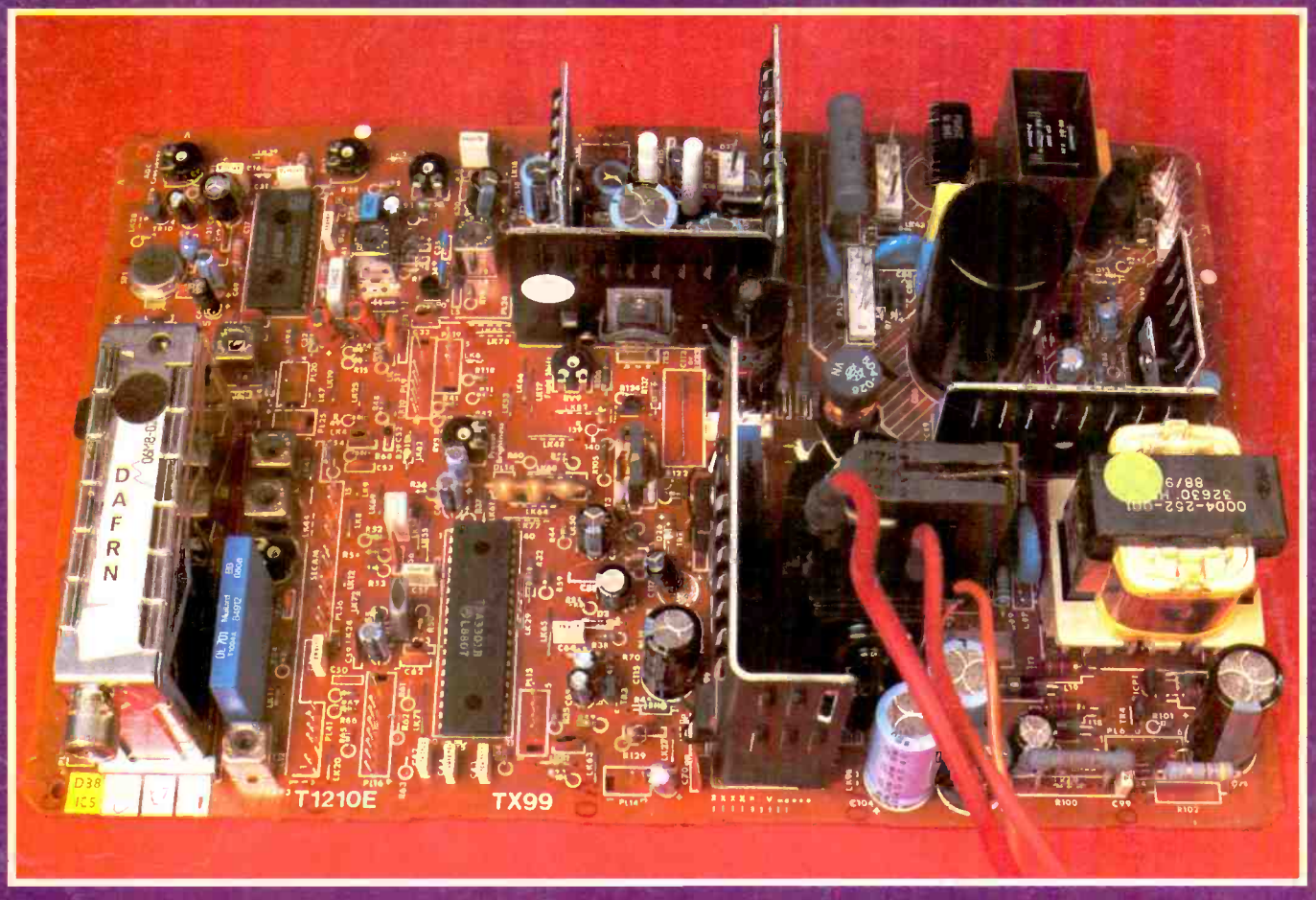
AUGUST 1988

Australia $4·40 (inc. GST), Malaysia $6·10 £2·05 (inc. VAT) £1·40

TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS

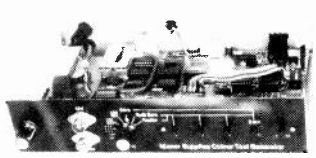


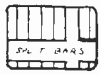
Ferguson's New TX99 Chassis
A Tifax-VM6101 Conversion
Video Tape Characteristics
VCR Back Tension • DX-TV
Picture-in-picture Displays
VCR Clinic • TV Fault Finding

MANOR SUPPLIES

MKV PAL COLOUR TEST GENERATOR FOR DOMESTIC TV & VCR.

TEST DEMONSTRATIONS AT 172 WEST END LANE





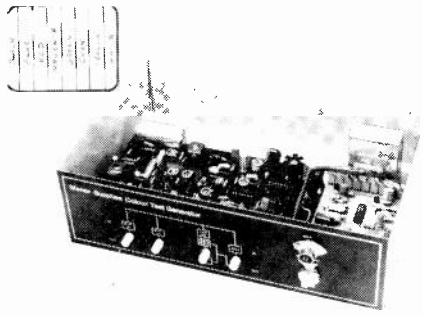
- ★ 40 different patterns and variations.
- ★ Fully interlaced sync pulses with correct picture blanking.
- ★ EBU colour bars, BBC colour bars, whole rasters & split bars (specially useful for VCR service), white, yellow, cyan, green, magenta, red, blue and black.
- ★ Chequerboard.
- ★ Mono outputs with border castellations, cross hatch, grey scale, vertical lines, horizontal lines and dots. UHF modulator output plugs straight into receiver aerial socket.
- ★ Additional video output for CCTV & VCR.
- ★ Facilities for sound output.
- ★ Easy to build kit, standard parts. Only 2 adjustments. No special test equipment required.
- ★ Mains operated with stabilised power supply.
- ★ All kits fully guaranteed with back-up service.
- ★ Also available with VHF Modulator.

Price of Kit	**£70.00**
Case (10″×6″×2¼″) app.	**£8.60**
Optional Sound Module (6MHz or 5.5MHz)	**£3.90**
Built & Tested in Case including Sound Module	**£108.00**

SPECIAL TEST REPORT 'TELEVISION' DEC. 1982

Post/Packing £2.80
Add VAT 15% TO ALL PRICES

PAL COLOUR BAR GENERATOR (Mk4)



- ★ Output at UHF, applied to receiver aerial socket.
- ★ In addition to colour bars R-Y, B-Y etc.
- ★ Cross-hatch, grey scale, peak white and black level.
- ★ Push button controls, battery or mains operated.
- ★ Simple design, only five i.c.s on colour bar P.C.B.
- ★ Backup service available.

PRICE OF MK 4 COLOUR BAR GENERATOR KIT £30.00. CASE £8.60. BATT HOLDERS £4.20. MAINS SUPPLY KIT £4.20 (Combined P&P £2.80).

MK 4 (BATTERY) BUILT & TESTED £58.00 + £2.80 P & P.
MK 4 (MAINS) BUILT & TESTED £68.00 + £2.80 P & P.
VHF MODULATOR (CH 1 to 4) FOR OVERSEAS £5.75.
EASILY ADAPTED FOR VIDEO OUTPUT & C.C.T.V.

ADD VAT 15%

TELETEXT DECODER PANELS (TESTED)
Mullard VM6101 **£30.00**, Philips KT3, K30 **£30.00**, p.p. £2.30

PHILIPS G11 PRESTEL TELETEXT UNIT includes Mullard VM6230 Teletext Decoder, 6330 panel, plus Line Coupler and Interface **£30.00**, p.p. £2.80

TV SERVICE SPARES

BACKED BY TWENTY YEARS EXPERIENCE & STAFF OF TECHNICAL EXPERTS

LOPTs, TRIPLERS, PANELS, TUNERS, SELECTORS ETC.

PHILIPS KT3, K30 PANELS, tested, exchange, sound power, frame, RGB **£7.50** each, Decoder (Non-text) **£10.00** p.p. £1.50.
THORN TX9 PANELS Complete & tested **£28.00** Exchange. (Shop only).
THORN 8000 TO 8500 Panels tested exchange. Power **£7.80, 8800, 9800** power **£8.80** p.p £1.50. Frame **£10.00** p.p. £2.30.
THORN TX9, TX10 Facia Control Panel Incl Infra Red Remote Receiver **£8.50** p.p. £2.00.
BUSH T20/22 Touch Tune Facia Unit **£7.50** p.p. £2.00.
THORN 8800, 9800 Touch Tune Facia Unit **£3.50** p.p. £1.50.
PHILIPS G11 PANELS (tested).
Frame, IF, decoder **£12.50** each p.p. £2.00. Scan **£20.00** p.p. £2.80.
PHILIPS G11 PANELS ex rental (untested).
Scan Frame, Decoder **£5.00** p.p. £2.00.
PHILIPS G11 IF PANEL (New) Less Tuner **£2.50** p.p. £1.30
PHILIPS HANDSETS (New Replacements) p.p. £1.50.
G11 Ultrasonic Nontext **£19.50**, Infra red Text **£19.50**. Others available.
KT3 Non text (RC4001) **£22.50, KT3, K30 etc.** Text **£22.50.**
PHILIPS HANDSETS Ex rental, text, Untested. KT Text/Video Type. **£3.50** p.p. £1.00.
PHILIPS COLOUR MANUALS p.p. 80p.
G11, K30, K35, 2A **£3.50**, KT3 **£4.50**, CTX-E, CTX-S, CF1 **£1.50** each.
THORN REMOTE CONTROL HANDSETS
TX9, TX10 Infra red (Non-Text) **£18.00; TX9, TX10** Infra red Teletext **£19.50**, p.p. £1.20. Large selection others available: Sony, Grundig, etc.
TX9 Ultrasonic remote handset transducer **£2.00**, switches 3 for **£1.50** p.p. 50p.
TX Remote panel 1564 (incl. SAA5012) **£5.00** p.p. £1.80.
THORN TX9, TX10 Saw Filter IF Panel. **£5.00** p.p. 80p.
TX9, TX10 Remote & tuning control panel (1515) **£10.50** p.p. £1.80.
PAL DECODER KIT (Video to RGB) for Monitors **£27.00** p.p. £1.00.
PAL ENCODER KIT (RGB to Video) **£18.50** p.p. £1.30.
CROSS HATCH UNIT KIT, Aerial Input type, incl. T.V. sync. and UHF Modulator. Battery Operated, also gives Peak White & Black Levels, can be used for any set. **£13.50** p.p. 80p. (Alum. Case **£2.90** p.p. £1.40.) **ADDITIONAL GREY SCALE** Kit **£2.90** p.p. 45p.
UHF SIGNAL STRENGTH METER KIT £22.00 Alum. Case **£2.90.** De Luxe Case **£8.60** (Built & Tested **£48.00**) p.p. £2.30.
CRT TESTER & REACTIVATOR KIT For Colour & Mono complete with Case, Panel Meter Indicator – can be adapted for latest CRTs **£29.50** p.p. £2.80.
BUSH A823, Time Base Panels **£5.00** each p.p. £1.80.
GEC 20AX Line Time Base **£18.00** p.p. £2.00.
ITT CVC30 SERIES, Convergence & Purity Panels. **£2.50** p.p. £1.50.
ITT CVC30 SERIES PANELS SURPLUS (untested) **£2.50 each.** CMP31, CMF31, CMA30, CM532, p.p. 80p; CMD33, p.p. £1.80.
ITT CVC20, 30 Series chassis for spares (shop only) **£2.50.**
THORN TX9 Panels ex factory for small spares. Includes I.Cs & Semiconductors etc. **£3.00** p.p. £2.00.
THORN TX9 Panels salvaged ex factory for spares incl. Electrolytic & Mains Transformers, **£8.50** p.p. £3.00.
THORN 8000/8500 IF/Decoder Panels salvaged **£3.20** p.p. £1.80.
THORN 9000 SERIES IF Decoder **£10.00** p.p. £2.30.
THORN 9000 IF/Decoder Panels Salvaged. For spares **£2.50** p.p. £1.80.
PHILIPS G8/G9 IF/Decoder Panels for small spares incl ICs **£2.50** p.p. £1.60.
GRUNDIG 8630 Series Varicap Tuners **£5.00** p.p. £1.00.
VARICAP TUNERS U321, U322/204, ELC1043 (equiv.) **£7.80** p.p. £1.00.
VHF Philips, NSF **£6.80** p.p. £1.00.
VARICAP UHF-VHF ELC 2000S **£9.80** p.p. £1.00.
UHF/625 TUNERS, many different types in stock. DECCA Bradford 5 position, MULLARD 4 position **£2.50**, JAP Rotary **£4.80** p.p. £1.80.
LOPTS New and guar. P/P **£1.50**, Bobbins **80p.**

