, DPM891, DX6620, M225, M235, M450, M850, PD3030, PDM991, RDX25, RDXC3, RDXC3L, UD209, UD302	KSS210A	1800p
DPDC2, DPC72, DPC77, DPC80, DPC92	KSS220A	2500p
DP1050, DP2050, DP3060, DP501, DP5050, DP722, DP76, DPB5, DPB9, M77A, PD3060, UD502, UD70, UD701, UD90, XE5	KSS240A	3000p
DPC321, DPC521, DPC531, DPC631K, DPC721, DPC731	KSS331A	3400p
DP1060, DP2060, PART No: RCTRHR136AFZ	RH8136A	4500p
PANASONIC		
SLP177A, SLP202A, SLP212A, SLP222A, SLP277A, SLP377A, SLP477AK, SLP477A, SLP6100A, SLP6200A, SLP6400A, SLP6500AK, SLP6500A, SLPJ24A, SLPJ26A, SLPJ27A, SLPJ28A, SLPJ325A, SLPJ325A, SLPJ37A, SLPJ38A, SLPJ46A	691-30209	5500p

Models & Description	Order Code	Price
SAD30, SLCH9, SLP150, SLP170, SLP200, SLP202, SLP222, SLP230, SLP250, SLP333, SLP370G, SLP400C, SLP555, SLP777, SLP999, SLP1A10, SLP2C, SLP2C5, SLPJ25, SLPJ26, SLPJ27, SLPJ37, SLPJ45, SLPK25, SLPK26, SLP550, SLP570, SLP5700, SLP5840, SLP5900	SOAAD70A	2350p
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AZ830A, 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, CD940, CD983, CD985, CD990, CD994, CD995, CD999, CD163, CD165, CD166, CD167, CD168, CD169, CD170, CD171, CD172, CD173, CD174, CD175, CD176, CD177, CD178, CD179, CD180, CD181, CD182, CD183, CD184, CD185, CD186, CD187, CD188, CD189, CD190, CD191, CD192, CD193, CD194, CD195, CD196, CD197, CD198, CD199, CD200, CD201, CD202, CD203, CD204, CD205, CD206, CD207, CD208, CD209, CD210, CD211, CD212, CD213, CD214, CD215, CD216, CD217, CD218, CD219, CD220, CD221, CD222, CD223, CD224, CD225, CD226, CD227, CD228, CD229, CD230, CD231, CD232, CD233, CD234, CD235, CD236, CD237, CD238, CD239, CD240, CD241, CD242, CD243, CD244, CD245, CD246, CD247, CD248, CD249, CD250, CD251, CD252, CD253, CD254, CD255, CD256, CD257, CD258, CD259, CD260, CD261, CD262, CD263, CD264, CD265, CD266, CD267, CD268, CD269, CD270, CD271, CD272, CD273, CD274, 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CD1116, CD1117, CD1118, CD1119, CD1120, CD1121, CD1122, CD1123, CD1124, CD1125, CD1126, CD1127, CD1128, CD1129, CD1130, CD1131, CD1132, CD1133, CD1134, CD1135, CD1136, CD1137, CD1138, CD1139, CD1140, CD1141, CD1142, CD1143, CD1144, CD1145, CD1146, CD1147, CD1148, CD1149, CD1150, CD1151, CD1152, CD1153, CD1154, CD1155, CD1156, CD1157, CD1158, CD1159, CD1160, CD1161, CD1162, CD1163, CD1164, CD1165, CD1166, CD1167, CD1168, CD1169, CD1170, CD1171, CD1172, CD1173, CD1174, CD1175, CD1176, CD1177, CD1178, CD1179, CD1180, CD1181, CD1182, CD1183, CD1184, CD1185, CD1186, CD1187, CD1188, CD1189, CD1190, CD1191, CD1192, CD1193, CD1194, CD1195, CD1196, CD1197, CD1198, CD1199, CD1200, CD1201, CD1202, CD1203, CD1204, CD1205, CD1206, CD1207, CD1208, CD1209, CD1210, CD1211, CD1212, CD1213, CD1214, CD1215, CD1216, CD1217, CD1218, CD1219, CD1220, CD1221, CD1222, CD1223, CD1224, CD1225, CD1226, CD1227, CD1228, CD1229, CD1230, CD1231, CD1232, CD1233, CD1234, CD1235, CD1236, CD1237, CD1238, CD1239, CD1240, CD1241, CD1242, CD1243, CD1244, CD1245, CD1246, CD1247, CD1248, CD1249, CD1250, CD1251, CD1252, CD1253, CD1254, CD1255, CD1256, CD1257, CD1258, CD1259, CD1260, CD1261, CD1262, CD1263, CD1264, CD1265, CD1266, CD1267, CD1268, CD1269, CD1270, CD1271, CD1272, CD1273, CD1274, CD1275, CD1276, CD1277, CD1278, CD1279, CD1280, CD1281, CD1282, CD1283, CD1284, CD1285, CD1286, CD1287, CD1288, CD1289, CD1290, CD1291, CD1292, CD1293, CD1294, CD1295, CD1296, CD1297, CD1298, CD1299, CD1300, CD1301, CD1302, CD1303, CD1304, CD1305, CD1306, CD1307, CD1308, CD1309, CD1310, CD1311, CD1312, CD1313, CD1314, CD1315, CD1316, CD1317, CD1318, CD1319, CD1320, CD1321, CD1322, CD1323, CD1324, CD1325, CD1326, CD1327, CD1328, CD1329, CD1330, CD1331, CD1332, CD1333, CD1334, CD1335, CD1336, CD1337, CD1338, CD1339, CD1340, CD1341, CD1342, CD1343, CD1344, CD1345, CD1346, CD1347, CD1348, CD1349, CD1350, CD1351, CD1352, CD1353, CD1354, CD1355, CD1356, CD1357, CD1358, CD1359, CD1360, CD1361, CD1362, CD1363, CD1364, CD1365, CD1366, CD1367, CD1368, CD1369, CD1370, CD1371, CD1372, CD1373, CD1374, CD1375, CD1376, CD1377, CD1378, CD1379, CD1380, CD1381, CD1382, CD1383, CD1384, CD1385, CD1386, CD1387, CD1388, CD1389, CD1390, CD1391, CD1392, CD1393, CD1394, CD1395, CD1396, CD1397, CD1398, CD1399, CD1400, CD1401, CD1402, CD1403, CD1404, CD1405, CD1406, CD1407, CD1408, CD1409, CD1410, CD1411, CD1412, CD1413, CD1414, CD1415, CD1416, CD1417, CD1418, CD1419, CD1420, CD1421, CD1422, CD1423, CD1424, CD1425, CD1426, CD1427, CD1428, CD1429, CD1430, CD1431, CD1432, CD1433, CD1434, CD1435, CD1436, CD1437, CD1438, CD1439, CD1440, CD1441, CD1442, CD1443, CD1444, CD1445, CD1446, CD1447, CD1448, CD1449, CD1450, CD1451, CD1452, CD1453, CD1454, CD1455, CD1456, CD1457, CD1458, CD1459, CD1460, CD1461, CD1462, CD1463, CD1464, CD1465, CD1466, CD1467, CD1468, CD1469, CD1470, CD1471, CD1472, CD1473, CD1474, CD1475, CD1476, CD1477, CD1478, CD1479, CD1480, CD1481, CD1482, CD1483, CD1484, CD1485, CD1486, CD1487, CD1488, CD1489, CD1490, 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REPLACEMENT LINE OUTPUT TRANSFORMERS

Part No.	Code	Price	HITACHI																
AKAI			2424593	LOT44	1050p														
45150344	LOT56	1650p	2432101	LOT79	1600p														
101-214017-03	LOT278	1300p	2432461	LOT169	1500p														
101-220005-03A	LOT72	1600p	2432611	LOT80	1800p														
D 050/37	LOT27	1450p	2432651	LOT80	1800p														
D 053/37	LOT207	1500p	2432761	LOT169	1500p														
D 056/37	LOT206	1450p	2432981	LOT37	1200p														
D 059/37	LOT250	1400p	2432981	LOT37	1200p														
D 069/37	LOT56	1650p	2432982	LOT37	1200p														
FCM 2015 AL	LOT78	1500p	2433011	LOT171	1650p														
FERGUSON			2433012	LOT171	1650p														
00 D-3-508-001	LOT38	1250p	2433014	LOT171	1650p														
00 D-3-508-002	LOT38	1250p	2433212	LOT168	1500p														
00 D-3-508-003	LOT76	1400p	2433291	LOT172	1350p														
00 D-3-515-001 PL1	LOT276	1400p	2433301	LOT246	1600p														
00 D-4-208-001	LOT79	1600p	2433441	LOT188	1900p														
00 D-4-208-002	LOT79	1600p	2433442	LOT191	1600p														
00 D-4-235-002	LOT240	1250p	2433451	LOT81	1350p														
00 D-4-235-002 HTI	LOT81	1350p	2433452	LOT82	1250p														
00 D-4-235-00201G	LOT81	1350p	2433453	LOT82	1250p														
00 D-4-260-004 HTI	LOT38	1250p	2433455	LOT234	1600p														
00 H-0-701-2400	LOT182	1450p	2433521	LOT85	1600p														
06 D-3-083-001	LOT82	1250p	2433551	LOT22	1250p														
06 D-3-083-002	LOT82	1250p	2433721	LOT83	1400p														
06 D-3-083-001	LOT82	1250p	2433751	LOT01	1300p														
06 D-3-084-001	LOT23	1400p	2433752	LOT01	1300p														
06 D-3-087-001	LOT23	1400p	2433752	LOT250	1350p														
06 D-3-088-001	LOT84	1450p	2433891	LOT23	1400p														
06 D-3-093-001	LOT204	1600p	2433892	LOT84	1450p														
06 D-3-095-001	LOT87	1000p	2433893	LOT23	1400p														
06 D-3-095-002	LOT87	1000p	2433952	LOT23	1000p														
06 D-333-512-001	LOT204	1600p	2434002	LOT200	1400p														
FETX 100 90 DEG	LOT04	1500p	2434141	LOT33	1000p														
FETX 90 WHITE	LOT06	1500p	2434141	LOT33	1000p														
FETX 100 100 OEG	LOT34	1500p	2434274	LOT44	1050p														
GRUNDIG			2434274	LOT44	1050p														
29201.008.01	LOT153	1750p	2434453	LOT86	1600p														
29201.014.01	LOT140	1500p	2434455	LOT234	1600p														
29201.015.01	LOT149	1400p	2434593	LOT44	1050p														
29201.017.01	LOT80	1250p	2435062	LOT296	1400p														
29201.018.01	LOT163	1300p	2435121	LOT87	1000p														
29201.018.02	LOT81	1700p	2435131	LOT251	1450p														
29201.019.01	LOT82	1250p	2435141	LOT282	1300p														
29201.019.02	LOT82	1250p	2435301	LOT88	1450p														
29201.022.01	LOT83	1700p	2435671	LOT89	1600p														
29201.022.02	LOT166	1600p	2436201	LOT109	1200p														
29201.022.03	LOT165	1350p	2436202	LOT109	1200p														
29201.022.04	LOT165	1350p	2432101-2	LOT79	1600p														
29201.022.04A	LOT165	1350p	2433451H	LOT81	1350p														
29201.024.01	LOT85	1500p	2433453H	LOT82	1250p														
29201.024.04	LOT164	1400p	2433891H	LOT23	1400p														
HINARI			2433892G	LOT84	1450p														
154 138 K	LOT24	1500p	I.T.T.																
51 13914 1	LOT24	1500p	4515 01 08	LOT113	1400p														
51 14184 1	LOT24	1500p	4515 01 15	LOT136	1600p														
CF 44 A	LOT24	1500p	4515 01 16	LOT139	1675p														
HM51-1411834-1	LOT24	1500p	4515 01 17	LOT139	1675p														
4515 01 19	LOT169	1500p																	
4515 01 24	LOT137	1600p																	
4515 01 46	LOT136	1600p																	
4515 03 01	LOT169	1500p																	
4515 03 02	LOT180	1500p																	
4515 03 05	LOT169	1500p																	
4515 03 06	LOT180	1500p																	
4515 03 08	LOT168	1500p																	
4515 03 09	LOT22	1250p																	
4515 03 10	LOT178	1500p																	
4515 03 14	LOT168	1500p																	
4515 03 13	LOT174	1400p																	
4515 03 18	LOT22	1250p																	
4515 03 19	LOT192	1550p																	
4515 03 20	LOT30	1250p																	
4515 03 22	LOT190	1650p																	
4515 03 24	LOT188	1900p																	
4515 03 25	LOT196	1550p																	
4515 03 26	LOT194	1550p																	
4515 03 28	LOT189	1550p																	
4515 03 28	LOT27	1450p																	
4515 03 29	LOT193	1550p																	
4515 03 30	LOT179	1550p																	
4515 03 31	LOT207	1550p																	
4515 03 34	LOT205	1650p																	
4515 03 35	LOT193	1550p																	
4515 03 38	LOT27	1450p																	
4515 03 40	LOT200	1400p																	
4515 03 41	LOT56	1650p																	
4515 03 43	LOT196	1550p																	