FERG., HMV, MARCONI, ULTRA		**R.B.M.** 120, 122	**£9.80**
1590, 1591, 1612, 1613, 1712	**£4.80**	**R.B.M.** 120, 122 Bobbin	**£5.60**
FERGUSON 3787 (Normende)	**£9.80**	**DECCA** Bradford (state Mod No)	**£8.80**
THORN 1600, 1615, 1690, 1691, 1700	**£9.00**	**DECCA** 100	**£8.80**
THORN 3000/3500 SCAN, LHT	**£6.90**	**FIDELITY** ZX2000, 3000 (Not 22")	**£14.50**
THORN 8000, 8500, 8800	**£12.80**	**GEC** 2110 series	**£10.60**
THORN 9000 to 9600	**£9.80**	**ITT** CVC 5 to 9, CVC20	**£9.80**
THORN TX9	**£12.50**	**ITT** CVC25, CVC30 series	**£8.80**
THORN TX10	**£16.50**	**ITT** CVC45	**£9.80**
SPECIAL OFFER		**PYE** 725 (90°) 731 to 741	**£9.20**
DECCA 70, 80	**£3.50**	**PHILIPS** G8	**£8.80**
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GEC 2114J Junior Fineline	**£2.80**	**PHILIPS** KT3	**£9.80**
PHILIPS 320	**£2.80**	**PHILIPS** K30, K35	**£27.00**
PHILIPS G11	**£5.00**	**PHILIPS** CTX-E	**£22.50**
GEC 2028, 2040, 2100	**£4.80**	**PHILIPS** CTX-S	**£22.50**
PYE 691-7 chassis type only	**£5.00**		

OTHERS AVAILABLE, PRICES ON REQUEST.
TRIPLERS Full range available. Mono & Colour.
SPECIAL OFFER TRIPLERS
THORN 3000/3500 **£2.50. PHILIPS G8** (short focus lead) **£2.50** p.p. £1.20.
THORN 1500 5 Stick **£1.50**, 1500 3 Stick **£1.50** p.p. 80p.
6·3V CRT Boost Transformers for Colour & Mono **£5.90** p.p. £1.40.
THORN TX10 focus control **£10.00** p.p. £1.00.
PHILIPS G8 6 position selector units (sloping buttons) **£2.50** p.p. £1.00.
455 CRYSTALS for Remote Control Handsets, 4 for **£1.00** p.p. 50p.
VHF to UHF Converters **£26.50** p.p. £2.50.

CALLERS WELCOME AT SHOP PREMISES
THOUSANDS OF ADDITIONAL ITEMS, ENQUIRIES INVITED
LARGE SELECTION TESTED COLOUR PANELS POPULAR MODELS
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Access from all over Greater London.
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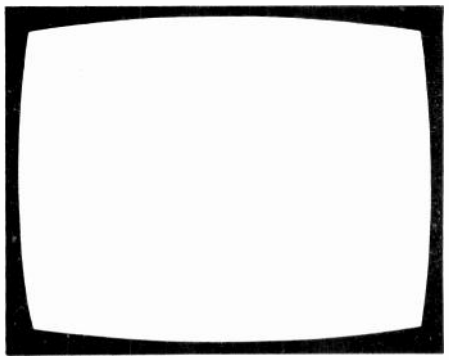

TELEVISION

August 1988

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CORRESPONDENCE

All correspondence regarding advertisements should be addressed to the Advertisement Manager, "Television", King's Reach Tower, Stamford Street, London SE1 9LS. Editorial correspondence should be addressed to "Television", IPC Magazines Ltd., King's Reach Tower, Stamford Street, London SE1 9LS.

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INDEXES

Indexes to Vols. 35 and 36 are available at 80p each from the Editorial Office (address above).

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We regret that we cannot answer technical queries over the telephone nor supply service sheets. We will endeavour to assist readers who have queries relating to articles published in *Television*, but we cannot offer advice on modifications to our published designs nor comment on alternative ways of using them. Correspondents should enclose a stamped addressed envelope.

Requests for advice on dealing with servicing problems should be directed to our Queries Service. For details see our regular feature "Service Bureau". Send to the address given above (see "correspondence").

this month

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BA521	1.50	SN76033N	2.49	TDA1006A	2.50	UPC1185H	2.45
BA536	2.00	SN76544N	2.35	TDA1005	3.60	UPC1186H	1.60
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CA1532	4.20	STK015	7.36	TDA1044	4.37	UPC1211V	2.70
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HA1151	3.89	STK441	11.57	TDA1180	2.91	UPC1223C	2.20
HA1175INT	10.82	STK461	12.60	TDA1236	3.44	UPC1225H	2.00
HA1342	5.58	STK465	12.60	TDA1270	3.95	UPC1226C	1.50
HA1306N	2.60	STK463	14.30	TDA1327	1.70	UPC1227V	1.20
HA1366WR	1.50	STK2129	17.27	TDA1352B	1.60	UPC1230H	4.39
HA1377	3.65	STK4352	6.00	TDA1412	95	UPC1238	2.50
HA11219	4.21	STR441	6.50	TDA1415	1.40	UPC1245V	1.35
HA11244	4.04	STR454	4.73	TDA1470	4.67	UPC1277	4.81
HA11741	23.22	STR451	6.50	TDA1770	5.60	UPC1350C	4.15
HA13008	13.58	STR6020	5.80	TDA1908A	1.95	UPC1353C	4.76
IS1555	43	SW153	3.90	TDA1950	2.39	UPC1365C	6.38
LA3350	95	TA7050P	95	TDA2002	75	UPC1356C2	2.08
LA4031P	3.21	TA7051P	95	TDA2003	1.10	UPC1367	2.00
LA4032P	1.30	TA7063P	2.20	TDA2004	1.60	UPC1358H	1.88
LA4102	1.10	TA7074P	3.46	TDA2006	1.45	UPC1360C	2.20
LA4112	3.25	TA7108P	3.43	TDA2010	2.40	UPC1363C	2.16
LA4422	1.20	TA7120P	2.43	TDA2140	5.95	UPC1368H2	2.15
LA7801	2.20	TA7129AP	3.76	TDA2151	3.25	UPC1370C2	2.58
LC7130	5.93	TA7130P	1.93	TDA2020	4.66	UPC1382C	1.08
LC7120	5.87	TA7146P	4.67	TDA2030	2.80	UPC1384	3.78
LC7137	5.50	TA7193P	5.67	TDA2270	1.65	UPC1394C	3.07
LM1011	3.25	TA7171P	8.90	TDA1870	6.46	UPC1447H	58
LM8361 = MM5387ANN	4.15	TA7172P	8.90	TDA2523	3.40	UPC41C	2.80
M293	7.10	TA7173P	8.90	TDA2524	2.25	UPC577H	2.46
M50790SP	6.98	TA7176P	2.00	TDA2525	4.00	UPC585C	1.28
M54544L	3.80	TA7202P	4.27	TDA2530	2.70	UPC1167C2	2.70
MC13002	4.98	TA7204P	1.35	TDA2532	2.90	UPD553C164	20.76
MC14493	8.97	TA7205AP	3.72	TDA2540	95	UPD7519G	17.13
MN1219	11.43	TA7208P	1.44	TDA2541	3.84	UPD7538C020	11.06
MB3712	2.60	TA7210P	6.60	TDA2560	1.15	UPD546C107	22.28
MC1307	1.99	TA7222	1.20	TDA2576A	7.84	UPD547C049	11.18
MC1310P	1.84	TA7223P	3.74	TDA2577	4.73	UO5G	1.27
MC1327	1.70	TA7227P	5.98	TDA2578A	5.12	V11N	1.27
MC1330P	1.84	TA7228P	5.98	TDA2581	3.95	10E2	43
MC1351P	2.93	TA7310P	2.78	TDA2582	2.60	10VT05	8.74
MC1349	1.99	TA7609P	4.39	TDA2593	2.95		
MC1350	1.50	TA7611AP	2.70	TDA2600	6.90		
MC1352	1.75	TAA570	3.98	TDA2610	3.20		
MC1495L	3.00	TAA310	2.83	TDA2611A	2.35		
ML231 ETTR6016	2.20	TAA320	2.00	TDA2640	2.90		
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ML237	2.50	TAA630	3.90	TDA2653A	5.90		
ML238	6.00	TBA120SA	1.49	TDA2680	3.40		
ML922	3.29	TBA120B	1.30	TDA2690	2.72		
ML923	2.90	TBA120SB	1.37	TBA2800	1.60		
MSM5807	7.87	TBA120T	1.47	TDA3190	2.00		
MS1513L	2.80	TBA120U	1.49	TDA3330	2.21		
MS1515L	3.28	TBA1440G	2.50	TDA3500	6.90		
SAA1025	8.50	TBA395	50	TDA3540	2.35		
SAA1124	5.34	TBA396	67	TDA3541	2.24		
SAA1250	4.99	TBA440N (TBA1441)	2.75	TDA3560	6.00		
SAA5000	6.15	TBA440P (TBA1440G)	2.50	TDA3561A	6.66		
SAA5010	6.30	TBA480Q	1.82	TDA3562	8.60		
SAA5012	6.50	TBA510	3.00	TDA3571	3.75		
SAA5020	5.90	TBA520(Q)	1.10	TDA3650	3.85		
SAA5030	8.25	TBA530(Q)	1.00	TDA3651A	4.50		
SAA5050	8.50	TBA540	1.10	TDA3652	6.00		
SAF1032	6.30	TBA560(Q)	1.10	TDA3950	4.37		
SAF1039	7.77	TBA570	1.79	TDA4420	5.55		
SAS560S	2.07	TBA690	1.50	TDA4500	5.84		
SAS570S	2.07	TBA700	2.12	TDA4503	5.68		
SAS660	3.25	TBA720	2.64	TDA4505	6.03		
SAS670	3.25	TBA750	2.98	TDA4600	2.95		
SAS580	2.90	TBA800	1.60	TDA4600-2D	2.95		
SAS590	2.90	TBA810AS	58	TDA8180	4.00		
SG-264A	5.12	TBA820	1.70	TDA8190	4.94		
SG629	8.05	TBA820M	1.25	TDA9503	4.21		
SG-6533	13.20	TBA890	3.94	TEA1009	1.86		
SL901B	7.00	TBA920(Q)	1.20	TL494CN	6.57		
SL917B	9.25	TBA950(2X)	1.08	UPC554	2.63		
SL1310	1.80	TBA970	4.09	UPC566H	75		
SL1327Q	1.20	TBA990	1.10	UPC575C2	89		
		TCA760	2.30	UPC576H	1.90		
		TCA270SQ	2.50	UPC585	3.06		
				UPC587C2	2.34		
				UPC1025H	2.15		
				UPC1026H	90		
				UPC1028H	90		
				UPC1032H	58		
				UPC1042C	1.56		
				UPC1156H	2.45		
				UPC1158H	3.60		
				UPC1163H	2.48		

SPECTRUM 48K SPARES

ULA6C001E	6.50
128K ROM	5.00
RAM 4116-2 (150n)	1.10
CPUZ80	1.70
LM1889	2.00
T14532 use 4164/4564	1.95
ZTX213	0.17
ZTX313	0.27
ZTX650/1	0.35
Xtal 4.4336 19MHz	0.80
Xtal 14MHz	0.80
7805 Voltage Regulator	0.78
74LS00	0.58
74LS32	0.90
74LS157	0.78
Modulator (UM1233)	2.20
Heatsink Iss. 1 & 2	0.45
Heatsink Iss. 3	0.45
Loudspeaker	0.90
Reset Pot 2.2k	0.15
Trimmer 50pf Max.	0.32
Keyboard Membrane	1.35
Keyboard Template	1.50
Keyboard Conn. 5 Way	0.17
Keyboard Conn. 8 Way	0.35
Double Sided Tape 40cm	0.35
Double Sided Tape Roll	5.75
PSU 1400	6.85
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Jack Sock. (Ear/Mic)	0.15
Lower Case	2.00
Feel Each	0.06
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Screw 9.5mm (Qty 4)	0.15
Spectrum Upgrade Kit without resets	23.65 22.95