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/for disposal: Require a satellite dish alignment meter. Have for disposal a Promax MC160B TV/FM aerial alignment/field strength meter with digital frequency readout. Covers FM radio/TV bands/PMR frequencies. Trevor Wiltshire, Tora Technology, Pelican Road, Pamber Heath, Tadley, Hants RG26 3EL. 01189 701 163.

For disposal: About 20 colour sets, mostly older 'brown' ones in need of service, some scrappers. £5 each ONO or £75 the lot ONO. Also lots of spares free, too many to list. Would consider swapping the sets for an old Beta eccentricity gauge or other non-VHS alignment tools, or jigs etc. M. Stephens, 01706 223 347 (East Lancashire).

Wanted: Circuit diagrams or complete manuals for the BBC Master and BBC B computers. Also an operators handbook for the Morley Electronics teletext adaptor as used with BBC computers. Loan of this information for photocopying would be appreciated if it's not available for sale. R.W. Goad, 7 Chipstead House, Chipstead Road, Cosham, Hants PO6 3JJ. 01705 382 918.

Wanted: On/off switch with solenoid for the Fidelity Model F14. Arthur Griffiths, 01626 864 486.

Wanted: Service manual or circuit diagram (photocopy OK) for the Canon Model E60E camcorder. M. Floyer, 17 Kedleston Close, Northampton NN4 0WF. 01604 761 420.

Wanted: Details of supplier of spares for the Kneissel 14in. colour portable Model KN1432, from Spain but made in Poland. We need a PAL system I IF module. An old system B/G module would help, provided we had a service sheet. Please phone Mike Adye on 0181 670 2303 9am-7pm.

For sale: Service manual for the Tektronix 455/A2/B2 portable oscilloscope, with operating instructions, £20. *Essential Electronics: an A-Z*

Guide by George Loveday, 257 pages, £3. Gemstar Videoplus+ automatic video programmer: works with any VCR, includes instructions; has LCD fault, hence £4. *Getting the Max from your Graphics Computer* by Lisa Walker and Steve Blount, 160 pages, £3. Julian Bohan, 30 Stanley Street, Lincoln LN5 8NG. 01522 871 926, mobile 0958 771 319.

Wanted: Circuit diagram (photocopy OK) for the Hitachi VT9900EM multistandard VCR. Would also welcome a scrap machine. Jim Littler, 363 Atherton Road, Hindley, Wigan, Lancs WN2 3XD. 01942 258 794.

Wanted/for disposal: Require remote control unit for the Ferguson TV Model 51P7, also a LOPT for the Audiosonic Model KT8355TX and a tuner unit for the Huanyu Model 37C. Have several 14in. CRTs for disposal. H.S. Downing, 16 Mayfield Crescent, Lower Stondon, Henlow, Beds SG16 6LF. 01462 850 244.

Wanted: Lopt part no. FM0520 for the Finlandia Model C59JZ5E (Salora N2 chassis). Duncan Allender, 9 Chester Drive, Ashton-In-Makerfield, Wigan WN4 9JB. 01942 723 969 (evenings).

Wanted: Aerial analyser or any aerial test/tuning equipment, dip meter etc. John Porter, 4 Cromore Gardens, Creggan Estate, Londonderry, N. Ireland BT48 9TF. 01504 266 794.

Thanks: To those who sent me information and a spare CZ1 thermistor for a vintage Eddystone 840C communications receiver. Trevor Wiltshire, Tora Technology, Tadley, Hants.

Wanted: Service information (photocopy OK) for the Philips LaserVision stereo Model VP600/05. W.A. Young, Foxgloves, Church Lane, Redmire, Leyburn, N. Yorks DL8 4EQ. 01969 622 598.

Wanted: Panasonic VCR control/audio head part no. VEH0138 for the NV7200 (or NV7000 will do). 0181 343 3008.

Wanted/for disposal: Require LOPT for the Sanyo Model CTP7131 (Series 80P chassis). Also sweep tuning/memory storage PCB with backup battery for the Ferguson TX10 chassis with text, plus any circuit information on the electronic tuning section. Have for disposal some EPROM-based £1 coin meters of Alberice manufacture and several assorted Eighties CRTs too good to throw away. John Fox, 291 Convamore Road, Grimsby, N.E. Lincs DN32 9HY. 01472 319 926 (phone/fax).

Wanted: Remote control unit for the Goodmans TX3650 VCR (Amstrad deck). Hugh Johnson, 3 Latimer Close, Maybury, Woking, Surrey GU22 8HD. 01483 851 158 or 0956 845 862.

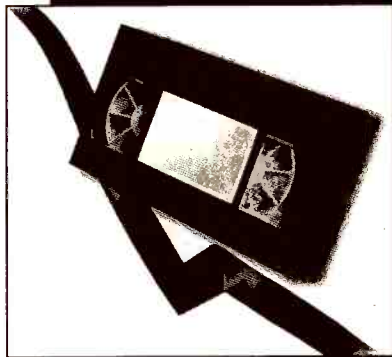
Wanted: LOPT for the Philips TX 12in. monochrome chassis, part no. 4822 140 10172. Bill Harris, 13 Bridle Drive, Clapham, Bedford MK41 6BB. 01234 363 813.

For disposal: Three Gould scopes, different models, for scrap. One partly working. Reader to collect or pay for p+p. T. Korai, 272 Barking Road, East Ham, London E6. 0181 591 0572.

Wanted: Station select module no. SBX-M904A for the JVC TV Model C210EK. Working module from scrap PCB would be OK. Dave Johnson, 159 Grove Road, London E17 9BZ. 0181 521 0618.

Wanted: Ferguson VCR Model FV30B, a scrap machine or just the lower drum assembly. A. Muktar, 34 Hackworth Point, Rainhill Way, Bow, London E3 3ET. 0181 983 6183.

For disposal: Copies of *Television* 1976-1987. P. Gohil, 137 Reynolds Drive, Edgware, Middx HA8 5BX. 0181 933 4963.



Reports from
Philip Blundell, AMIEEIE
Eugene Trundle
D. Evans
Michael Dranfield
Chris Watton
Pete Gurney, LCGI
Gerald Smith
Michael Maurice and
Ronnie Boag

Philips Turbo Decks

Stuck tapes have been a common problem recently. You find that the tape is still laced around the drum, and that a grinding noise comes from the mechanism when it tries to unlace. The cause is that either the gear on the threading shaft or the gear on the worm shaft has moved out of alignment. The two shafts are available as a pair, part no. 4822 310 10657. To prevent a bounce, replace them both.

The problem is that the cassette covers the deck retaining screws and the tape is still threaded around the capstan. If you are careful, the tape can be removed from the capstan without the need to cut it. When the spring on the top of the pinch roller arm has been disconnected you should find it possible to remove the pinch roller and its arm. The tape can then be eased over the guides and, by turning the reel-belt pulley, wound back into the cassette.

If you are lucky, you will now be able to turn the gears on the side of the lift and eject the cassette. If this is not possible, disconnect the red plastic strap that holds the lift gears together and remove the lift by undoing the four screws underneath the deck. **P.B.**

Mitsubishi HSM58V

This machine would play for just a few seconds then return to the stop mode. Suspecting a reel tacho prob-

VCR Clinic

lem, I scoped the tacho pulses at the collectors of transistors Q5A0 and Q5A4 on the main PCB. The pulses at the collector of Q5A4 were of low amplitude. As cleaning the window on the sensor had no effect, a new take-up reel sensor (part no. 268P044010) had to be fitted to cure the fault. **P.B.**

Ferguson FV77H

We've had three of these machines in recently with the same complaint: no response to the remote-control unit. In each case the micro-controller chip (IK01) on the front panel was responsible. Take care when you replace it – the device seems to be very vulnerable to attack by electrostatic charges. **E.T.**

Akai VSG740/760/770 Series

If you have to remove and replace the deck or front-loading parts for service, you may then find that the machine won't load a cassette fully or that the spools are scraping. If so, it's likely that you have bent the pressed-steel plate that runs across the bottom of the cassette cradle. It synchronises the two sides of the cassette loading mechanism and is very fragile. **E.T.**

Toshiba V411

Playback was marred by sparklies – the effect you get with a satellite receiver and a weak signal. This is usually caused by poor drum shaft earthing. When I phoned Toshiba I was told to replace the lower drum unit, which is expensive. I got round the problem by fitting an external earthing brush.

It's easiest to fit one underneath the tape deck. If you look at the underside of the drum you will see a hole in the chassis, to the rear, already tapped. I used a brush from a scrap Sharp VC381. The arm had

to be rebent and a small piece sawn off the end of its cranked arm as this was in the way of fitting it to the chassis. I used the original Sharp screw. The modification was a complete success. **D.E.**

Matsui VX1000Y

The usual cause of tape damage, with the tape looping out on eject – sometimes intermittently – is a split capstan motor rotor. Superglue or Araldite provide a lasting solution. **M.Dr.**

Goodmans GRV3450

There were four dashes in the display but the machine wouldn't power up. In addition the tape was fully laced and the loading motor was twitching backwards and forwards. Voltage checks showed that the 5V supply at the emitter of Q801 was pulsing up and down. I initially suspected a heavy load on this supply. Wrong! F803 (1-25AT) on the power PCB was open-circuit. A replacement restored normal operation. **M.Dr.**

Sharp VCA63HM

This machine had a very interesting fault. There were tracking errors and the capstan speed was slightly slow, with poor colour. Checks in the capstan circuit failed to reveal anything amiss, then I found that if the pause button was pressed the machine went into fast forward search and locked up. The only way to stop the machine was to unplug it from the mains supply.