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Sys. Test Cartridge	4.93
74LS04	0.58
ZX8401=PCF 1306	4.50
Lower Case	3.00
Upper Case	9.17
Membrane (5 Layer)	4.50
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COMPUTER ICs

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2732	3.30
2764	3.20
27128	4.95
27256	5.90
6264	2.75
6522	4.00
TMS1000	8.95
8271	60.00

COMMODORE ICs

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6526 CIA Keyboard	
Int.	5.11
6561	7.74
6569 Col. Vid. Cont.	20.77
6581 Sound Gen.	7.79
901225 Char. ROM	3.37
901226 Basic ROM	6.45
901227 Kernel ROM	3.52
906114 PLA	4.51
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8501	3.50
8701 Clock Chip	5.46
8360	19.61

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Solder Sucker Antistat std.	5.40
Solder Sucker Antistat lge.	6.20
Solder 500g	See Special Offer
D.I.Y. Solder Small Pack	45
Solder Sucker Nozzles	81
Solda Mop Stnd.	77
For sold. irons see Antex/Weller Under Specific Spares	
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Fuse Wire 5A, 15A, 30A	05
Fluorescent Starter (4-80W)	45
Battery Press Studs min.	11
Battery Press Studs std.	15
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17SWG 60 Amp	1.86
19SWG 45 Amp	1.86
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Cable Ties ALT21 per 100 (large)	1.69
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ECC88	1.35	PCH200	1.45
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ECF82	88	PCL84	1.20
ECH81	1.60	PCL805	1.09
ECH84	1.66	PCL86	92
ECL80	84	PFL200	1.86
ECL82	1.30	PL36	1.87
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SONY	24 2	18	5 1	50p
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PANASONIC	37	29	3 9	52p
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JVC	39 3	32 8	3 9	56p
JVC	33	23 9	4	56p
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VS9300	3HSSV	18.00
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3V22	3HSSV	18.00
3V23	3HSSV	18.00
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3V30	3HSSV	18.00
3V31	3HSSV	18.00
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HR3320	3HSSV	18.00
HR3330	3HSSV	18.00
HR3350	3HSSV	18.00
HR3360	3HSSV	18.00
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NV7000	3HSSN	18.00
NV7200	3HSSN	18.00
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9300	3HSSSP	26.95
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MS48	Thorn TX9 10 with solenoid	3.42
MS14	Thorn TX10	2.74
MS09	GEC 2040	0.97
MS31	Philips K13	3.84
MS30	Philips K30	2.60
MS32	Fidelity 70109 Front Panel	0.91
MS33	Fidelity 70150 Remote	2.43
MS43	Fidelity 70170	0.94
NI130440	Amstrad VCR7000	5.32
NI150433	Amstrad VCR7000	1.87
NI150441	Amstrad VCR7000	1.87
NI1400009	Amstrad CTV1400	5.31
NI1402010	Amstrad CTV1401	3.56
NI1422017	Amstrad CTV2200	1.87
1 534-967 11	Sony KU14/2022 2060	4.14
1-552-116-11	Sony KU Gen Power	5.12
1-554-820 11	Sony KU Gen Power	5.12
1-552-836-00	SL 8000UB Slide Rec/back	1.82
1-552 834 00	SL 8000UB Slide Rec	1.27
	Sony W114 Stop/Eject	1 27
0-654 542 00	Sony SLC7 Control Knob	1.27
MS12	Fidelity 70110 Rear Mount	0.94

Please send large SAE (30p stamp) for our complete catalogue

EXPORT ORDERS WELCOME

REMOTE HAND SETS

DAY DESPATCH FAST – FAIR – EFFICIENT SERVICE

AMSTRAD

1422292	CTV2210	15.00
1422187	CTV2290	15.00
151910	TV VIDEO	15.00
1409221	CTV1409	15.00
151175	VCR5200	17.00
150583	VCR7000	10.00
150878	VCR9000	10.00

FIDELITY

FD09193	Txt	32 butt	15.90
FD09820	IS500	12 butt	13.81
FD09156	F14R	12 butt	13.81
FD09111	AVS	14 butt	13.75
FD09141	CTV14S	4 butt	13.75

20R 22R 140R

GRUNDIG

RTP20 VRC112	TP16-21-21VHR	IR	13.50
RTP05 VRC138	TP8-120-120E	IR	13.50
RTP06 IR1078	TP160-160E	IR	13.50
RTP07 IR3808	TP200-300-390	IR	13.50
RTP400 IR401	TP400VT-500VT	IR	13.50
VRC204	TP12	US	13.50
RTP400	TP400TT		13.00

NEW
PRC6000
Programmable Remote Control
Will operate most infra-red remote equipment TV-HiFi-VCR etc
PRC6000
Engineers need only carry 1
Remote ONLY £52.95
DONT BE WITHOUT ONE!!

DECCA

80 100	NON TXT	US	16.50
80 10	NON TXT	US8511	19.50
101	NON TXT	US8513	23.50

SONY

C5	RM75T	29.04
C6	RM72	22.62
C7	RM7200	45.00
C9	RM7213	45.00

ITT

305	IR8649	29.04
306	IR8650	22.65
CVC45 RG5	VS8262	25.00
CVC32 RG15	VS8573	25.00

PLEASE NOTE THAT SOME HANDSETS ARE MANUFACTURERS ORIGINALS BUT SOME MAY BE AN ALTERNATIVE TYPE

THORN/FERGUSON

T723	TX9 10	NON TXT IR	13.00
T725	TX9	NON TXT IR	13.00
T731	TX9 10 100	TXT STEREO IR	13.00
T732	TX10	TXT IR	13.00
T736	TX9 10 100	TXT IR	13.00
T739	TX100		13.00
3V23	IR 8817		14.95
3V31	IR 8945		14.95
3V35	IR 8946		14.95
T718	US 8517		16.50

PHILIPS

G11 IR170 843 TXT IR	13.50
G11 (KONIG) TXT IR8435	22.20
G11 (KONIG) TXT 2 FUNCTION VS851	18.75
G11 (KONIG) NON TXT VS8263	21.50
G11 31 BUTTON 691 17181 (PHILIPS) US	27.00
KT3.30 (KONIG) NON TXT IR8331	15.85
KT3.30 (KONIG) TEXT IR8420	17.90
KT3-30 35 40 RC5	13.95

GEC

GEC HITACHI	9300/V4001	9.93
GC56520831	C1404H-C1656H	30.00
GCA512220	C1653	22.00
GCA512230	C2086H C2087H	28.50
GCA510710	C2067H	28.50
GCA514620	C2089H, C2090H C2889H C2290H	21.00
GCA510870	C2069, C2269H	27.50

JVC

TP843	TXT	IR	13.50

REPAIR KITS – FOIL/BUTTONS/INST.

KT3 K30	WITHOUT TEXT	8.95
KT3 K30	WITH TEXT	8.95
REMOTE CONTROL TESTER		29.94

NEW
DOORCHAIN LOCK ALARM 2.75
PERSONAL ALARM TORCH 1.90
IMMERSION HEATER TIMER 14.50
PLUG IN 24 HOURS 11.80
TIMERS 7 DAYS 13.90
PHOTO CELL SWITCH 10.50

LIMITED STOCK
GOLD PLATED PHONO PLUS 0.60
GOLD PLATED JACK PLUG 0.90
CHOC BLOCK, 6.3M 5A 0.18
For one month only

BELLS/BOXES

GG1	CHALLENGER PANEL BKH	27.95
A75	SHORROCK ACORN 75 PANEL	32.50
B1	EUROBELL (No S.A.B.)*	21.00
B2	EUROBELL (with S.A.B.)*	26.95
BV	6V BATTERY FOR EUROBELL	3.75

*Price includes Multi Adaptor to use with C type bell boxes

T1	12V BELL (Tan)	12.95
B5	'C' TYPE Polyprop Boxes (comp)	4.55
B6	'C' TYPE Polycarb Boxes (comp)	7.80
B12	'C' TYPE DUMMY COVER (no back)	3.25
B13	C TYPE Translucent	7.80

SOUNDERS/SIRENS

S2	712 EXTERNAL SIREN	(116db)	5.75
S4	1010/2010 EXTERNAL SIREN	(116db)	5.96
S22	DYNABLAST	(127db)	18.14
S13	SOUND BOMB 1	(104db)	3.37
S14	SOUND BOMB 2	(111db)	5.17
S15	SOUND BOMB 3 MULTITONE		4.50
S16	PZ28	(105db)	4.61
S17	MIKRO	(110db)	5.28
S18	362 PIEZO	(110db)	7.80
	12V MUSICAL BUZZER		1.56
M801	722 BUZZER		0.60
802	PMB27 BUZZER		0.70

SECURITY EQUIPMENT

INFRA RED/SECURITY LIGHTS

8175	SHORROCK	PIR	22.50
815S	SHORROCK	PIR	41.50
8175M	SHORROCK	PIR	24.15
815SM	SHORROCK	PIR	43.57
01	ORION	PIR	24.00
04	ORION EXTERNAL	PIR	48.00
05	ORION EXTERNAL with built in Floodlight		60.00
SL5	HALOGEN FLOOD with Lamp		17.74
SL5R	SPARE LAMPS SL5		4.50
SL8	INFRASCAN EXTERNAL	PIR	62.94
ST	TASLEY AUTO LANTERN		27.00

WE ARE AUTHORISED DISTRIBUTORS FOR SHORROCK SECURITY PRODUCTS

RECHG. BATTERIES

12V	1.2A	7.23
12V	2.6A	7.87
12V	6A	10.73
12V	1.9A	7.77

S.A.B. MODULES

SHORROCK S.A.B.	8.76
SHORROCK DE LUXE	11.49

PANIC BUTTONS

STND	2.88

SUNDRIES

XENON FLASHERS

XE1 12 PCL 128 Red Amber Blue	6.75
XE3 LOW PROFILE 121PCL Red Amber Blue	6.90
TAMPER SWITCHES 2.5	0.60
SELF CONTAINED ALARM	25.00

CONTACTS

C10	5 TERM FLUSH	0.62
C11	4 WIRE FLUSH	0.62
C12	5 TERM SURFACE	0.59
C13	4 WIRE SURFACE SLIMFIT	0.62
C6	ROLLER SHUTTER CONTACTS	3.10
C9	ROLLER SHUTTER CONTACTS PLASTIC	2.28

PRESSURE MATS

PM1	STAIR MAT	1.35
PM2	STANDARD MAT	1.50

ACCESS VISA

LINKABLE SMOKE DETECTORS	£9.75
NEW SMOKE DETECTORS	£8.75
PERSONAL ALARM/TORCH	£1.90
DOOR CHAIN/LOCK ALARM	£2.75
SMOKE DETECTORS WITH LIGHT	£12.50

CONFUSED?
DON'T BE – IT'S EASY!
TYPICAL PACKAGE FOR 3 BED HOUSE
£120

Includes

2 Zone Panel with connection diagram	★
Rechargeable Battery	★
Outside Bell Box with Bell	★
Inside Multitone Sounder	★
Roll 6 core cable	★
2× Infra Red Detectors	★
5 Pairs Window Contacts	★
Panic Button	★
Buzzer	★
Tamper Switch	★

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4164-150	1.95
4532/20NL3	2.50
4532/20NKL4	2.50
6510	5.65
6526	4.95
6561	7.95
6581	7.70
LM1889	2.45
ULA6C001	7.95
ZTX213	.30
ZTX313	.30
ZTX650	.40
Z80A CPU	1.75

DIODES

TYPE	PRICE
BY127	.10
BY133	.25
BY164	.60
BY179	.65
BY223	1.25
BY227	.20
BY299/800	.95
BY299/800	.25
BYX55/600	.30
SKE5F3/10	1.45
1N4001-7	.07
1N5401-8	.18

E.H.T. TRAYS

Continental Inc. Focus	8.95
DECCA 80	7.20
DECCA 100	7.35
DECCA 120/130	7.95
ITT CVC20/30	6.95
ITT CVC45	7.50
PHILIPS G8 (550)	7.90
PHILIPS KT3	7.95
RBM T20/T22A	7.35
THORN 8500/8800	7.20
THORN 9000	8.00
UNIVERSAL	5.70

FUSES

20mm A/S: (Pkts of 10)
250MA, 315MA, 400MA, 500MA, 630MA, 800MA, 1A, 1.25A, 1.6A, 2A, 2.5A, 3.15A, 4A, 5A, 6.3A,8A 1.20
20mm Q/B: (Pkts of 10)
500MA, 630MA, 800MA, 1A, 1.6A, 2A, 2.5A, 3.15A ..... .60

INTEGRATED CIRCUITS

TYPE	PRICE (£)
AN303	3.75
AN305	3.50
AN318	6.95
AN7116	2.10
AN7145M	2.95
HA1339A	2.95
HA1366W	1.85
HA1366WR	1.85
HA1374	2.45
HA1377	2.95
HA1392	2.95
HA1397	3.95
HA13001	4.50
HA13008	12.95
LA1201	1.25
LA1230	2.95
LA1365	2.45
LA4440	2.75
LA4445	2.45
LA4460	2.45
LA4461	2.45
LA7800	1.95
LA7801	2.90
MC13002	3.95
MC14497P	4.50
SAA1250	3.85
SAA1251	4.95
SAA3027	3.95
SAA5000A	3.95
SAA5010	4.95
SAA5012	4.95
SAA5030	5.95
SAA5050	6.95
SAF1039P	2.75
SL470/1DP	2.95
SL480	2.85
SL490	2.90
SL1430	1.95
SL1431	1.95
SL1432	1.75
SN76660N	.65
STA471C	6.95
STK077	6.95
STK2129	11.95
STK433	5.95
STK4332	5.95
STK435	5.95
STK437	6.95
STK439	7.50
STK459	8.55
STK461	9.95
STK463	9.95
STK465	11.95
STK5421	4.95
STK5720	4.50
STK5730	4.75
STK7308	8.95
STR4090	6.50
STR40090	6.95
STR4211	3.95
STR441	4.95
STR451	5.35
STR454	4.95
STR6020(KIT)	5.75
TA7193P	4.50
TA7205AP	1.40
TA7222P	1.85
TA7227	2.95
TA7270	3.25
TA7609	3.35
TBA120AS	1.00
TBA120U	1.00
TBA530	1.25
TBA800P	.85
TBA810S	1.25
TBA820	1.50
TBA820M	1.25
TBA890	3.25
TBA920S	1.95
TBA950/2X	2.25
TBA1440G	2.95
TCA270S	1.55
TDA440	2.95
TDA1020	2.75
TDA1035T	2.40
TDA1037	1.95
TDA1044	2.95
TDA1151	1.25
TDA1170S	1.80
TDA1180P	2.65
TDA1190Z	2.85
TDA1470	3.25
TDA1506	4.35
TDA1510	3.80
TDA1512	3.50
TDA1515	4.50
TDA1670A	4.20
TDA1770A	3.70
TDA1870	6.95
TDA1908A	1.95
TDA1950A	3.95
TDA2002	1.50
TDA2003	1.55
TDA2004	2.90
TDA2005	2.55
TDA2006	1.95
TDA2020	3.20
TDA2030	1.80
TDA2170	2.95
TDA2270	2.95
TDA2525	2.95
TDA2530	2.00
TDA2532	2.10
TDA2540	1.70
TDA2541	2.70
TDA2560	1.95
TDA2576A	3.25
TDA2577	2.95
TDA2578A	2.95
TDA2581	2.00
TDA2582	1.95
TDA2591/3	1.95
TDA2594	2.95
TDA2600	6.75
TDA2611A	1.50
TDA2653A	3.50
TDA2655B	5.95
TDA3190	1.95
TDA3540	2.95
TDA3541	2.95
TDA3560	4.95
TDA3561A	4.95
TDA3562A	5.50
TDA3650	4.75
TDA3651	1.95
TDA3651AQ	3.80
TDA3652	2.95
TDA4500	3.95
TDA4503	4.65
TDA4600/2	2.85
TDA4600/2D	3.30
TDA7270	3.35
TDA8180	4.50
TDA8190	2.80
TDA9503	2.95
UPC1031H	2.60
UPC1181H	1.70
UPC1182H	1.70
UPC1185H	2.50
UPC1230H	4.35
UPC1363C	3.95
UPC1365C	4.20
UPC1378H	3.70
UPC1382	4.35
UPC1394C	2.95
Z80ACPU	1.75

I C SOCKETS

16 Pin Dil-Dil	.16
16 Pin Dil-Quil	.35
18 Pin Dil-Dil	.18
24 Pin Dil-Dil	.25
28 Pin Dil-Dil	.30
40 Pin Dil-Dil	.40

LINE O/P TR.

DECCA 80	7.95
DECCA 100	8.30
FERGUSON 1615	9.95
FERGUSON 1690/1	9.95
FERGUSON 1790/1	7.95
FERGUSON TX9	23.50
FERGUSON TX10	29.95
FERGUSON TX90 (14")	19.75
FERGUSON TX90 (20")	19.75
FERGUSON TX100 90°	19.95
FERGUSON TX100 110°	20.95
FIDELITY ZX2000 (Inc. Mod.) 14"/20"	12.50
FIDELITY ZX3000 14"/20"	11.50
FIDELITY 22"/26"	20.95
GEC 1405	19.95
HITACHI CTP1444/6	19.95
ITT CVC20	8.50
ITT CVC25/30/32	8.40
ITT CVC40	22.95
ITT CVC45	8.75
PHILIPS G8	9.95
PHILIPS G11	14.95
PHILIPS KT3	11.95
PHILIPS K30	16.95
PHILIPS K35	24.95
PHILIPS CTX (14")	19.75
PHILIPS CTX-E	17.95
PHILIPS CTX-S	17.95
RBM T20/T22A	9.95
SHARP C1410	23.95

ON/OFF SWITCHES

Decca 80/100	1.00
Ferguson (Universal)	1.00
Ferguson TX9/10 (Rem)	1.95
Ferguson TX90 (Rem)	1.75
Fidelity AVS1600/2000	1.45
Fidelity CTV140	1.45
Fidelity CTV14S/140R	2.75
Fidelity CTV14R	2.75
Grundig CUC731	3.75
Philips G8 (Metal)	1.95
Philips G11	1.35
Philips G11 (Rem)	1.85
Philips KT3 (Rem)	1.95
Philips CTX (Rem)	1.95
Pye G11 (Rem)	1.85
RBM T20A (3K3)	2.45
Sony KV1612	4.95
Sony KV2022 (Rem)	4.95
Thorn Universal	1.00

TRANSISTORS

TYPE	PRICE
BC107	.15
BC147	.10
BC148	.10
BC307	.12
BC327	.11
BC328	.12
BC337	.11
BC338	.12
BC360	.35
BC372	.95
BC546	.10
BC547	.10
BC548	.10
BC557	.10
BC558	.10
BC639	.25
BC640	.25
BD131	.33
BD132	.33
BD201	.70
BD222	.50
BD225	.50
BD237	.40
BD238	.40
BD278A	.70
BD437	.40
BD438	.40
BD677	.65
BD701	.95
BD707	.95
BD807	.95
BF337	.28
BF338	.30
BF422	.35
BF423	.35
BF458	.35
BF459	.95
BF469	.50
BF470	.50
BF757	.70
BF871	.80
BR103	.75
BR303	1.95
BT116	1.30
BT151/800	1.15
BU126	1.50
BU205	1.40
BU208A	1.45
BU208D	1.95
BU326A	1.45
BU407	1.25
BU407D	1.50
BU426A	1.35
BU500	1.95
BU508A	1.75
BU508D	1.95
BU526A	2.50
BU536	2.75
BU807	1.30
BU826A	2.25
BUW81A	3.95
BUX84	.80
R2540	2.35
R4050	1.38
SG264A	3.95
SG613	8.95
T6071V(KIT)	5.75
T9053V	3.50
T9054V	3.50
T9064	.95
TIP29E	.70
TIP31C	.45
TIP32C	.45
TIP41C	.45
TIP42C	.45
TIP112H	.75
15/80H	2.45
15/85R	2.45
2SC867A	3.20
2SC1034	3.95
2SC1114	5.95
2SC1124	1.00
2SC1413A	2.95
2SC1942	2.90
2SC3156	3.50
2SD725	4.95
2SD870	6.50
2SD1398	2.35
2SD1453	2.95
7805	.50
7812	.50
7815	.70
7824	.70

TUNERS

ELC 1043/05	8.50
ELC 1043/06	9.95
ET548	14.20
U321	8.75
U322	8.80
U341	7.95
U343(coax skt)	14.95
U343 (phonol	16.95
U344C	9.95
U411	11.95
UE5-B31F	28.95

TV ELECTROLYTICS

DECCA 80 (400/800)	4.50
FIDELITY ZX(220/385)	2.95
PHILIPS G8(600/300)	2.95
PHILIPS G11(470/250)	2.20
RBM T20A(220/400)	2.50
THORN 1690 (4700/25)	1.35
THORN 9000(400/400)	2.90

FERGUSON TV SPARES

TX9/10

Dual PTC	2.85
Focus Unit TX10	8.50
Line D/P Trans TX9	23.50
Line O/P Trans TX10	29.95
On/Off Switch (Remote)	1.95
Push Button TX9	16.95
Push Button TX10	16.95
RFI Choke TX9	2.95
Tuner	14.95

TX90/100

Line O/P Trans TX90 14"	19.75
Line O/P Trans TX90 20"	19.75
Line O/P Trans TX100 90°	19.95
Line O/P Trans TX100 110°	20.95
On/Off Switch (Remote)	1.75
Push Button TX90	12.95
Tuner	14.35

FERGUSON VIDEO SPARES

3V90/16/22

Capstan Motor	24.95
Drum Motor	24.95
Pinch Roller	3.95
Take-Up Clutch (Small)	5.65
Take-Up Clutch (Large)	5.95
Video Head	19.50

3V29/30

Booster	22.95
Capstan Motor	37.95
Loading Motor	8.70
Pinch Roller	4.50
Pilot Lamp	.80
Reel Idler	2.85
Take-Up Clutch	2.45
Take-Up Idler	1.40
Video Head	19.50

3V35/36

Capstan Motor	24.95
Cassette Housing	28.95
Reel Idler	2.85
Take-Up Clutch	2.45
Take-Up Idler	1.40
Video Head	19.50

3V44/45

Capstan Motor	37.95
Cassette Housing	28.95
Loading Motor	8.95
Take-Up Clutch	1.95
Video Head	37.50

GEC/HITACHI SPARES

HM6232	5.95
HM6251	4.70
HM9032	5.95
STR6020 (Kit)	5.75

VIDEO SPARES

V4000H/VT8000

Audio Head	18.95
Capstan Motor	31.90
FF/Rew Idler	2.65
FF/Rew Pulley	.85
Pinch Roller	3.95
Play Idler	4.50
Video Head	22.95

V4100H/V4002H
9300E/9500E

Capstan Motor	31.95
FF/Rew Idler	1.95
FF/Rew Pulley	.85
Play Idler	3.95
Pinch Roller	3.95
Video Head	22.95

V4100H/VT11E

Audio Head	19.95
Capstan Motor	23.95
Clutch Assy	8.30
FF/Rew Idler	2.50
Pinch Roller	3.95
Video Head	27.95

V4004H/VT33E

Capstan Motor	29.95
FF/Rew Idler	2.50
Video Head	27.95

V4005H/VT63E

Capstan Motor	15.95
End Sensor	1.75
Video Head	49.95

NAT. PAN. VIDEO SPARES

NV333 Reel Idler	.90
NV333 Pinch Roller	3.95
NV333 Play Idler	3.95
NV370 Pinch Roller	3.95
NV370 Idler Arm	2.75
NV777 Reel Idler	3.95
NV2000 Reel Idler	.90
NV2000 Loading Gear	1.60
NV2000 Pinch Roller	4.50
NV2000 Play Idler	1.00
NV7000 Reel Idler	.90
NV7000 Pinch Roller	3.95