A very useful feature is that if a prerecorded tape (no safety tab) is inserted the machine can be operated with the front panel, which contains the timer microcontroller chip and memory, completely disconnected. This enabled the front panel to be eliminated. When I made further checks in the servo section I

found that the drum PG signal at pin 52 of IC801 was missing. The drum PG amplifier is within IC702, but this chip had no input at pin 28 from the sensor on the head drum motor. As the sensor is part of the drum motor I decided to try resoldering it. This provided a complete cure. The PG sensor's DC resistance is about 200Ω. **M.Dr.**

Sharp VCM271

There were two problems with this newish machine: the capstan motor ran in reverse intermittently, and the fluorescent display was out. It must have received a bang at some time. Socket P702, where the capstan motor is plugged in, was dry-jointed. The display had no filament supply because of a cracked print land at the chopper transformer. **M.Dr.**

Amstrad VC9140

Intermittent loss of the record colour was the complaint – always a tricky fault. Fortunately I noticed that the E-E picture was lost when the tape was ejected, which suggested a fault in the power supply. When some checks were carried out while the tape was being loaded and ejected I noticed that the 'P.ON50V' supply fluctuated quite a lot – in fact it varied when there was any deck mode change. The cause was traced to R06 (100kΩ).

Having cured this fault I put the VCR on soak test to wait for the intermittent record colour problem to show up. It didn't. I assume that the power supply fault had also been the cause of this symptom. The tuning voltage is derived from the 50V supply, so it's likely that the machine drifted off tune to the extent that the colour was lost. **C.W.**

Ferguson FV32L

The power supply had blown up. I fitted the SP3881 kit, which is a bag full of bits – loads of diodes, transistors etc. Once this job had been completed I tried the machine and found that it was still dead. But at least it didn't blow the mains fuse, and there was 320V across the bridge rectifier's reservoir capacitor. Checks on the secondary side of the chopper transformer then revealed that DP48 (BA158) was short-circuit. A replacement restored normal operation. **C.W.**

Mitsubishi MX1

Playback was OK but there was no E-E video – the sound was not affected. There was video at pin 16 of the IF processor chip IC101 but

not at the video output from Q102. The cause of the fault was traced to coil L108, which was open-circuit. It's in parallel with CF101, which is part of the filter network just after the signal for the sound detector is extracted. **P.G.**

Daewoo DVF502P

There were no functions and no display. The cause of the problem was C703, which had changed value. It's linked to IC701's reset line. **G.S.**

Samsung VIK310

The complaints were picture flicker and wow on sound. I found that the back-tension arm was oscillating and the take-up reel was jerky. After a thorough tape path clean and fitting a replacement back-tension band the back-tension arm had stabilised but the take-up reel remained jerky, producing wow on sound. A replacement clutch assembly cleared up the wow. I then replaced the worn audio head and pinch roller, and as a precaution the now infamous C110 in the power supply. **G.S.**

Sharp VCM27

This machine failed to erase in the record mode. Tests showed that the erase bias oscillator wasn't running. After checking for shorts etc. I found that the microcontroller chip IC701 didn't switch the bias on. All was well when the microcontroller chip had been replaced. **G.S.**

Nokia VR3615

The faults with this machine were intermittent loss of the E-E picture and intermittent going to standby. Both were caused by dry-joints at Q853. **G.S.**

Samsung VIK310

This machine would sometimes damage a tape: at the end of rewind it would eject too quickly, leaving tape out. It would also intermittently eject the tape when stop was pressed. The cause of these problems was a faulty mode switch. **G.S.**

Aiwa FX55S

This machine would accept a tape. But when any mode was selected it would operate for a fraction of a second then eject the tape and shut down. It seemed to be a reel sensor problem. The PCB on which this item is mounted is connected to another PCB via an exposed four-way connector, which appeared to be incorrectly located. I loosened the fastening screw and moved the

reel-sensor PCB slightly so that the connector was centrally aligned. This cured the fault. **M.M.**

Philips VR6291

After running for about one and a half hours this machine would start to behave erratically and then shut down. A quick glance in the power supply section revealed that R247 (270Ω) had cooked. It's in the optocoupler circuit. So I replaced R247, using an 0.25W type, T246 (BC547) and the CNX83A optocoupler. After a prolonged test I decided that the machine was now OK. **M.M.**

Matsui VP9501

This machine didn't wind the tape into the cassette during eject. When the mechanism had been removed it was clear that the take-up clutch had disintegrated. The cause of this was the plastic circlip, which couldn't take the force of the clutch spring. I first reassembled the clutch using the original circlip: as it sprang open two seconds later I used a metal E circlip. This solved the problem, which I understand is quite common. **M.M.**

Nokia VR3785

The rather unusual symptom was that the characters in the on-screen display wouldn't remain stationary. It occurred when the machine had been on for some time. Application of freezer to the LC74760 on-screen control chip IC162 stopped the characters moving and a replacement cured the fault. **R.B.**

Sanyo VHR287

This machine would cut out intermittently in the play/record modes. The fault was cured by replacing protector PR512. **R.B.**

Hitachi VTF150

There were noise bars in the E-E mode. The capstan was noisy in play and tended to cut out in the record mode. Checks in the power supply revealed that there was a lot of ripple across C12. A replacement cleared all the symptoms. **R.B.**

Nokia VR3716

There was intermittent loss of the E-E picture. The cause turned out to be dry-joints at filter FL2401. **R.B.**

Samsung VIK326

The guides wouldn't load up around the drum assembly. The cure was to replace the mode-state switch and the slide main assembly. **R.B.**

The Nokia N Chassis

This chassis uses digital processing in the signals sections but is otherwise fairly conventional. Michael Maurice on the main things to bear in mind when servicing these sets

The Nokia N chassis, successor to the Salora M chassis (see *Television* August/September 1997), uses a number of custom-made digital chips in the signal processing sections. Unlike the M chassis, it has fairly conventional power supply and line output stage circuits. The chassis is designed to drive 21, 25 and 28in. CRTs, with some line output stage component value variations depending on tube size.

The chassis can be described as truly international, catering for PAL, Secam and NTSC signals. Some sets have facilities to cater for the various sound systems. The user can even select the menu language – more on this later. You will find the chassis in Nokia, Salora, Finlandia, De Graaf and Hitachi receivers released around 1991-3. In the UK the chassis was mainly sold by Nokia on an OEM basis to Granada (Finlandia) and Hitachi.

The chassis consists of a large mother board with plug-in modules for the IF, Fastext and Nicam circuitry. A front operation PCB carries the four switches and the programme display. There's another board for the CRT base, with the RGB output stages on it.

When you look at the chassis you will see a number of copper heatsinks. One at the left-hand side, viewed from the rear, carries the line output and EW modulator driver transistors and the line driver chip. Another heatsink, towards the centre of the chassis, carries the field output and voltage regulator chips.

Dismantling

How a set has to be taken apart depends on the model of course. Hitachi and Finlandia sets have separate speaker boxes which are screwed to the cabinet back. You'll have to remove them before taking the back cover off. Take care not to short-circuit the speaker leads, as this can damage the output amplifiers. When refitting the cabinet boxes, ensure that the speakers are wired correctly and in phase. Don't overtighten the screws – doing this could break the fragile plastic.

De Graaf models have the speakers fitted to the front of the set, so you can remove the back in the normal way.

Once the back is off the complete chassis can be slid out. With Hitachi and Finlandia sets the mains switch, display, IR receiver and headphone sockets are on a small panel at the front of the chassis. You will have to disconnect them to slide the main PCB out of its runners. In De Graaf models these items are at the top right-hand side of the set.

Take care not to damage the front flap. Apart from the flap itself the side panels could be damaged.

Power Supply

This chassis represented a departure from the well-known Nokia/Salora Ipsalo circuit, with its single transformer for the chopper and line output stages. In the N chassis there are separate chopper power supply and line output stages.

The power supply circuit is shown in Fig. 1. It's based on a TDA4605 chopper control chip (IN01) which drives a 2SK1118 field-effect chopper transistor (TN01). When operating normally (this includes the standby mode) the circuit produces an HT supply of 155V across reservoir capacitor CN12.

To check whether there's a fault in the power supply or the line output stage, disconnect the latter and connect a 60W bulb as a dummy load in its place. If the fault is in the line output stage, the power supply will now work.

The power supply is generally reliable (but see fault notes later). Normal operation can usually be restored by replacing the TDA4605 chip and the 2SK1118 transistor. Before fitting these items, it's best to check all the high-value resistors associated with IN01.

Line Output Stage

The only unconventional thing here is that the drive for the base of the S2000AF line output transistor TH02 comes from pin 1 of the TDA8140 line driver chip IH01, i.e. there's no discrete component driver stage with transformer.

If the line output transistor has died, the tuning capacitors CH07/08/09 should be checked. It's best to replace CH07 whenever there has been line output stage failure. The value is 9.1nF (11nF in 21in. sets) and the rating 1.6kV. In the larger-screen models you can use the blue Philips type that does the job in the 2A chassis. CH09 (150nF, 400V) should also be replaced. In some sets this capacitor is rated at 250V: uprate it to 400V. I use the RS Components polypropylene type (stock code 169-1821). CH08 (27nF) can be responsible for some weird and wonderful EW faults when faulty. Check the two EW modulator diodes DH02 (BY228) and DH03 (RGP15J). Replace them if in any doubt.

The line output transformer seems to be reliable, which is more than can be said for the focus/A1 control module that's fitted to it. This item can arc and burn up, usually affecting the focus lead that comes out of the