PUSH BUTTONS

DECCA/ITT 6 WAY	9.95
FERGUSON TX9	16.95
FERGUSON TX10	16.95
FERGUSON TX90	12.95
FIDELITY CTV140 8 WAY	7.95
ITT CVC5 7 WAY	11.75
ITT CVC8/9	12.80
ITT CVC20/30	8.50
ITT CVC45 (PORT.)	19.95
PHILIPS G8 (S/L 550)	16.50
PYE G11 TIP SWITCH	29.95
RBM T20A 6 WAY	11.95

REMOTE CONTROLS

Ferguson TX9 U/S Basic	14.95
Ferguson TX9/10 N/Text	13.95
Ferguson TX9/10 Text	13.95
Ferguson TX Stereo Text	14.95
Ferguson T725 (Equivalent)	16.00
Ferguson 3V23 Video	15.95
Ferguson 3V31 Video	19.95
Ferguson 3V35 Video	17.95
Fidelity CTV14S	12.95
Fidelity Teletext	17.95
Grundig TP160	14.95
Grundig TP200	14.70
Grundig TP400 Text	14.50
ITT Digivision	15.95
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REPAIR KITS

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Philips KT3/30 Text	6.50
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5000/5300

Capstan Motor	32.95
Loading Roller	1.95
Pinch Roller	6.95
Reel Motor	8.95
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Fidelity CTV20R	4.95
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481/483

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Ferguson 3V00/16/22	2.50
Ferguson 3V23	1.75
Ferguson 3V29/30	1.80
Ferguson 3V29 L/Belts (5)	1.95
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Ferguson 3V35/39	1.95
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Hitachi VT9300/9500	1.80
Hitachi VT11E	1.95
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Nat. Pan. NV370	1.90
Nat. Pan. NV2000	1.95
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Nat. Pan. NV7000	1.95
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Sanyo VTC5500	1.75
Sanyo VTC9300	2.95
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Sharp VC8300	2.40
Sharp VC9300	2.40
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Ferguson 3V23 (Plug)	.85
Ferguson 3V29 (Plug)	.80
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Hitachi VT9300/9500	.95
Nat. Pan. NV2000	.70
Nat. Pan. NV7000	.70
Sharp VC8300	.70
Sharp VC9300	1.95
Universal	.50

VIDEO HEADS

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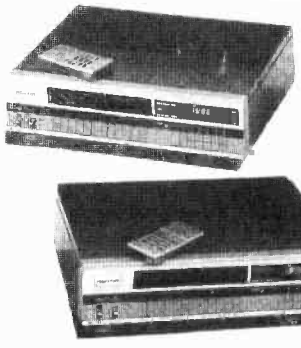

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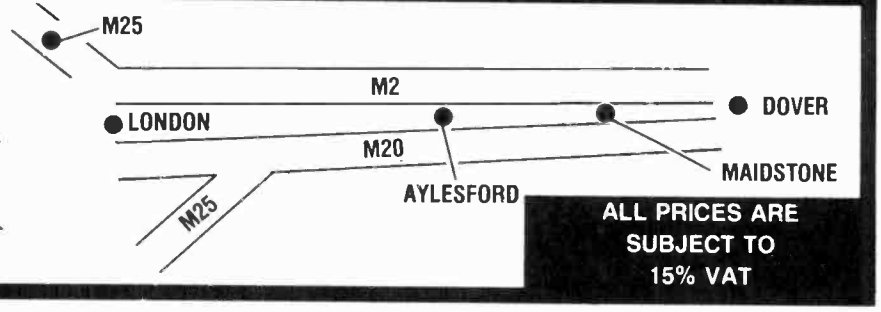

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VIDEO HEADS

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Fits model numbers: NV370 & Philips VR6460.
3HSS(4N) £46.50
Fits model number. NV366
3HSS(4NB) £54.60
Fits model number NV730

Ferguson
3HSS(V) £22.95
Fits model numbers. 3V00, 3V16, 3V22, 3V29, 3V30, 3V31, 3V35, 3V36, 3V38, 3V39, HR3300, HR3330, HR3360, HR7200, HR7300, HRD120
3HSS4VB £54.60
Fits model numbers: 3V32.

Sharp
3HSS(SP) £29.90
Fits model numbers. VC9100, VC9300, VC9500, VC9700, VC381, VC8381, VC383, VC388, VC482

Toshiba
PS3B(T) £31.95
Fits model numbers: V9600, V31B, V33B

Hitachi
3HSS(H) £26.50
Fits model numbers: VT8000, VT9300 etc.

Sony
PS3B(S) £24.95
Fits model numbers. SLC5, SLC6, SLC7, SL3000 also various NEC models
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3HSS(FI) £34.50
Fits model numbers: VCR4500, VCR5200, VCR9000 etc.

Fisher/Fidelity
3HSS(SF) £29.95
Fits model numbers: FVHP615, FVHP710, V1000

GENUINE HEADS

Panasonic
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NV7000, NV7200 ..... £44.00
NV333, NV370 ..... £44.00
NV366 ..... £64.50
NV688, NV777, NV788 ..... £64.50
NV730 ..... £67.50
All others available P.O.A.

Ferguson
3V00, 3V16, 3V22 ..... £59.90
3V29, 3V30 ..... £59.90
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Sharp
VC7300, VC7700, VC7750 ..... £69.90
VC8300 ..... £69.90
VC9300, VC9500, VC9700 ..... £62.00
VC381, VC383, VC386 ..... £62.00
VC482 ..... £62.00
All others available P O.A.

Sanyo
VTC5000, VTC5150 ..... £39.90
VTC5300, VTC5400 ..... £39.90
VTC9300 ..... £39.90

Sony
SLC5, SLC6, SLC7 ..... £49.50
SL8000, SL8080 ..... £49.50
SLC20, SLC30 ..... £54.50
SLC9 ..... £54.50

Toshiba
V9600 ..... £59.90
V8600 ..... £69.90
V31, V33 ..... £59.90
V55, V56 ..... £59.90

Hitachi
VT5000, VT5500 ..... £49.50
VT6500, VT8000, VT8300 ..... £49.50
VT8500, VT8700 ..... £49.50
VT9300, VT9500, VT9700 ..... £49.50
VT11E, VT14E £45.50
VT17E, VT19E £54.60
VT33E £49.50

Philips
VR6460 ..... £44.00
VR6462 ..... £44.50
Please call if your model is not listed.

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GENUINE

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NV370, NV830, NV850 ..... £2.80
NV688 ..... £6.50
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NV730 ..... £1.90
NV230, NV430, NV870 ..... £2.80
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Ferguson
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3V23 ..... £3.90
3V29, 3V30 ..... £4.90
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Sanyo
VTC5000, VTC5150 ..... £1.99
VTC5300, VTC5400 ..... £4.50
VTC9300 ..... £6.50

Sony
SLC5, SLC7 ..... £6.50
SLC6 ..... £7.50
SL8000, SL8080 ..... £6.50

Sharp
VC7300, VC7700, VC7750 ..... £6.50
VC8300 ..... £6.50
VC9100, VC9300, VC9500 ..... £6.50
VC381, VC383, VC386 ..... £6.50

Hitachi
VT5000, VT5500 ..... £6.50
VT8000, VT8300, VT8500 ..... £2.90
VT9300, VT9500, VT9700 ..... £3.30
VT11E, VT14E, VT17E, VT19 ..... £6.50
VT33E £6.50

Akai
VS9700 ..... £6.50
VS2, VS3, VS4, VS5 ..... £4.90
VS9300, VS9500, VS9700 ..... £6.50
Many others available

REPLACEMENTS

Panasonic
NV2000, NV2010 ..... £3.50
NV7000, NV7200 ..... £3.00
NV333, NV366 ..... £3.00
NV8600, NV8610 ..... £3.95

Ferguson
3V00, 3V16, 3V22 ..... £3.50
3V23 ..... £2.90
3V29, 3V30 ..... £3.50
3V35, 3V36, 3V38, 3V39 ..... £2.90

Sanyo
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VTC5300, VTC5400 ..... £2.50
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Sony
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SL8000, SL8080 ..... £4.25

Sharp
VC7300, VC7700, VC7780 ..... £3.50
VC8300 ..... £3.90
VC9100, VC9300, VC9500 ..... £3.90
VC381, VC383, VC386 ..... £3.90

Hitachi
VT5000, VT5500 ..... £4.50
VT8000, VT8300, VT8500 ..... £1.50
VT9300, VT9500, VT9700 ..... £1.50
VT11E, VT14E, VT17E, VT19 ..... £3.90
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Akai
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Many others available

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All Panasonic £1.80
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Sharp VC9300 etc. £2.90
Sharp VC7300 etc. £1.80
Amstrad 7000 ..... £2.30
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Hitachi VT64E ..... £1.20 each

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Sharp VC9300, VC381 etc. £18.20
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Sharp VC8300 ..... £26.40
Hitachi VT5000 ..... £24.75

CAPSTAN MOTORS

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Sharp VC7300, VC7700 ..... £29.30
Ferguson/JVC 3V00, 3V16, 3V22 ..... £29.90
Ferguson/JVC 3V29, 3V30 ..... £34.50
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Hitachi VT5000 ..... £24.75
Hitachi VT8000, 8500, etc. £34.50
Hitachi VT9300, 9500, etc. £34.50
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Sanyo
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VTC5000, VTC5150, VTC5300, VTC5400 ..... £4.95

Sony
SLC5, SLC7 ..... £5.95
SLC6 ..... £5.95
SL8000, SL8080 ..... £5.95

Sharp
VC7300, VC7700, VC7750 ..... £4.95
VC8300 ..... £4.95
VC9100, VC9300, VC9500 ..... £4.95
VC381, VC383, VC386 ..... £4.95
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Hitachi
VT5000, VT5500 ..... £5.95
VT8000, VT8300, VT8500 ..... £4.95
VT9300, VT9500, VT9700 ..... £4.95
VT11E, VT14E, VT17E, VT19 ..... £4.95
VT33E £5.95

Akai
VS9700 ..... £6.95
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VTCM10 Reel drive pulley £9.90

Sony
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SLC6 ..... Rewind kit £4.95

Sharp
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VC482 etc. (Equivalent) £2.98
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Hitachi
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VT9300, VT9500, VT9700 ..... £4.75
VT11E, VT14E, VT17E, VT19 ..... £3.96
VT33, VT63, VT64, VT65 ..... £3.96

Akai
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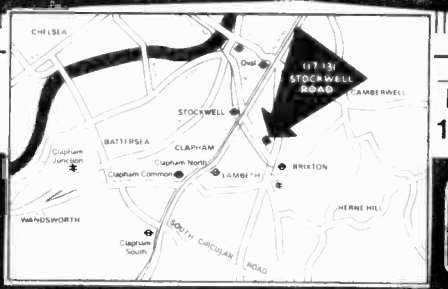

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Access

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BD7	4	in flex switches with neon on/off lights, saves leaving things switched on
BD9	2	6v. 1A mains transformers upright mounting with fixed clamps
BD11	1	6½" speaker cabinet ideal for extensions, takes your speaker. Ref BD137
BD13	12	30 watt reed switches, it's surprising what you can make with these — burglar alarms, secret switches, relay etc etc.
BD22	2	25 watt loud speaker two unti cross-overs
BD29	1	B.O.A.C. stereo unit is wonderful value
BD30	2	nicad constant current chargers adapt to charge almost any nicad battery
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BD34	48	2 meter length of connecting wire all colour coded
BD42	5	13A rocker switch three tags on/off, or change over with centre off
BD45	1	24hr time switch, ex-Electricity Board, automatically adjust for lengthening and shortening day. Original cost £40 each
BD49	10	neon valves, with series resistors, these make good night lights
BD56	1	mini uniselector, one use is for an electric jigsaw puzzle, we give circuit diagram for this. One pulse into motor, moves switch through one pole
BD59	2	flat solenoids – you could make your multi-tester read AC amps with this
BD67	1	suck or blow operated pressure switch, or it can be operated by any low pressure variation such as water level in water tanks
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BD132	2	plastic boxes approx. 3" cube with square hole through top so ideal for interrupted beam switch
BD134	10	motors for model aeropianes, spin to start so needs no switch
BD139	6	microphone inserts – magnetic 400 ohm also act as speakers
BD148	4	reed relay kits you get 16 reed switches and 4 coil sets with notes on making c/o relays and other gadgets
BD149	6	safety cover for 13A sockets – prevent those inquisitive little fingers getting nasty shocks
BD180	6	neon indicators in panel mounting holders with lens
BD193	6	5 amp 3 pin flush mounting sockets make a low cost disco panel
BD196	1	in flex simmerstat – keeps your soldering iron etc always at the ready
BD199	1	mains solenoid very powerful has 1" pull or could push if modified
BD200	8	keyboard switches – made for computers but have many other applications
BD210	4	transistors type 2N3055 probably the most useful power transistor
BD211	1	electric clock mains operated put this in a box and you need never be late
BD221	5	12v alarms make a noise about as loud as a car horn. Slightly soiled but OK
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BD246	2	tacho generators, generates one volt per 100revs
BD252	1	panostat, controls output of boiling ring from simmer up boil
BD259	50	leads with push on ¼" tags – a must for hook ups – mains connections etc
BD263	2	oblong push switches for bell or chimes, these can mains up to 5 amps so could be foot switch if fitted into pattress
BD268	1	mini 1 watt amp for record player. Will also change speed of record player motor
BD275	1	Guitar mic – clip on type suits most amps
BD283	3	mild steel boxes approx. 3" × 3" × 1" deep – standard electrical
BD293	50	mixed silicon diodes
BD296	3	car plugs with lead, fits into lighter socket
BD305	1	tubular dynamic mic with optional table rest

Most other packs still available and you can choose any as your free one.