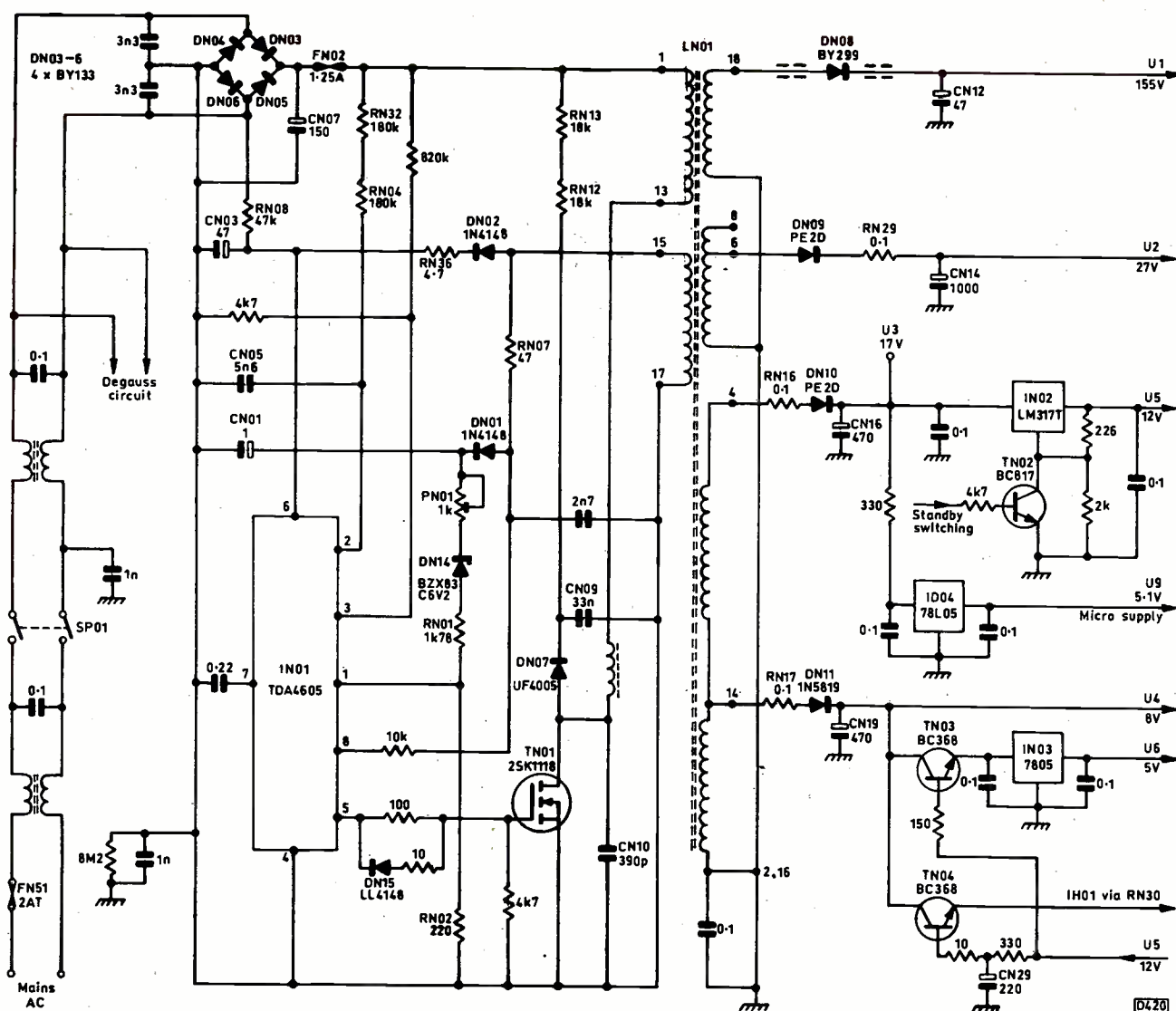


Fig. 1: Circuit diagram of the FET chopper power supply circuit used in the Nokia N chassis. TN02 provides on/standby switching, controlled by ID01. The line driver chip IH01 is also switched. When the 12V supply U5 is present TN03 switches on to enable the U6 supply (5V) and TN04 switches on to provide the supply for IH01.

transformer. If this has been badly damaged you will need a new transformer.

Check the whole area for dry-joints, especially around CH07/08/09.

In addition to the items so far mentioned, EW correction involves transistors TH03 (BD241D) and TH04 (BC639) and the loading coil LH06. The drive comes from pin 8 of the XC/MC44000 digital chip IF01 in the signals part of the main board. Most problems are caused by the tuning capacitors, as mentioned above, but the loading coil can fail with shorted turns. Check it by substitution.

Line Driver Stage

The line driver stage is certainly different, see Fig. 2. It's based on a TDA8140 chip (IH01) which only rarely fails. This is just as well, because removing it is difficult. The chip can be responsible for loss of line drive and for repeated failure of the line output transistor.

IH01 is mounted on the same large copper heatsink that carries the line output transistor. The problem is that pins 9-16, which are connected to chassis, are soldered

to both the PCB and the heatsink. It's not easy to unsolder these pins because the heat is absorbed by the heatsink. This is how I do it - others may have different ideas.

First unsolder the eight pins that are not soldered to the heatsink, then lift the IC so that the eight unsoldered pins are out of the board. Apply heat to the remaining eight pins and remove as much solder as possible with desoldering braid. Next apply a generous amount of flux. Heat the pins and at the same time use thick pliers to pull the IC out. You may break several of its pins or the lot. Once the chip is out, any remaining pins can be removed. Be prepared to have to repair some of the print in this area afterwards.

Field Output Stage

A TDA8170 chip, IV01, is used in the field output stage. Should this chip fail it will load the line output stage, from which its 24V supply (U8) is derived. The microcontroller chip ID01 will detect that a fault is present and switch the set to standby.

Unfortunately you can't remove or unsolder IV01 to prove that it is responsible for the reversion to standby,

as the microcontroller chip needs to know that it's there! Replace the flyback boost capacitor CV01 (220µF) as well as the IC.

The Signal Circuits

The signals circuits are on the right-hand side of the main PCB. They are separated from the power stages by the metal heatsink that carries the regulator and field output chips.

UK sets have a UHF-only tuner. The IF strip is a plug-in module fitted with UK standard 6MHz crystals. I have come across modules with crystals for 5.5MHz sound as well: if you have such a module, the tuning menu (see later) can be used to select the sound.

There are two types of stereo sound module, a large one that incorporates a standard Nicam decoder and another that has two digital ICs, one of which is an MSP2400 multisound processor. The former is generally found in De Graaf and Hitachi models, the latter in Finlandia sets. I understand that it will process the German Zweiton sound signal as well as Nicam. The modules are not interchangeable, and I am not sure whether an MSP2400 chip obtained from another manufacturer will work – I am told that there are different versions of this chip. Perhaps someone can clarify this for us? A peculiar fault occurs when this chip fails: the set will not come on, though the front LEDs flicker at switch on. To check, remove the Nicam module and switch on. If the set now works normally (with mono sound) it's likely that the MSP2400 chip has failed.

The text module also plugs in. It uses SAA5231 and SAA5243 text processing chips.

Video and sync processing and video input switching is carried out by the XC44000 chip IF01 (or its equivalent, type MC44000). It's a sort of digital jungle chip that's controlled by ID01 via an I2C bus. IF01 carries out PAL, Secam and NTSC decoding; grey-scale adjustment; generation of line, EW and field drive signals; geometry adjustments; and beam limiting. Note that there are several versions of this IC. Although they are interchangeable, realignment for geometry and grey scale may be required if a different version is fitted. Details are given in the electronic screwdriver section.

Audio processing at baseband frequencies is carried out by IL01 (MC44130). It's essentially an input/output switcher together with tone, balance and volume controls. Overall control is again by ID01 via the I2C bus.

The microcontroller chip ID01 is the heart of the set. It works in conjunction with an SDA2526/MCM2814 EPROM, ID03, controlling everything from the comprehensive user settings to the equally comprehensive electronic screwdriver system.

Tube Base PCB

A single TEA5101A chip, IT01, on the CRT base panel provides the RGB drive signals. The chip can be responsible for the loss of one or more colours. If it goes short-circuit, RT05 (10Ω) will go open-circuit. The result will be a bright raster with flyback lines.

If the picture appears washed out, bright and with flyback lines, check the 200V line. If the voltage is low, replace CH17 (2.2µF) on the main PCB.

Common Faults Summary

Dead set: Check the fuse in the power supply and the one on the mains input panel. If the latter (FN51, 2AT) has blown, suspect the BY133 mains bridge rectifiers DN03-6 or the degaussing resistor RN10. If the DC fuse FN02 (1.25A) has blown, the 2SK1118 chopper FET TN01 is probably short-circuit. The FET and its

TDA4605 control chip IN01 should be replaced as a pair. Check the associated resistors and capacitors.

Power supply tripping: The most likely cause is a short-circuit S2000AF line output transistor (TH02). Check the tuning capacitors in the line output stage, also the EW modulator diodes DH02-3, before replacing the transistor (see earlier comments).

Set goes to standby: Check the TDA8170 field output chip IV01 by substitution. Alternatively there could be data line corruption: check the text and Nicam boards by unplugging them, and the tuner.

Very wide picture with no EW correction: Suspect that the BD241D EW modulator driver transistor TH03 is short-circuit and/or the RGP15J diode DH03. Check the tuning capacitors in the line output stage.

Narrow picture with no EW correction and transistor TH03 getting very hot: Suspect the tuning capacitors in the line output stage and the EW loading coil LH06.

Picture size varies horizontally and vertically with changes in picture brightness: Suspect CH08 (27nF, 400V) in the line output stage. You can use a 33nF, 400V capacitor if a 27nF one is not available.

Set sometimes goes to standby when changing channels, poor sync and/or poor picture regulation: Suspect the XC44000/MC44000 digital jungle chip IF01.

Low contrast: Suspect the BC857B video buffer transistor TF03.

Others may be able to add to this list, which is a short guide to some of the faults that I and my colleagues have had.

Programming and Menus

With the exception of power on/off, volume and programme up/down, the remote control unit has to be used to operate the set. The user can set and store all tuning information, including standards settings, and operate and store contrast, brightness, colour, volume, base, treble, balance and headphone levels (the latter is independent of the volume level). This is all done by using the menu button and the Fastext colour buttons. To access these settings, press menu on the remote control unit. You will then see the following:

colour	contrast	brightness
balance	bass	treble
h.phone	mono	wide
volume	norm	prog

with the top line highlighted in colour. All programming is carried out in this section.

Select the programme number you want to set then press menu repeatedly until the bottom line comes up in colour. Press the blue button. You will now see:

TV	satellite	radio
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in which only TV will be highlighted in red – unless you have a receiver with a built-in satellite and/or radio system (the chances of seeing one of these is small). When you have selected TV, the menu will change to:

Electrical Retailing

Show report

This year's Show occurred at a significant time, when digital TV and other developments are about to reach us. George Cole was there to report on the new equipment



Top photograph:
The Sony Model
KV32FD1 with its
flat Trinitron tube.
Available at
about £2,800.

The *Electrical Retailing Show '98* was held at the NEC, Birmingham during March 29-31st. It provided a showcase for many new television, video and audio products. The event has replaced the old Brown Goods Show, enabling retailers (and the press!) to get to see ranges of products from many manufacturers under one roof. This year's show was dominated by digital TV, but there were other interesting developments. These included DVD, Data-VHS, flat-screen TV and recordable CDs.

DTT and the Digital Network

There was no escaping digital TV, with many exhibitors demonstrating digital TV products, programmes and services. The Digital Network group has been set up recently by the broadcasters planning to start digital terrestrial television (DTT) in the UK later this year: members include the BBC, ITV, Channel 4, Channel 5, S4C, SDN, British Digital Broadcasting (the joint Carlton/Granada group) and Teletext Ltd. The only major broadcaster not represented on the Digital Network is BSkyB, which does however have programming links with BDB.

Anthony Sethill, BDB's executive director and chairman of Digital Network's marketing group, explained that the name was chosen because DTT was considered to be too much like "techno-jargon", Digital Network

being considered to have greater appeal to consumers. Hmm. Anyway, to save space we'll stick to DTT in this report. The Digital Network group has devised its own logo, but there are no plans at present to use it on DTT receivers or set-top boxes.

Members of the Digital Network will co-operate in a number of areas, including receiver and set-top box specification, broadcast standards, technical specifications/interfaces for DTT equipment, conditional access technology, frequency allocations and the roll-out of transmissions.

The slogan "no dish, no cable, simply plug-and-play" is being used to promote DTT, the message being that viewers can use their existing aerials to receive DTT broadcasts. This needs a bit of qualification. In some areas the existing aerial group will have to be widened to provide for all the DTT multiplexes, i.e. some people will have to switch to wideband aerials if they want all the DTT transmissions. It's estimated that when DTT is launched in the fourth quarter of 1998 some 65-70 per cent of homes will be able to receive the signals using their existing roof-top aerials – a similar proportion to when Channel 5 started. Anthony Sethill claims that the number will rise to 90 per cent by the end of 1999, with an eventual maximum reach of 95 per cent of homes.