5A BATTERY CHARGER KIT

All parts including case. Only £5 plus £1 postage.

OVER 400 GIFTS YOU CAN CHOOSE FROM

There is a total of over 400 packs in our Baker's dozen range and you become entitled to a free gift with each dozen packs

Our latest "News Letter" will be enclosed with your goods, and you will automatically receive our next news letter. If you want our 1988 classified list please request this.

F.D.D. BARGAIN

3½ floppy Disk Drive, made by the Chinon Company of Japan. Beautifully made and probably the most compact device of its kind as it weighs only 600g and measures only 104mm wide, 162mm deep and has a height of only 32mm, other features are high precision head positioning – single push loading and eject – direct drive brushless motor – Shugart compatible interface – standard connections – interchangeable with most other 3½ and 5¼ drives. Brand new with copy of makers manual. Offered this month at £28.50 post and VAT included.

CASE – adaptable for 3" or 3½" FDD, has room for power supply components price only £4 includes circuit of PSU. Our Ref 4P7

POWER SUPPLY FOR FDD – 5V and 12V voltage regulated outputs, complete kit of parts will fit into case 4P7 price £8 or with case £11. Our ref. 11P2.

9" MONITOR

Ideal to work with computer or video camera uses Philips black and white tube ref M24/306W. Which tube is implosion and X-Ray radiation proiected. VDU is brand new and has a time base and EHT circuitry. Requires only a 16V dc supply to set it going. It's made up in a lacquered metal framework but has open sides so should be cased. The VDU comes complete with circuit diagram and has been line tested and has our six months guarantee. Offered at a lot less than some firms are asking for the tube alone, only £16 plus £5 post.

CASE FOR 9" MONITOR

We have arranged with a metal worker to make cases for the 9" Monitor. Delivery promised for the end of May and the price £12 plus £2 post. The case will be made from coated sheet steel, overall size approx 10in x 10in x 7in high which will give ample space for the Power Supply and external controls if you fit them.

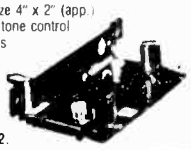
PROBLEM SOLVED

We have obtained from the manufacturers of the 9" Monitor, the TTL converter which makes it composite input suitable to work with any computer. We have had the printed circuit board made and have all the components and can supply this converter in kit form price £6. Our ref. 6P4.

3" FDD HITACHI 305SXA

This has standard Shugart connections and will work with most computers but is particularly suitable for Amstrads, in fact it was recommended in a recent "Computing with Amstrad" **Price £30** + £3 post.

MINI MONO AMP on p.c.b. size 4" x 2" (app.)



Fitted volume control and a hole for a tone control should you require it. The amplifier has three transistors and we estimate the output to be 3W rms. More technical data will be included with the amp. Brand new, perfect condition, offered at the very low price of **£1.15 each, or £13 for 12.**

THIS MONTH'S SNIP

ACORN COMPUTER DATA RECORDER (CASSETTE). This is a morse data recorder with switchable motor contel intended fo use with the Acorn Electron or BBC computers but also functions with almost any other computer and can be used for normal record and play-back of music and speech.

Six key controls give "PAUSE" "STOP" and "EJECT" "CUE/FAST FORWARD" "REVUE/REWIND" and "RECORD", fast forward and rewind (100 seconds for C60). Also tape counter with resel button. Input signal range 5mV. Input impedance 40k ohm. Can be battery operated but is supplied with a mains adaptor. Brand new still in manufacturer's wrapping £8. Order Ref. 8P18 add £2 postage.

VENNER TIME SWITCH

Mains operated with 20 amp switch, one on and one off per 24 hrs, repeats daily automatically correcting for the lengthening or shortening day. An expensive time switch but you can have it for only **£2.95** without case, metal case – **£2.95,** adaptor kit to convert this into a normal 24hr time switch but with the added advantage of up to 12 on/offs per 24hrs. This makes an ideal controller for the immersion heater. Price of adaptor kit is **£2.30.**

Ex-Electricity Board. Guaranteed 12 months.

GPO TEST METER 12/C1

20,000 opv. 19 AC/DC ranges, including all the usual ones and a very useful low ohms range, also shunt provision for reading up to 10a DC. It is in a real leather carrying case and comes complete with leads, prods and croc clips. **Price £7** Ref. 7P5.

8" GREEN SCREEN MONITOR

Complete and in a case with optional tilt stand for improved viewing angle. A very compact unit measuring only 10½"×10½"×7½" high operates from a 15V DC supply – composite input so ideal for use with Electron or similar computers. Used, but we test before despatch and guarantee 6 months. **Price £17.50** – Our Ref: 17P1 – please add £3 post.

25A ELECTRICAL PROGRAMMER

Learn in your sleep. Have radio playing and kettle boiling as you wake—switch on lights to warn off intruders— have a warm house to come home to. You can do all these and more. By a famous maker with 25 amp on/off switch. A beautiful unit at £2.50.

POWERFUL IONISER

Generates approx. 10 times more IONS than the ETI and similar circuits. Will refresh your home, office, shop, workroom etc. Makes you feel better and work harder – a complete mains operated kit, case included **£11.50** + £3 P&P

J & N BULL ELECTRICAL

Dept. T.V., 250 PORTLAND ROAD, HOVE, BRIGHTON, SUSSEX BN3 5QT.

MAIL ORDER TERMS: Cash, P.O. or cheque with order. Orders under £20 add £1 service charge. Monthly account orders accepted from schools and public companies. Access & Bi-card orders accepted. Brighton (0273) 734648 or 203500.

NEW ITEMS

Some of the many described in our current list which you will receive with your parcel.

RE-CHARGEABLE NICADS 'D' SIZE these are tagged for easy joining together but tags can easily be removed, unused, tested and grtd £2.00 each ref 2P141, 6 for £14 ref 10P47

BRIGHT LIGHT SWITCH will control mains circuits up to 10 amps, gets its switch pulses from car headlights, bright daylight etc. so it does not use batteries and its sensor is completely isolated from the mains, with full instruction supplied. Price £10 ref 10P46.

POWERFUL 12V MOTOR was intended for Sinclair Electric Car, rating approx. ⅓ HP. Price £15 plus £2 post.

3 INCH FDD Hitachi ref. HFD 205SXA. Ideal replacement or second drive in most computers, especially Amstrad 6128 etc. Price £30 plus £3 post.

SOLAR POWERED NI-CAD CHARGER 4 NI-CAD batteries AA (HP7) charged in eight hours or two in only 4 hours. It is complete, boxed ready to use unit Price £6. Our ref. 6P3

50v 20A TRANSFORMER 'C' Core constuction so quite easy to adapt for other outputs – tapped mains input, only £25, but very heavy so please add £5 if not collecting. order Ref. 25P4.

FREE POWER! Can be yours if you use our solar cells—sturdily made modules with new system bubble magnifiers to concentrate the light and so eliminate the need for actual sunshine—they work just as well in bright light. Voltage input is .45—you join in series to get desired voltage—and in parallel for more amps. **Module A** gives 100mA. Price £1. Our ref. BD631. **Module C** gives 400mA, Price £2. Our ref. 2P199. **Module D** gives 700mA, Price £3. Our ref. 3P42.

SWITCH AC LOADS WITH YOUR COMPUTER This is easy and reliable if you use our solid state relay. This has no moving parts, has high input resistance and acts as a noise barrier and provides 4kW isolation between logic terminals. The turn-on voltage is not critical, anything between 3 and 30V, internal resistance is about 1K ohm. AC loads up to 10A can be switched. Price is £2 each. Ref. 2P183.

METAL PROJECT BOX Ideal size for battery charger, power supply etc, sprayed grey, size 8" × 4¼" × 4" high, ends are louvered for ventilation other sides are flat and undrilled order Ref. 2P191 price £2.

BIG SMOOTHING CAPACITOR. Sprague powerlytic 39,000uF at 50V. £3. Our Ref. 3P41.

4-CORE FLEX CABLE. Cores separately insulated and grey PVC covered overall. Each copper core size 7/0.2mm. Ideal for long telephone runs or similar applications even at mains voltage. 20 metres £2. Our ref. 2P196 or 100 metres coil £8. Order ref. 8P19.

TWIN GANG TUNING CAPACITOR. Each section is .0005uf with trimmers and good length ¼in spindle. Old but unused and in very good condition. £1 each. Our ref. BD630.

13A PLUGS. Good British make complete with fuse, parcel of 5 for £2. Order ref. 2P186.

13A ADAPTERS – Takes 2 13A plugs, packet of 3 for £2. order Ref. 2P187.

20v – 0 – 20v – Mains transformers 2½ amp (100 watt) loading, tapped primary. 20v 245 upright mountings £4. order Ref. 4P24.

BENCH ISOLATION TRANSFORMERS 500 watt – 230v in and out with plenty of tappings to give exact volts. £12 + £3.

BURGLAR ALARM BELL – 6" gong – OK to fix outside in the rain and shelter – mains operation. £8. Ref. 8p2.

24 HOUR TIME SWITCH – 16A changeover contacts, up to 6 on/offs per day. Nicely cased, intended for wall mounting. Price £8. Ref. 8P6.

CAPACITOR BARGAIN – axial ended – 4700uf 6v 25v Jap made. Normally 50p each, but you will get 4 for £1. Ref. 613.

PIEZO ELECTRIC FAN an unusual fan, more like the one used by Madame Butterfly, than the conventional type, it does not rotate. The air movements is caused by two vibrating arms. It is American made, mains operated, very economical and causes no interference. So it is ideal for computer and instrument cooling. Price is only £1 each. Ref. BD605.

SPRING LOADED TEST PRODS – heavy duty, made by the famous Bulgin company. Very good quality. Price four for £1. Ref. BD599.

CURLY LEAD – four core, standard replacement for telephone handset, extends to nearly two metres. Price £1 each. Ref. BD599.

TELEPHONE BELLS – these will work off our standard mains through a transformer, but to sound exactly like a telephone, they then must be fed with 25Hz 50v. So with these bells we give a circuit for a suitable power supply. Price 2 bells for £1. Ref. BD600.

ASTEC PSU. Mains operated switch mode so very compact (6½" × 4" × 2" approx.). Outputs: +5 Volts 3.5 amp, +12 Volts 1.5 amp, −5 Volt 1.5 amp. Brand new. Normal price £30+. Our price only £10. Ref. 10P34.

APPLIANCE THERMOSTATS – spindle adjust type suitable for convector heaters or similar. Price 2 for £1. Ref. BD582.