The DTT promoters are pushing its theoretically improved picture and sound quality (Nicam already provides excellent digital sound with analogue services however), increased widescreen programming and interactive viewing (see below), also the fact that digital is inevitable – the government will eventually announce an analogue switch-off date, as it did with 405 lines, though the announcement is unlikely to be made for several years.

Preliminary specifications for the DTT box were agreed in November 1997, but at the time of writing (April 1998) they have yet to be finalised. The companies selected to produce DTT boxes are known however: Grundig, Nokia, Pace, Philips, Sony and Toshiba. The box will sell at a subsidised price of £200 when purchasers take out a year's subscription to BDB (£120). Without the subsidy, the boxes are expected to cost £350-£400.

BDB's service will offer twelve basic channels plus three premium channels – Sky Screen One, Sky Screen 2

and Sky Sports. The BBC will provide much of its programming in widescreen format and introduce two new channels, BBC Choice and BBC News 24. The ITV companies' plans have not yet been released, though Channel 4 intends to offer a premium film channel. Viewers will be able to receive free-to-air DTT programmes, such as the BBC channels, without the need to purchase a card for the set-top box's conditional access system.

The DTT box is to use the SECA conditional access system rather than BSkyB's News Datacom system. There's some dispute between BDB and BSkyB as to whether this will be a threat to compatibility between terrestrial and satellite digital services. Both sides say they are willing to discuss this, but neither side has made the first move. It's unlikely that the proposed digital satellite 'sidecar', which will plug into a DTT box to enable viewers to receive satellite digital services as well, will be available until well into 1999.

The DTT box will have a wide range of audio and video connections, including a UHF input (for the aerial), an RF output, twin scart connectors and an RJ11 modem connector for a telephone link. The box will have a basic built-in modem (speed 2,400bits/sec) which is intended for pay-per-view services, definitely not for exploring the internet. There will also be an RS232 socket for an external modem, a smart card slot and a DVB common interface adaptor for a satellite TV sidecar, audio description channel module and an IEEE 1394 interface. Incidentally the satellite TV sidecar will require an external power supply.

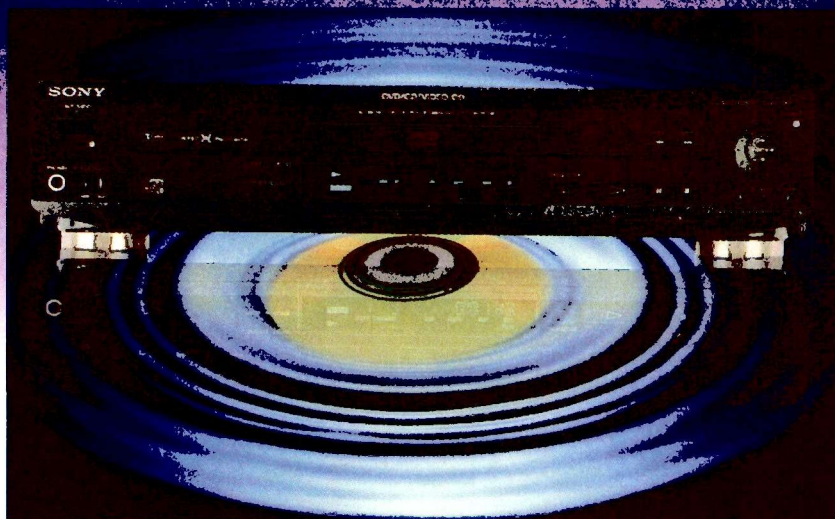
The DTT box may include software for interactive services. BDB says that it is talking to a number of interactive-TV companies including British Interactive Broadcasting (BIB), Microsoft's WebTV and Network Computers Inc. (NCI).

The Digital Network group provided the first public demonstration of live DTT broadcasting: a 100W signal from the Sutton Coldfield transmitter, supplied by Castle Transmission International, was picked up by a miniature receiver/transmitter inside the hall.

BSkyB

BSkyB had a large stand at which its prototype Electronic Programme Guide (EPG) and some of the programming that could be available via its digital satellite service (still due for a June launch) was shown. There will be some 200 channels – 150 video and 50 audio. BSkyB's new 52cm elliptical dish for the digital transmissions was on display. The EPG will help viewers to find their way about amongst the multitude channels and services, and enable them to plan their viewing for up to seven days in advance. It uses a remote control handset, on-screen menus and icons.

The TV Guide tells viewers what is available on the various channels up to a week in advance, and may include extra information such as a cast biography or programme synopsis. There's a personal planner which is like an electronic diary. The viewer can select programmes of interest and note them in the planner: at the relevant time an on-screen message announces that a selected programme is about to start – future digital



The Sony DVPS315 DVD player which offers high-quality pictures and sound, full software compatibility and digital outputs for connection to a separate audio decoder. Available at about £500.

receivers will presumably actually switch to the programme.

Box Office is used to select pay-per-view films, which will be broadcast on various channels at staggered start times (about 15-30 minutes apart). These near video-on-demand services are expected to prove popular and could be a challenge to the high street video rental store. Box Office may offer short clips for film previewing.

The EPG will incorporate a parental control system that uses a PIN code. Parents will be able to block programmes and channels, and also put a spending limit on PPV events – they will not however be able to limit how much is spent per week or per month.

Sky Mail will be a one-way e-mail system that enables the broadcaster to send advertisements and messages to a viewer. An EPG may for example discover that you enjoy watching football: it could then send you information about a forthcoming live soccer broadcast. It will be interesting to see what the civil liberties people make of this feature!

Astra

Astra Marketing demonstrated live digital test transmissions from Astra 1D at 28.2°E. They included programming from the BBC, BSkyB and SES, the owner of the Astra satellites. There were also digital transmissions from 19.2°E, provided by CanalSatellite Numerique (France), DF1 (Germany) and Canal Satellite Digital (Spain). Visitors to the Astra stand could not only see digital services in operation: they could also use the various EPGs.

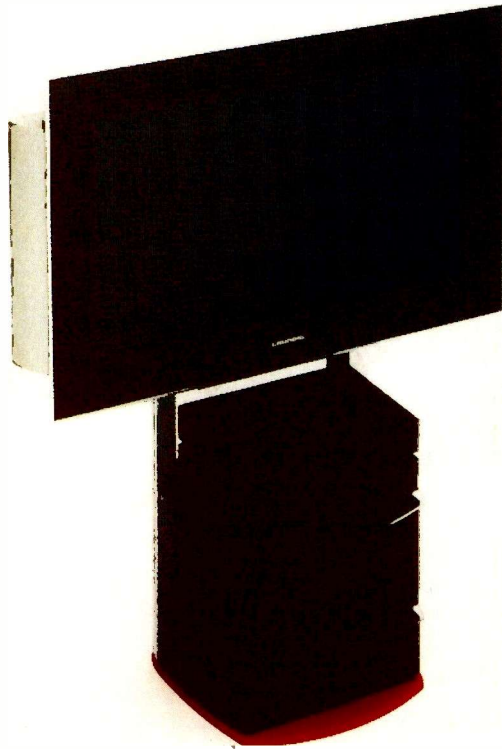
Astra says that there will be three ways of receiving its digital satellite services from 28.2°E: by purchasing a new digital system with a 50cm dish; by fitting a universal LNB to an existing dish and pointing it at 28.2°E; or by adding a second, universal LNB to an existing dish and pointing it at 28.2°E, enabling the viewer to receive both analogue and digital services.

Astra Marketing's trade support manager Tony Buszka said that retailers were very interested in digital satellite TV, and commented that the ability to try out an EPG gave them a better understanding of what digital TV has to offer.

BBC

The BBC had its own stand which was being used to promote digital TV, enhanced Ceefax – the pages have improved graphics and fonts, plus pictures – and Digital Radio. The latter is now available to sixty per cent of the UK's population. The BBC envisages that TV programmes will have links to the internet, and plans to offer services with this feature.

The Grundig 42in. Planatron display.



The well-designed remote-control handset for the Nokia 9850T DTT set-top box.



Digital TV Equipment

The stands were awash with digital set-top boxes and digital receivers. Nokia showed its prototype Model 9850T DTT set-top box, which can handle data rates up to 15Mbits/sec and incorporates a high-speed RISC processor, 2Mbytes of RAM and 4Mbytes of flash memory. It can provide both 4:3 and 16:9 pictures plus letterbox and pan-and-scan. The audio and video connectors include an RF connector and twin scarts (each with RGB, composite video and audio outputs). There are two phono audio sockets for connecting the 9850T to a stereo system – audio phono sockets are an option listed in the DTT box specification.

The power consumption of the DTT set-top boxes on show was quite high (6W) when in the standby mode. Graham North, Nokia's sales and marketing director, said that this may be reduced when production models appear.

Owners will be able to switch off their DTT set-top boxes for two-three weeks, perhaps when they go on holiday, without having to worry about the update and authorisation signals periodically sent by the SECA conditional-access system being missed. A Digital Network spokesman said that the DTT CA system has been designed so that reception breaks of several weeks will not affect a decoder's ability to receive the digital signals.

Nokia demonstrated its DTT box with a 40in. Pioneer flat-screen set. The picture was fine, although some material produced an occasional 'blocky' effect. The remote-control handset is well designed.

Nokia also demonstrated its digital satellite receivers: the Mediamaster Model 9600S is the world's first with a common interface; the Mediamaster 9200S is a free-to-air digital satellite receiver that was launched last year.

The Pace stand had a row of digital TV set-top boxes, including those being developed for BSkyB and BDB. The BSkyB box handles the 4:3 and 16:9 formats and includes a built-in modem. It has a twin smart-card slot, Macrovision decoding of all composite video and RGB signals, an IEEE 1394 module interface, a modem phone connection, an RS232 interface, a stereo audio output and two RF outputs – the second one is for an IR acces-

sory, so that programmes can be viewed and controlled at a second location in the home. There are 4Mbytes of flash RAM, 4Mbytes of SDRAM and 2 x 16Kbytes of EEPROM. Other features include a BSkyB EPG, off-air software downloads, parental lock, World Teletext decoding and display and 22kHz LNB control with DiSEqC.

Philips had on show a prototype DTT set-top box and an IDTV (Integrated Digital TV). The latter was a 32in. 16:9 set with a built-in DTT tuner. Philips plans to launch 28 and 32in. IDTVs later this year.

Grundig and Toshiba also demonstrated digital TV set-top boxes. Hitachi showed the IDTV Model C32W40DTN, a 32in. 16:9 set with a DTT tuner, a Dolby Pro-Logic decoder and a built-in centre amplifier and speaker. A 28in. version, Model C28W40DTN, is to follow. Hitachi also had one of the nicest looking DTT set-top boxes, the silver DV-K2.

TV Sets

There were plenty of large-screen TV sets at the show. Toshiba displayed the 3787DB, a 37in. CRT model with a built-in Dolby Digital 5.1 decoder. This is a 4:3 aspect ratio set which also includes Fasttext with a 500-page memory, a 100-channel tuner, and three scart sockets. The suggested price is £2,000. Toshiba also had a new 28in. widescreen set, Model 28W8DB, with Dolby Pro-Logic sound at a suggested price of £850.