3 CORE FLEX BARGAIN No.1 – Core size 5mm so ideal for long extension leads carrying up to 5 amps or short leads up to 10 amps. 15mm for £2. order Ref. 2P189.

3 CORE FLEX BARGAIN No.2 – Core size 1.25mm so suitable for long extension leads carrying up to 13 amps – or short leads up to 25A. 10m for £2. order Ref. 2P190.

CASE WITH 13A PRONGS – to go into 13A socket, nice size and suitable for plenty of projects such as car battery trickle charger, speed controller, time switch, night light, noise suppressor, dimmers etc. Price – 2 for £1. Ref. BD565.

ALPHA-NUMERIC KEYBOARD – this keyboard has 73 keys with contactless capacitance switches giving long trouble free life and no contact bounce. The keys are arranged in two groups, the main area field is a QWERTY array and on the right is a 15 key number pad, board size is approx. 13" x 4" – brand new but offered at only a fraction of its cost namely £3, plus £1 post. Ref. 3P27.

TELEPHONE EXTENSIONS – it is now legal for you to undertake the wiring of telephone extensions. For this we can supply 4 core telephone cable, 100m coil £8.50. Extension BT sockets £2.95. Packet of 50 plastic headed staples £2. Dual adaptor for taking two appliances from one socket £3.95. Leads with BT plug for changing old phones 3 for £2.

WIRE BARGAIN – 500 metres 0.7mm solid copper tinned and p.v.c. covered. Only £3 + £1 post. Ref. 3P31 – that's well under 1p per metre, and this wire is ideal for push on connections.

INTERRUPTED BEAM KIT – this kit enables you to make a switch that will trigger when a steady beam of infra-red or ordinary light is broken. Main components – relay photo transistor, resistors and caps etc. Circuit diagram but no case. Price £2. Ref. 2P15.

3-30V VARIABLE VOLTAGE POWER SUPPLY UNIT – with 1 amp DC output. Intended for use on the bench for experimenters, students, inventors, service engineers etc. This is probably the most important piece of equipment you can own. (After a multi range test meter). It gives a variable output from 3-30 volts and has an automatic short circuit and overload protection, which operates at 1.1 amp approximately. Other features are very low ripple output, a typical ripple is 3mV pk-pk, 1mV rms. Mounted in a metal fronted plastic case, this has a voltmeter on the front panel in addition to the output control knob and the output terminals. Price for complete kit with full instructions is £15. Ref. 15P7.

TRANSMITTER SURVEILLANCE (BUG) – tiny, easily hidden, but which will enable conversation to be picked up with FM radio. Can be housed in a matchbox. All electronic parts and circuit. Price £2. Ref. 2P52.

EAST CORNWALL COMPONENTS

BARCLAYCARD VISA — Access

CATALOGUE available – range of components greatly increased – over 136 pages fully illustrated. Price £1.00 per copy (free upon request with orders over £15). Credit Tickets (3), Special Offer Sheets, Order Form and Pre-Paid Envelope. Order your copy now.

AUGUST SPECIAL

4-WAY EXTENSION SOCKET

£3.25 EACH 10+ £2.95 EACH

3-PIN SOCKETS – FUSED & NEON INDICATOR SLEEVED AS REGULATIONS

SPECIAL OFFERS WHILE STOCKS LAST

ENGRAVER – BATTERY OPERATED
Simple to use this very handy engraving tool may be used on Metal, Plastic, Wood, Nameplates, etc. Uses 2 × "AA" Penlight Batteries (not included).
Length: 170mm. Dia. 25mm
Order Code SO/022 — Price: £1.75 Per 10: £1.50 each

HALOGEN LAMP – 500 Watt
Tungsten Halogen Lamp for use in external Halogen Light Fittings
Voltage: 240Vac Watts: 500
Order Code SO/023 — Price: 3.50 Per 10: £3.00 each

END NIPPERS – Economy
Yellow insul. handles. Length 4½"
Order Code SO/024 — Price: £1.00 Per 10: 90p each

FLAT NOSE PLIERS – Economy
Yellow insul. handles. Length 4"
Order Code SO/025 — Price: £1.00 Per 10: 90p each

ALUMINIUM SHEETS
Dimensions: 125mm × 220mm (Approx.)
Order Code: SO/014 — Price: 50p Per 10: 45 each

SPEAKER LEADS
2-Pin Din – Prepared E.
Length: 6 Metres.
Quantity available: Approx. 200.
Order Code: SO/019
1+ 10+
Price: 75p 60p

NI-CAD BATTERY CHARGER
Universal
PRICE
1+ £4.50 each
10+ £4.25 each
100+ £3.75 each

NI CAD BATTERIES

AAA	£1.25	£1.20 ea/10
AA	.90	.85 ea/10
C	£2.10	£1.90 ea/10
D	£2.50	£2.20 ea/10
PP3	£4.10	£3.90 ea/10

20mm FUSES
QUICK BLOW – 80mA, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1A, 1.25, 1.5, 1.6, 2, 2.5, 3.15, 4, 5, 6.3 — 45p/10
TIME DELAY – 50mA, 60, 80, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1A, 1.25, 1.6, 2, 2.5, 3.15, 4, 5, 6.3, 10 — 90p/10

1 DOMESTIC MAINS FUSES
ALL 13A, FUSED WITH NEON INDICATOR
2A, 3A, 5A, 13A — £1.00/10

1¼ QUICK BLOW FUSES
500mA, 1A 1.25A, 2A, 12A — 50p/10

BT APPROVED EQUIPMENT

Master Socket (Flush)	£2.90	Wiring Tool	36p
Master Socket (Surface)	£2.75	Plug – 431A	25p
Secondary Socket (Flush)	£1.90	Slimtel Phone	£17.35
Secondary Socket (Surface)	£1.70	Viscount Phone	£26.04
B.T. Cable (per metre)	15p	Conversion Kit & Wiring Diag.	£6.90
Line Jack Cord with Plug	£1.25		
Extension Lead 5 Mtr	£2.90		

ORVX PORTASOL GAS SOLDERING IRON
PRICE £16.00 each
SPARE TIPS – 1, 2.4, 3.2, 4.8mm £4.00 each

RESISTORS – CARBON FILM 5%
¼W 1RO to 10M (E12 Range) — 2p each. 15p/10. 75p/100
½W 2R2 to 10M (E24 Range) — 2p each. 15p/10. 75p/100
1W 10R to 2M2 (E12 Range) — 5p each. 40p/10. 3.00/100
2W 10R to 2M2 (E6 Range) — 8p each. 60p/10. 5.00/100

RESISTOR KITS – each value individually packed

¼W pack 10 each value E12 – 10R to 1M 610 pieces	4.50
¼W pack 5 each value E12 – 10R to 1M 305 pieces	2.95
¼W pack Popular – 10R to 10M 1000 pieces	6.50
½W pack 10 each value E12 – 2R2 to 2M2 730 pieces	7.75
½W pack 5 each value E12 – 2R2 to 2M2 365 pieces	4.70
½W pack Popular – 2R2 to 10M 1000 pieces	9.50
1W pack 5 each value E12 – 2R2 to 1M 353 pieces	13.75
2W pack 5 each value E6 – 10R to 2M2 317 pieces	21.75

ADDITIONAL KITS

DISC CERAMIC 50V	125 pieces	£3.50
ZENER DIODES 5ea	55 pieces	£3.50
ELECTROLYTICS R	100 pieces	£7.25
FUSES Q/BLOW 20mm	80 pieces	£3.75
FUSES T/DELAY 20mm	80 pieces	£7.50
PRE-SET POTS-H	120 pieces	£6.75
PRE-SET POTS-V	120 pieces	£6.74

SOLDER: 60% TIN 40% ALLOY
22g. Non-corrosive Multi-core Solder.
500gm Reel £4.99 each – 10 Reels £3.75 each

SOLDERING SECTION

Soldering Station complete with 30W or 40W Iron (state which)	72.50	CS 18W, as above	10.90
XS25 W Iron kit/complete with stand, 1m lead & plug attached	8.20	Antex 15W iron	5.40
CS17 Iron Kit	7.99	Antex 18W iron	5.60
C15 Iron Kit	8.30	Antex 25W iron	5.80
XS25 W Iron kit/complete with steel & plug attached	11.00	Antex elements	3.20
		Antex bits	1.15
		Antex stands	2.20
		Soldersucker	2.99
		Spare nozzles for Soldersucker	0.60

SERVICE AIDS

Goldklene Degreasing Solvent	1.78	Aero Duster	1.55
Switch Cleaner Lubri	1.18	Super 40	1.94
Supa Freeze-it	1.46	Rapid Fire Extinguisher	3.45
Foam Cleanser	1.26	Silicone Grease Tube	1.82
Video/Tape Head Cleaner	1.14	Silicone Grease Spray	1.48
Plastic-Seal	1.40	Heat Sink Compound	1.20
Aero-Klene	1.16	**Solda-Mop**	
Anti-Static Spray ellist	1.28	Light guage 0.08mm	0.80
Excel Polish	1.24	Standatd gauge1.2mm	0.78
		Industrial reel 1.2mm	2.96

T.V. AERIAL ACCESSORIES

Co-Ax Cable 75 Ohm 100 Metre Reel	£11.00
	1+ 10+
Co-Ax Metal Plug	20p, 18p
Co-Ax Line Socket	25p, 22p
Co-Ax Line Connector	12p, 10p
Co-Ax In-Line Splitter	80p
TV/Video/Computer Combiner 7042	£4.05
TV Indoor Amplifier 7253	
Improves signal 3 times	£16.95
Second Set Amplifier 7243	
Improves signal to 2 sets 50%	£15.75
CB Interference Suppressor 9700	
Minimises CB interference on TV	£5.55
TV/FM Diplexer 9006	
Separates UHF TV signals from FM radio signals	£4.95

VALVES
Enquiries are welcomed for any other valve not listed here.

Type	Price (£)
AZ31	4.55
AZ41	2.05
DAF96	1.05
DF96	0.80
DK96	2.70
DM71	3.00
DY86/87	0.70
DY802	0.95
CV850	2.55
CV4015	2.85
E180F	6.55
EABC80	0.85
EAF42	1.55
EB91	1.35
EBC41	3.50
EBF80	0.80
ECC81	1.05
ECC82	0.95
ECC83	1.20
ECC84	0.85
ECC85	1.00
ECC88	1.25
ECC189	0.90
ECF80	0.85
ECF82	0.90
ECF83	1.95
ECH35	3.80
ECH81	1.45
ECH84	1.55
ECL85	0.80
ECL86	1.80
EF80	0.80
EF86	1.85
EF91	2.05
EF95	1.70
EF183	0.95
EF184	1.05
EH90	1.00
EL34	3.45
EL36	2.30
EL81	7.00
EL84	2.40
EL85	5.00
EL86	6.95
EL509	7.90
EL519	8.00
EM80	0.90
EM84	1.80
EM87	3.90
EY51	0.95
EY86/87	0.70
EY88	0.80
EY500A	2.20
EZ41	2.85
EZ81	0.85
GY501	1.45
GZ32	1.25
KT66(G.E.C.)	18.00
KT77	11.50
KT88(G.E.C.)	19.00
PC88	1.45
PC92	3.05
PC900	1.45
PCC88	0.85
PCC89	0.80
PCC189	0.90
PCF80	0.95
PCF82	1.00
PCF84	0.80
PCF86	1.30
PCF87	0.60
PCF200	2.00
PCF201	2.00
PCF800	1.25
PCF801	1.10
PCF802	1.10
PCF805	1.75
PCF806	1.25
PCF808	1.65
PCL82	1.05
PCL83	2.55
PCL84	1.05
PCL86	0.90
PCL88	2.55
PCL805	1.05
PD500	2.95
PFL200	1.80
PL33	1.55
PL36	1.80
PL82	0.80
PL95	2.05
PL504	1.55
PL508	2.75
PL519/509	5.20
PL802	5.55
PY81/800	1.15
PY82	1.80
PY88	0.80
PY500A	2.25
PY801	0.75
UABC80	0.90
UAF42	1.30
UBC41	4.35
UBC81	1.75
UCC85	0.80
UCF80	1.25
UCH42	5.65
UCH81	2.05
UCL82	1.85
UCL83	3.30
UF41	1.30
UF89	2.55
UL84	1.30
UY85	1.20
2D21	2.65
6AT6	1.30
6AU6	1.05
6C4	1.05
6GH8A	1.25
6J5GT	2.55
6K7G	2.05
6K8G	2.80
6K25	6.55
6X4	1.55
30FL2	1.75
30FL12	1.65

13A TEST PLUG – useful for testing 13A sockets.
PRICE: 99p ea. 10 off 90p ea.