Sony plans to launch fifteen new sets this year, including Model KV29FX11. This is a 29in. FD Trinitron set with a 4:3 aspect ratio flat screen. Suggested price is £800. Model KP41S4 is a 41in. projection set with auto-convergence technology. Suggested price is £1,800. Sony is to announce its plans for IDTVs later in the year.

Grundig showed a 37in. CRT set, Model M95-411/9, which has a VGA socket for displaying computer graphics and 100Hz scanning technology. Suggested price is £2,300. The LG Electronics range included a 16:9 Nicam set, Model WF32A14T, at £900.

Flat-screen TV sets were displayed on a number of stands. The Philips Model 42PW9982C has a 42in. plasma display and is just 10cm deep. Due for release this summer, it will include a 13-speaker Dolby Pro-Logic sound system. It's expected to sell at about £12,000. Grundig's Planatron is also a 42in. 16:9 plasma-screen set at £12,000.

The Mitsubishi stand was dominated by a prototype 46in. 16:9 plasma TV set. There was also the XP4015C, a 40in. 4:3 plasma display model with a 160° viewing angle. It is 11.3cm deep, weighs 42.5kg and is expected to sell at about £10,000 plus VAT. The pictures displayed by both these sets looked good, though the 46in. prototype had a defect which produced a vertical line down the screen.

Hitachi also showed a set with a 42in. plasma display: no marketing plans were announced. Hitachi displayed sets with progressive scanning, including a 17in. PCTV which was described as a PC monitor with a built-in tuner.

DVD

I was surprised by how low-key DVD was at this year's show. Although a number of companies, including Grundig, Hitachi, Sony and Toshiba, had players on display the format was overshadowed by digital TV.

The Toshiba SD3107B has a scart lead and an optical lead for connection to a Dolby digital TV or decoder. Sony's DVP715 at £600 and DVPS315 at £500 can also play Video CDs. Grundig showed Model GDV100D. Hitachi had a silver-look player.

VCRs

DVD may have arrived, but there were still plenty of VCR developments. The Hitachi Model VTFX770E at about £380 includes MovieText, which is better known as Closed Captioning – an integrated decoder enables viewers who are deaf or hard-of-hearing to see the captions now encoded with many prerecorded tapes. This model also has a Tape Navigation system. Each tape is automatically given its own ID number, and information relating to it is stored in a memory chip. An on-screen display lists the contents, with recording details that include the date, channel number and length. By moving an on-screen cursor and pressing play the machine goes to a particular recording. The system tells you how much blank space is left on a tape, and whether you have already watched a recording.

I was surprised that Sony didn't show its new SmartFile VCRs, which use a super-thin microchip inside a cassette label to store recording information. The company was pushing its SmartLink system however. This enables suitably-equipped TV sets and VCRs to communicate with each other via a scart link. The Sony Smart Engine system has an aluminium diecast drum base, a thicker lower drum and an artificial-intelligence control chip: the system provides improved head tracking and tape transport. It will be introduced with Model SLVF900UX, which is due for release in July at a suggested price of £480.

Mitsubishi displayed many new VCRs on its stand. The company is proud of its auto set-up and 1-2-3 Menu systems. They make it easier to use a VCR, in particular by providing lots of on-screen help.

The Philips Model 21PV688, a combined 21in. Nicam TV and VCR, is due for a July release at a suggested price of £630. Hitachi and Philips also had D-VHS (D for data) VCRs on show: Philips plans to introduce a D-VHS model at £800 later this year.

Satellite Systems

Analogue satellite transmissions will be around for a long time yet. As if to emphasise the point, a number of companies introduced new analogue receiving systems.

Nokia's range included the SAT1800 SatScan, which has 600 preset channels and a 31-satellite location memory. A 60cm version costs £280. The Nokia SAT780 is a budget system that costs £100 when bought with a BSkyB multichannel package.

Grundig introduced three new analogue systems, the GRS2, STR3200 and STR300T. Modified software in the GSR2 and STR3200S makes installation easier and controls the DiSEqC switching. Features include a 200-channel tuner, preset Astra 1A-D channels and 22kHz tone switching. These models cost £100 with a 60cm dish when bought as part of a BSkyB package. The STR300T with its 300-channel tuner, twin LNB inputs, VideoCrypt decoder and Wegener Panda stereo sound costs £200.

Camcorders

The Sony DCR-TRV9 at £1,600 includes the company's NightShot technology, which uses infra-red light to enable a camcorder to record images in complete darkness.

Canon showed its new DMV100 MiniDV camcorder, which is very compact. It includes an 11x optical zoom, 2.5in. LCD screen and an electronic image stabiliser. Canon also launched four new 8mm and Hi-8 models: it clearly feels that the analogue formats still have much to offer.

Audio

Philips had four home CD recorders on display, includ-



ing the CDR765. This is a twin CD player and CD recorder: you can pop a CD in one slot, a blank CD-R disc in the other and start copying. It also has synchro-start recording and double-speed copying. It's due in the shops later this year at around £450.

Sony is still pushing its MiniDisc format. The latest Sony range includes the playback Model MZE25 at £199 and Model MZE35, which is only slightly larger than the disc it plays, at £280.

Sony's DCR-TRV9 Digital Handcam which, at about £1,600, incorporates the NightShot feature.

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DX and Satellite Reception

Terrestrial DX and satellite TV reception and news. Possible aerial problems with DTT. A strange mode of FM DX reception. Roger Bunney reports

The first DX-TV column appeared within the pages of *Practical Television*, as this magazine was then known, back in 1963. It was written by Charles Rafele, who had carried out a lot of research on the subject. After his death in 1971, I was asked to take over. The column was renamed Long-distance Television to make its purpose quite clear.

Until fairly recently the emphasis has been on the reception of terrestrial signals, though there was a lot of excitement in 1975/6 when the first regular satellite TV broadcasts started – via the ATS-6 satellite to India from 35°E, at 860MHz. Pioneering DX-TV enthusiasts were able, using home-made receivers and dishes, to receive pictures of varying quality from the satellite. Most of us had a go.

From the mid-Eighties an ever larger number of enthusiasts turned to scanning the Clarke Belt in their search for unusual signals. This

change of emphasis has increased during the present decade. At the same time TV broadcasters have moved away from the VHF bands. Their departure has left the spectrum free for other uses, which has meant a dramatic increase in interference.

To reflect the change of emphasis, the name of this column has been changed to DX and Satellite Reception. I will continue to report on terrestrial TV-DXing, but will give greater attention to satellite signals, both analogue and digital. There will be more on the latter when a reasonably priced and, hopefully, user-friendly receiver becomes available.

Terrestrial DX

There was an unusual event in mid-March: an intense and unexpected meteor shower occurred on the 15th. So no one was prepared! The evening sky was lit up with meteor burns, the display being spectacular enough to attract the attention of local radio and the newspapers.

The Virginids 1998 MS was listed as being active during March-April, peaking on April 7-18th with a maximum on the 10th. The activity produced by this shower is usually insignificant. Perhaps we should pay greater attention to it next year.

Jean-Louis Dubler reports that all Swiss channels other than SF1 now use Viaccess.

Satellite Reception

First, a personal note. My polarisation adjustment, by means of an outboard knob, gradually changed. When I examined the prime-focus dish I discovered that the LNB's central support clamp and the feed

tube cap, which were both plastic, had melted as a result of the dish focusing solar heat on them. Odd that a dark green dish in the UK could produce such a problem, but it did. Unicorn Satellite has now supplied an aluminum LNB clamp, so hopefully there will be no more frying tonight!

A lot of excitement has been created by the on-going satellite dispute between SES/Astra and Eutelsat over the 28/29°E orbital location. Eutelsat claims the 29°E position and plans to establish its Europesat-1 project there. But Hot Bird-4's departure from 29°E to its permanent orbital position at 13°E has left Astra 1D in occupation, at 28.2°E, with a solitary Sky analogue test pattern. SES claims that its occupation of the 28.2°E slot is perfectly legal. On March 30th I noticed that Sky digital activity was present aboard Astra 1D. Presumably BSKyB is now digging in, with no opposition likely from Eutelsat until its next satellite launch and test period. Eutelsat's Hot Bird-4 appeared at 29°E on about March 12th, with tests proclaiming "Transmission via Europesat of the Eutelsat Network". The frequency was 12.305GHz (horizontal). Astra 1D put in an appearance at 28.2°E some days later. The dispute could delay BSKyB's digital opening.

March was otherwise fairly uneventful. The merging of the Amex and Nasdaq financial institutions on Wall Street produced some interest around the 19th: several news feeds were seen via Intelsat K at 21.5°W, with the German NTV feeds providing some extensive, in-depth coverage. An 'exotic' signal via the North Atlantic path arrived

Return of an old favourite (EBU NY), this time via PAS-3R (43°W) at 12.606GHz vertical.



from PAS-3R (43°W) on the 16th. There was a test pattern with "TLD de Puerto Rico" while a second caption read "B M S" with a long phone number – on colour bars with a 1kHz tone.

The Louise Woodward appeal hearings in Massachusetts on March 8th were given extensive coverage. Sky's Garry Cotterill led several live reports via Intelsat K for Sky News, preceded by the WBZ Boston TV test pattern. My thanks to David Gilroy (St. Albans) who gave me the nod that there's a very strong signal at 11.558GHz vertical from PAS-5R at 58°W. When I checked this out I was able to confirm the very strong signals – despite the fact that nearly half my dish was obscured by a panel fence!

John Womersley (Bradford) has corrected my comments on the January Saffest via Sirius. The Radio Caroline video visit was not aboard the Mebo 2 but the Ross Revenge boat. In the late Seventies Mebo ended up as El Fatah in Libyan government use for transmitting English/Arabic broadcasts while land-based AM stations were being built. When it became redundant it was towed out into the Mediterranean, used for bombing practice and sunk. Thus ended a colourful career in 20th century broadcasting!

Alex Smith (Chonburi, Thailand), who is currently working in South Africa, recently visited old friends in Bulawayo, Zimbabwe. They use a 1.2m dish for reception from PAS-4 at 68.5°E. The SABC-1, 2 and 3 services are available, along with Bop-TV. This signal package is intended for the South African backwoods, beyond the reach of the terrestrial network. Zimbabwe is at the edge of the satellite's footprint, but the 1.2m dish is just sufficient for these Ku-band signals. A reception package that consists of a dish, receiver, TV set, battery and solar panel is available in South Africa – to ensure that Neighbours can be received in even the most remote parts!

Alex Baxendale (Sowerby Bridge, West Yorkshire) wrote to us asking for help in identifying his reception during the afternoon of February 22nd. Crowds of people were seen lining the decorated, dirt street of a Mediterranean-looking town. There was a band, and two fellows with horns, dressed in bright Caribbean-style cloths, were attempting to thrust rapiers through

a hole in a suspended metal star while on horseback. There was a carnival atmosphere, and the logo "Stampa Services" was seen.

We normally require more information than this to identify a signal – the satellite, time and frequency at least. But Roy Carmen (Sandown, Isle of Wight) also saw the programme, via Intelsat K at 11.590GHz vertical, live from Sardinia! Alex uses a Pace MSS508IP receiver, a 1.25m Channel Master dish and a universal LNB.

Peter Pollard (Rugby) also uses a Pace MSS508IP receiver, with an 0.7dB Grundig LNB and an 80cm Lenson Heath mesh dish. They enable him to receive many programmes/feeds from Turksat round to Thor. The dish is driven by a Jaegar Silent Gold 99 H-to-H mount.

Terrestrial News

Hungary: The 120kW ERP ch. R1 transmitter at Budapest, used for MTV-1, is to close by the end of next year. A UHF replacement is already in operation on ch. R41. Pecs ch. R2 now transmits the RTL Klub programme.

Austria: ORF is to terminate cross-boarder transmissions to Germany (Bavaria and Baden-Württemberg). There have been programme clashes between ORF TV1 and commercial German channels, leading to pressure from the latter.

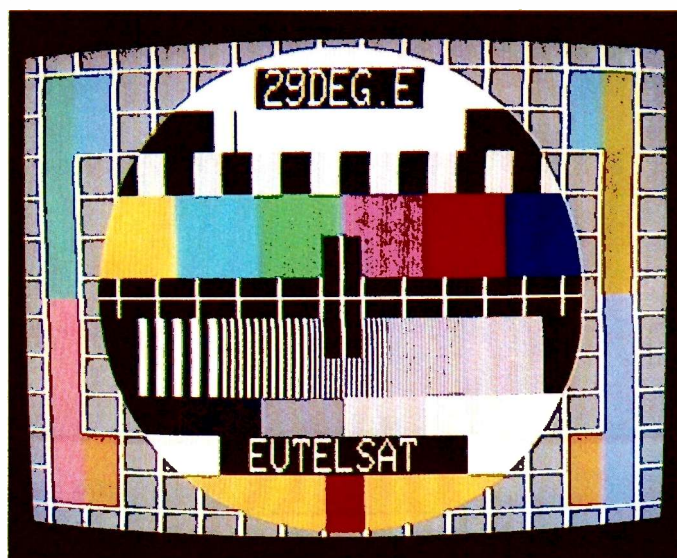
Scotland: Channel 6 Broadcasting, the new RSL (Restricted Service Licence) network, is to operate in Aberdeen, Dundee, Edinburgh, Perth and Stirling for two years and will be on-air by the end of 1998. There will be common programming for part of the day. At other times each region will produce its own content for a potential 300,000 or so viewers. Daytime is to be mainly for music, with local programmes in the evening.

South Africa: The IBA will shortly award an eight-year TV licence for a second commercial free-to-air service. It has only just given the green light for the first such network. The new stations are to come on-air next year.

Bophutatswana: Mmabatho-TV closed down at the end of January and Bop-TV has been merged with SABC. The government is at an advanced stage with preparations to start up a national TV service.

Aerials for DTT

The first digital terrestrial transmit-



ter listing I've come across has arrived, courtesy of Antiference Ltd. It makes curious reading. Normally the channels used by a transmitter are kept within a specific aerial group – A, B and C/D, with K, E and W for the wider band requirements.

Naturally the first check I made was on my local Rowridge, Isle of

A transmission from Hot Bird-4 while it was at 29°E.

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PAS-5 (58°W) is now providing a strong Euro spot beam in the UK.

Wight transmitter, whose channels are in group A (21-37). It is proposed that multiplex 1 (BBC) will use ch. 67, multiplex 2 (ITV + Ch. 4) will use ch. 52 while multiplexes 3-6 will be in the group A spectrum. Thus the aerial group for Rowridge becomes W rather than A. The powers used for the digital transmissions will be about -20dB down relative to the analogue transmissions, i.e. 10kW.

Rowridge isn't unique: other main transmitters have gone to K (21-48) or W (21-68). Fremont Point, Jersey is one that has gone to W, with channels ranging over 38-68.

Unless a stacked bowtie array is used, with its flattish wideband UHF gain characteristic, those in former group A areas now W might well find that their reception suffers. Low group A channels could be 3-6dB down with respect to C/D channels when a wideband Yagi aerial is used. This of course assumes that the customer is going to be willing to pay for a new and perhaps more elaborate aerial system. Shock horror may prevail if a Channel 5 aerial has just been installed.

It will need a tempting and perhaps subsidised carrot to persuade viewers to invest in a new aerial system for digital TV. With BSkyB about to offer 150 video channels via a small dish, I am wondering whether DTT is on. I recall BSB and Squarials!

The *Analogue and Digital UK Television Transmitting Sites* station list has just been published by Antiference Ltd. (phone no. 01295 482 511).

FM DX

I recently received Smile FM 93.9MHz, a Manila, Philippines

radio station, here in Romsey, Hants! Commercials for Marlborough Country fags, music and the news were heard, although reception was rather hissy. Hugh Cocks in the Algarve, Portugal alerted me to this reception possibility – he has received the signal using just a half-wave dipole.

There's a catch here. It's definitely Smile FM, but received in a curious fashion. Check 269-650MHz with your scanner. I did and, although I have an elderly AR2002 coupled to an Icom discone aerial, the signal appeared. Hugh recommends a bandwidth of about 30kHz. I can only select either narrow at 5kHz or mega wide, so there's distortion, particularly with speech.

How is this propagation phenomenon taking place? The signals arrive courtesy of a US Fleetsatcom bird at around 40°E. Hugh thinks that the satellite is picking up the STL (studio-to-transmitter) radio link and reradiating it in error. An internet printout from Christian Maas suggests that the satellite reradiates third harmonics of errant terrestrial FM transmitters. He mentions other, South American transmitters that are downlinked within this general band. Again it's three times the fundamental plus the difference between the US Fleetsatcom uplink and downlink at 53.7MHz.

I've checked other frequencies, but although the carriers are there the audio is too low to be understood. Signals should be much better using a dedicated Yagi or helical aerial. So it's worth checking the 240-270MHz band (Radio Aurora, Chile 249.083MHz; Super Radio, Bogota 254.100MHz; Blue Danube Radio, Austria 260.125MHz). Let us know if you have any luck, with details of the aerial/equipment used.

The SpE Season

The coming Sporadic E season should be an improvement on last year. As ever, check the ch. E2-4 band not forgetting ch. R1 at 49.75MHz – if it's not swamped with local 49MHz pollution. SpE openings can occur at any time of the day or evening. You often find that during a particular season reception from certain directions is predominant. The usual distance is 500-1,400 miles, though signals from the Middle East and down into Africa can be received should double-hop reflection occur.

Late June to mid-July is the best

time for double/triple-hop reception from North America, where the lowest TV channel is A2 (55-25MHz, with 525 lines and 60Hz fields – so you might have to adjust the set's line and field hold controls slightly). If you are lucky enough to see an American signal on ch. A2, check chs. A3 and A4 where the signal is often of better quality. A scanner is very helpful: you can listen for the AM video buzz produced by a weak incoming signal. Hot, thundery weather is often a good omen for SpE.

An SpE opening can last from five minutes to five hours, with signals ranging from weak to very strong. The skip distance can change rapidly, and you can expect multiple images. SpE is unpredictable, but those with experience have a feel for when to look. Good hunting!

Satellite News

The digital Television par Satellite (TPS) operation is to carry a new regional service, Chaine Regionale. This is due to start in May, financed by the France-3 public TV service. TPS carries the France-2 and -3 services, which are not carried by its main rival Canal Satellite. The latter now has over 800,000 subscribers, TPS 400,000. Both are making considerable losses.

The Swedish TV6 channel is to be revamped and relaunched as a subscription channel.

Satellite technology is advancing into ever higher-frequency regions. New allocations have recently been announced by the FCC in the States and are already being snapped up. Reaching beyond the Ka band at 20-30GHz, the FCC has defined Q band as 33-50GHz, U band as 40-60GHz, V band as 50-75GHz and W band as 75-110GHz (*FCC Bulletin* no. 70; July 1997). Some overlapping will be noticed. So the following subdivisions have been proposed: Q band 30-40GHz, U band 40-50GHz, V band 50-60GHz and W band 60-70GHz. Rather confusing, but there you have it. Hughes, Lockheed, PanAmSat and Loral are amongst those who have applied to the FCC for allocations.

Astra 1K will be a future replacement for the present B sat at 19.2°E. It will provide additional capacity, with 52 Ku-band and two Ka-band transponders, while higher powers will enable 60cm dishes to be used from Portugal through to the Ural Mountains. Two steerable spot beams will provide simultaneous frequency downlinking across different areas.



Service Briefs

The following modifications/service updates have been announced by Pace Micro Technology plc

Models MSS100/MSS228/Prima

Intermittent loss of audio on channel change: Solder an 8.2V, 5% surface-mounted zener diode (part no. 925-0082511) across C506, on the underside of the PCB, with the cathode (bar end) of the diode connected to the capacitor's positive terminal and the anode to its negative terminal. Do the same with C517. Don't add these diodes if they have already been fitted. C506 and C517 are connected to pins 38 and 49 of U500 respectively. The fault may affect either the left or the right channel.

Audio buzz when the white level of the on-screen graphics is too high: Change R604 (SMD) to 680Ω, 0.1W 5% (part no. 940-6810501).

Tighter power supply output tolerance: Reduce the value of R3 (SMD) to 10Ω, 0.1W 5% RES 0805 (part no. 940-1000501).

Models MSS228/Prima

Patterning on the picture: This can be caused by an excessive load on the power supply, possibly because a damaged B SkyB card takes too much current, the result being power supply instability. The instability can be cured by reducing the value of C7 to 220pF, 10% (5mm ceramic capacitor, part no. 159-2219651).

Models MSS100/Prima

The UHF output is marred by faint horizontal lines when the RC handset keys are pressed: Adjust the angle of L201 in the UHF modulator so that it leans towards the front of the PCB at approximately 45°. This minimises interaction between the data bus and the UHF oscillator circuit.

Hum bars with terrestrial channels when the UHF loop-through is being used: Add an inductor and diode in the UHF modulator section. For details refer to Satellite Workshop, pages 476/7, May 1998; also correction on page 541.

Prima

Loss of video/audio: This can occur when the amplitude of the 4MHz clock signal at U500 is low. To cure the problem, change R706 (SMD) to 220Ω, 0.1W 5% (part no. 940-2210501); change R208 (SMD) to 2.2kΩ, 0.1W 5% (part no. 940-2220501); and C219 (SMD) to 1.8pF, 50V 5% (ceramic capacitor, part no. 940-0185301).

Models MSS500/MSS1000

Failure of C216: For improved reliability this power supply capacitor has been changed to a high-temperature, long-life type. It should be replaced whenever one of these receivers comes in for service. The new specification for C216 is 1,000μF, 63V 20% 7.5mm RD/EL LXF (part no. 857-1086760).

Models MSS200/MSS300/Apollo

Loss of video because of failure of transistor Q40: To prevent failure of Q40, which provides chroma and luminance phase compensation, its dissipation should be reduced. Increase the values of its collector and emitter load resistors (R261/R263) to 270Ω. The full specification of these SMD resistors is 270Ω, 0.1W 5% (part no. 940-2710501). The fault has occurred with only a small number of receivers.

Model MSS100

The handset was changed to the RC-10 type used with the Prima model in March 1997. It can be recognised by the marking "RC-10" at the bottom, right-hand side of the keypad. There can be difficulties with Video Plus Deluxe equipment if the wrong handset is used. Receivers with serial numbers beginning PCAA or NBIOO, or which contain letters later in the alphabet (e.g. PCAAB), use the RC-10 handset. If the serial number starts PBAAA etc. the old handset is required. This may need clarification – if necessary check with Pace on 01274 532 000.

Pace



Reports from
David C. Woodnott
 and **Adrian Spriddell**

Sony CCDTR70E

This modern unit had been dropped. As a result there were no viewfinder pictures. The LCD and all other functions worked. A broken EVF CRT was, I thought, the most likely cause, but on opening the EVF case I found that inductor L903 was damaged and had been 'uprooted' from the PCB. As it couldn't be repaired a replacement had to be obtained and fitted. When this had been done the viewfinder worked but there was a severe line linearity problem.

A small magnet is glued to the top end of the inductor, placed off-centre. If fitted incorrectly, as I had done, the magnet will be too close to the CRT, causing geometry errors. The problem was resolved by reversing the position of the magnet. **D.C.W.**

Sony CCDTR60E

No viewfinder picture was the complaint, which was cured by replacing C924 (68µF, 16V) on the EVF PCB. This is becoming quite a common fault. The usual symptom is a bright, blank raster with fly-back lines. **D.C.W.**

Canon UC100E

The customer told us that new heads were required, that he had been phoning around for the best (lowest) price, and that we were "best on this score" (not intentionally!). So the unit was brought in for inspection. The customer was pleased to learn that new heads were not required, merely refitting

Camcorner

the head drum connector. We have found this to be a problem with other models: poor connection can give the impression that one head has failed. **D.C.W.**

Sony CCDTR750E

Intermittent failure to accept a tape was the complaint with this camcorder. A check, using the Lanlink interface, showed that there was a head drum error during loading. The connections to the drum (CN500) were checked, cleaned and treated with Sony Floid grease. A long soak test then proved that all was well. We have found it advisable to remove all such deck connectors, especially those associated with the various sensors, and service them in the manner described above. **D.C.W.**

JVC GRAX7

There was a tape stuck in this machine. An accompanying note said that the problem had occurred before, and that the unit had been 'fixed' by an undisclosed repairer. It's not uncommon for the mechanism to fail because of wear or broken plastic guides, cams etc. The mechanism has been generally reliable, but these units are now about seven years old.

I removed the tape and checked the mechanism for signs of wear or damage, but couldn't see any. The take-up and supply guides were out of sync however. So the drum was removed to gain access to the loading rings, which needed resetting. When the Sony mode box was used to power the loading motor, the loading and unloading cycles seemed to be OK, with no unusual noises or drive sticking. So the PCBs were reconnected and the machine was powered.

Tape loading was OK up to the point at which the pinch arm starts to move. A click was then heard, after which loading ceased and the emergency unload mode was entered. On investigation I found that the mechanism was again out of alignment. So the unit was dismantled, but no reason for the failure was immediately obvious. I did

however notice that the loading rings had perhaps more play than is normal.

The fault was cured by replacing the three sets of loading guides and the washers that control the amount of free play (items 7 and 12). The guide slackness had allowed the upper loading ring to ride up and 'hop a tooth' at the point of failure, because of the increased stress required to operate the pinch roller assembly. **D.C.W.**

Sony CCDF375E

One of these camcorders arrived with a note to say that it wouldn't accept a tape but was otherwise OK. On test we found that the drum didn't rotate: it just twitched instead. Failure and leakage of capacitors C502 and C904 on the main syscon PCB was the cause of the trouble.

The fault has become quite common with models that use this PCB layout, i.e. the **F450** etc. Other capacitors in the same area can fail, causing this or other symptoms. They are wire-ended components. **D.C.W.**

JVC TK885E

Hot-air rework facilities and a scalpel are useful when the fault is intermittent luminance and/or chrominance. Remove the encoder card and carefully desolder the CX20053 chip IC1. Scrape off all the glue that secures the 'flying' electrolytics to the PCB. You will find that this glue has trickled beneath the flatpack IC, hardened and forced the IC's legs off the pads.

Clean the tracks and pads, coat with reflow flux and resolder the platethroughs beneath the IC. Clean the IC's legs, then refit it. Check the encoder and leadout wires for dry-joints. Finally clean off and refit the card. Fingers crossed! But it should be OK now. **A.S.**

Sony CCDF555E

The customer complained that the viewfinder picture was streaky. C909 (1µF) on the EVF PCB was the cause. **D.C.W.**

Answer to Test Case 426

- see page 555 -

Chopper power supplies in TV sets are fitted with protection arrangements which are designed to prevent fire, damage or danger when something goes wrong. Sometimes however protection occurs when the safety circuit itself has a problem and there's no external (to the power supply) fault at all. So it was in this case.

This Mitsubishi power supply is based on a TEA2261 chopper control chip (IC901). The excess-current protection system uses a couple of resistors, the parallel combination of R908 (0.33Ω) and R909 (0.27Ω), to monitor the current passed by the chopper transistor Q901. In normal operation the voltage developed across these resistors is relatively low, and thus has no effect on the operation of IC901 when applied to pin 3 via R905. When Q901, in a fault condition, draws excess current however enough voltage is developed across R908/9 to trigger the protection circuit within IC901, removing the chopper drive momentarily. The IC samples the current a few times more before the charge across C909 at pin 8 reaches the level at which the chip shuts down permanently - until the set is switched off and on again.

In this case the sampling resistors R908/9 were telling fibs! One was dry-jointed while the other one had gone high in value. Replacements restored normal operation and stopped the set bonking once and for all.

NEXT MONTH IN TELEVISION

Servicing the Mitsubishi Euro 12 Chassis

John Coombes on how to fault-find with this chassis, whose features include a master-slave chip control system in the chopper circuit. Models that use the chassis include the CT21A2STX, CT21A3STX, CT25A2STX and CT25A3STX.

Sony Chassis Guide

A listing of models fitted with the various Sony CTV chassis released over the past ten years. Particularly helpful when the service manual for a particular model is not available.

The IEEE 1394/FireWire Bus

The FireWire bus was originally devised by Apple Computers Inc. in 1988. It has since become an international standard (IEEE 1394) high-speed serial data link, and is likely to be adopted as the standard method of interconnecting domestic digital electronic equipment - PCs and the whole new generation of digital audio/TV/video boxes. Geoff Lewis describes the system and its operation.

Panasonic K Mechanism Fault Guide

A listing of common fault conditions and the repair procedures required.

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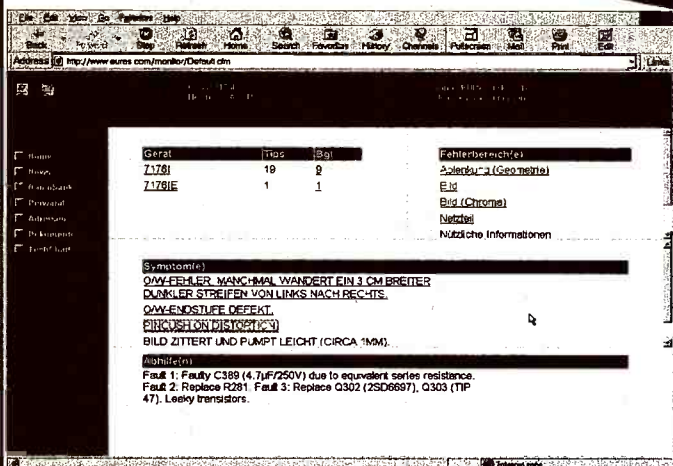
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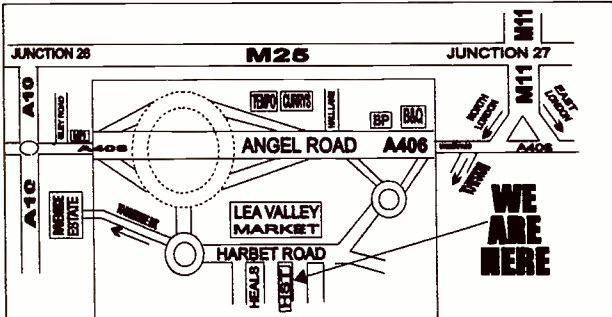
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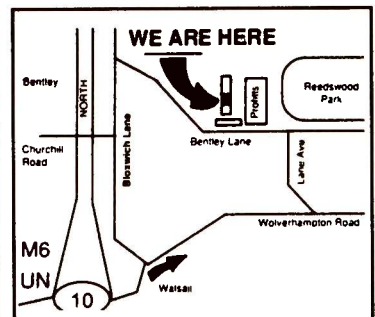
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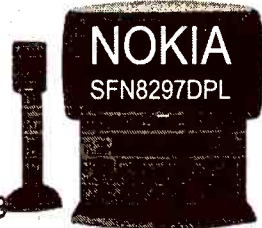
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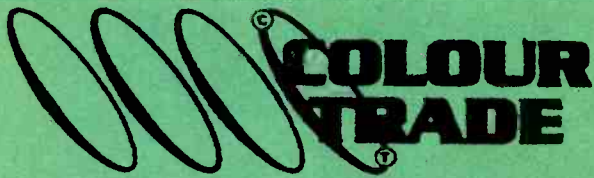
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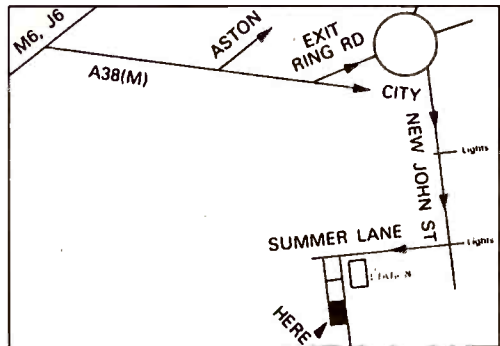
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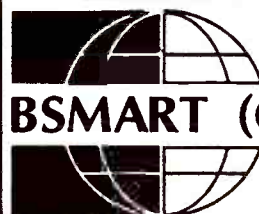
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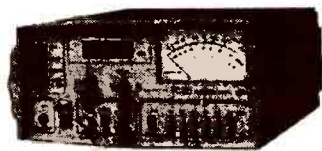
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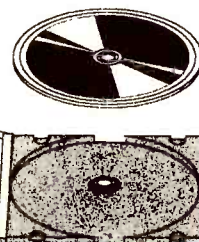
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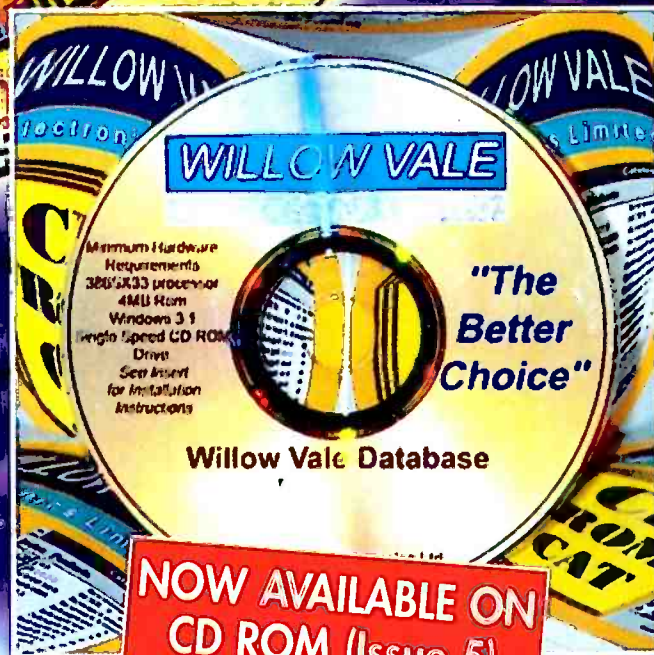
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