TEST PRODS – FUSED – 99p pair

SAFEBLOC – Quicktest – Mains – £6.75 each

HELPING HANDS WITH MAGNIFIER ONLY £3.99

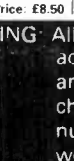
EXTENSION MULTI SOCKETS
ALL 13A, FUSED WITH NEON INDICATOR

2-WAY	£2.75 each £2.50ea/5
3-WAY	£3.80 each £3.50ea/5
4-WAY	£3.99 each £3.75ea/5
4-WAY with lead & plug	£5.75 each £5.25ea/10+
PLUGS 13A 3-pin fused	£0.46 each £0.42ea/10

BOOKS

DATA VOLUME 1 – Trans. data & drawings A-BUY	£9.99
DATA VOLUME 2 – as above C-Z	£10.75
DATA VOLUME 3 – 2N-2N6735	£10.20
DATA VOLUME 4 – 2SA & on	£13.50
DIODES VOLUME 1	£10.75
DIODES VOLUME 2 Both Volumes	£10.65 £20.60
I.C. CMOS	£8.95
I.C. TTL	£19.50
I.C. LIN VOLUME 1	£6.95
I.C. LIN VOLUME 2 Both volumes	£6.99 £13.00
THYRISTORS A to Z	£10.45
TRANSISTORS A to Z	£5.40
TRANSISTORS 2N-3N Both volumes	£5.50 £10.00

FM TRANSMITTER
Very High Quality 'MINI-BUG' – Ideal for Baby Alarm etc.!!
A very good range is obtainable – we have obtained over ½ mile, but it does depend on conditions.
Simply remove cover – insert battery – and you're ready to go
Reception can be obtained on any F.M. Radio.
Frequency: 105-109 MHz F.M.
Power: PP3 9V Battery (not included)
Dimensions: 4.25" × 2.25" × 0.75"
Order Code – SO/034 — Price: £8.50



NEW REDUCED PRICES FOR TELEVISION SPARES

REPLACEMENT VIDEO HEADS

AKAI	
VS1	29.45
VS2	29.45
VS3	29.45
VS5	29.45
VS10	29.45
VS77	29.45
VS88	29.45
VS7100	29.45
VS7200	29.45
VS9300	29.45
VS9500	29.45
VS9700	29.45
VS9800	29.45
FERGUSON	
3V00	21.45
3V01	21.45
3V06	21.45
3V16	21.45
3V22	21.45
3V23	21.45
3V24	21.45
3V29	21.45
3V30	21.45
3V31	21.45
3V35	21.45
3V36	21.45
8903	21.45
HITACHI	
VT6500	25.00
VT7000	25.00
VT8000	25.00
VT8040	25.00
VT8100	25.00
VT8500	25.00
VT8700	25.00
VT9000E	25.00
VT9300	25.00
VT9500S	25.00
VT9700	25.00
VT9900	25.00
VT4000	25.00
VT4200	25.00
VT5000	25.00
VT5500	25.00
ORION	
VH1	21.45
VH2	21.45
JVC	
HRD110	21.45
HRD111	21.45
HRD120	21.45
HRD121	21.45
HRD220	21.45
HRD225	21.45
HR2200	21.45
HR3300	21.45
HR3320	21.45
HR3330	21.45
HR3350	21.45
HR3360	21.45
HR3660	21.45
HR4000	21.45
HR4100	21.45
HR7200	21.45
HR7600	21.45
HR7610	21.45
HR7650	21.45
HR7700	21.45
NATIONAL PANASONIC	
NV100	25.45
NV230	36.45
NV250	36.45
NV270	36.45
NV280	36.45
NV300	21.45
NV322	21.45
NV330	35.45
NV333	21.45
NV340	21.45
NV370	25.45
NV380	25.45
NAT. PAN. Cont	
NV390	21.45
NV450	36.45
NV470	36.45
NV480	36.45
NV600	35.45
NV777	35.45
NV861	21.45
NV2000	21.45
NV3000	21.45
NV7000	21.45
NV7200	21.45
NV7500	21.45
NV7800	21.45
NV7850	21.45
NV8170	21.45
NV8200	21.45
NV8400	21.45
NV8600	21.45
NV8620	21.45
NEC	
PV760	23.45
PV764	23.45
PV774	23.45
N830	21.45
N831	21.45
N832	21.45
N833	21.45
PV2300	23.45
PV2400	23.45
SHARP	
110	26.45
381	26.45
383	26.45
384	26.45
385	26.45
386	26.45
387	26.45
388	26.45
481	26.45
482	26.45
2000	26.45
3300	26.45
9100	26.45
9300	26.45
9400	26.45
9500	26.45
9600	26.45
9700	26.45
SANYO/FISHER	
FVHP615	34.50
FVHP910	34.50
PHILIPS	
DV462	25.45
6460	25.45
6520	25.45
SONY	
SLF1	29.45
SLC5	23.45
SLC6	23.45
SLC7	23.45
SLC8	39.45
SLC20	29.45
SLC24	29.45
SLC30	29.45
SLC33	29.45
SLC40	29.45
SLC50	39.45
SLC60	39.45
SLK95	39.45
SL200	39.45
SL3000	25.00
SL8000	24.50
SL8080	24.50
TOSHIBA	
V31	29.50
V33	29.50
V55	21.45
V57	21.45
V5470	24.50
V9600	29.50

TRANSISTORS + DIODES

Type	Price (£)	Type	Price (£)	Type	Price (£)
AC128	0.30	BC237	0.12	BF185	0.28
AC128K	0.38	BC238	0.12	BF194A	0.15
AC141	0.58	BC251/A/B	0.14	BF195	0.12
AC141K	0.38	BC262	0.26	BF224J	0.20
AC142	0.40	A B	0.29	BF240	0.15
AC142K	0.38	BC301	0.36	BF241	0.18
AC152	0.48	BC302	0.38	BF257	0.22
AC153K	0.46	BC303	0.36	BF258	0.26
AC176K	0.32	BC307A	0.15	BF259	0.30
AC187	0.40	BC317B	0.15	BF262	0.34
AC187K	0.42	BC323	0.90	BF263	0.38
AC188	0.24	BC327	0.10	BF270	0.30
AC188K	0.38	BC328	0.10	BF271	0.28
ACY22	1.50	BC337	0.08	BF273	0.22
AD142	0.88	BC338	0.10	BF274	0.34
AD149	0.95	BC350A	0.24	BF294	0.46
AD161/162	1.20	BC351	0.16	BF336	0.40
AF114	0.88	BC516	0.35	BF337	0.38
AF115	2.10	BC547	0.08	BF338	0.28
AF116	2.10	BC440	0.36	BF355	0.42
AF121	0.66	BC548	0.08	BF371	0.27
AF124	0.70	A B or C	0.10	BF450	0.30
AF125	0.50	BC549	0.08	BF457	0.36
AF126	0.50	A or B	0.10	BFR51	0.36
AF127	0.50	BC550	0.10	BFR61	0.32
AF139	0.56	A or B	0.10	BFR90	0.86
AF178	1.50	BC557A	0.10	BFT41	0.68
AF239	0.65	BC558A	0.10	BFT43	0.38
AF279S	1.40	BCY70	0.36	BFY50	0.32
AF280	5.20	BCZ10	3.21	BFY51	0.32
ASZ17	2.00	BD123	2.60	BFY52	0.32
AU110	2.90	BD124P	1.20	BFY90	0.80
AY102	4.32	BD129	0.90	BFY90S	1.34
B40C200	1.03	BD130Y	0.68	BR100	0.60
BA115	0.12	BD131	0.46	BR101	0.76
BA121	0.40	BD132	0.50	BR103	0.60
BA148	0.16	BD135	0.26	BR303	2.75
BA155	0.12	BD136	0.26	BRY39	0.80
BA157	0.20	BD137	0.28	BRY56	0.42
BB105B	0.32	BD138	0.30	BSX20	0.20
BB105G	0.30	BD139	0.30	BSX52	0.20
BB110B	0.42	BD140	0.29	BSY95A	0.25
BC108	0.10	BD142	1.60	BT100A/02	0.90
A,B or C	0.14	BD145	1.82	BT101/300	2.75
BC109	0.10	BD150B	0.50	BT101/500	3.25
A,B or C	0.14	BD160	1.58	BT102/300	3.60
BC115	0.15	BD165	0.45	BT106	2.05
BC117	0.28	BD183	0.70	BT116	1.20
BC118	0.20	BD201	0.52	BT119	3.30
BC119	0.43	BD202	0.57	BT138/600	0.98
BC125	0.14	BD222	0.80	BT151/560R	0.90
BC140	0.48	BD225	0.40	BTY79/400R	2.80
BC141	0.36	BD232	0.52	BU104	1.80
BC142	0.26	BD234	0.30	BU105	1.40
BC143	0.36	BD235	0.30	BU108	1.90
BC147B	0.16	BD236	0.36	BU126	1.60
BC148	0.10	BD237	0.38	BU133	1.90
BC148B	0.12	BD410	0.76	BU204	1.60
BC149	0.12	BD438	0.64	BU205	1.40
BC149C	0.14	BD439	0.85	BU208A	1.50
BC159	0.14	BD441	0.85	BU326S	1.75
B/C	0.16	BD507	1.05	BUY20	2.75
BC160	0.38	BD520	1.20	BUY69A	2.90
BC161	0.30	BD587	0.88	BUY69B	1.98
BC168B	0.25	BD707	0.80	BY100	0.80
BC170/A/B/C	0.12	BDX18	1.00	BY103	0.50
BC171/A/B	0.10	BDX32	1.75	BY122	0.60
BC172/B/C	0.12	BF115	0.32	BY126	0.10
BC177/B/C	0.24	BF117	0.50	BY127	0.08
BC182/A/B/C	0.10	BF119	0.82	BY133	0.10
BC182L	0.10	BF125	0.42	BY135	0.35
LA LB LC	0.12	BF127	0.44	BY164	0.45
BC183/A/B/C	0.10	BF154	0.14	BY179	0.60
BC183L	0.10	BF157	0.46	BY182	0.80
LA LB LC	0.12	BF160	0.23	BY184	0.38
BC184	0.08	BF167	0.32	BY187	0.65
A B CL LC LB	0.10	BF177	0.42	BY189	6.75
BC212/A/B/C	0.10	BF178	0.36	BY198	0.64
BC212L	0.10	BF180	0.27	BY199	0.72
LA LB	0.10	BF181	0.27	BYZ06	0.14
BC213/A/B/C	0.10	BF182	0.32	BYZ07	0.16
BC213L	0.10	BF183	0.32	BYZ10/400	0.21
LA LB LC	0.10	BF184	0.47	BYZ10/800	0.22

INTEGRATED CIRCUITS (£) EACH

741	0.16
CA810QM	1.20
CA3020	2.10
CA3065	1.60
HA1366WR	1.59
LA4422	3.20
LC7131	4.90
LM324N	0.40
LM380N8-P	0.80
LM380N14-P	1.80
LM1011N	3.20
LM1458N	1.35
LM3900N	0.50
M51513L	2.30
M51515L	3.15
MC1307P	1.99
MC1327P	1.50
ML237B	2.30
NE555	0.20
SAS560S	1.85
SAS570S	1.85
SAS580	2.85
SAS590	2.85
SN76226DN	1.30
SN76227N	1.10
SN76533N	1.75
STK015	6.20
TA7203P	2.50
TA7204P	2.50
TA7205AP	1.80
TAA550	0.50
TAA611A12	3.50
TA120B	1.30
SA/SO	1.30
TBA520	1.50
TBA530	1.20
TBA540	1.64
TBA560C	1.50
TBA810S	1.20
TBA950/2A	3.05
TCA270SQ	4.02
TDA1006A	2.45
TDA1035S	4.50
TDA1170S	1.99
TDA1352A	1.80
TDA2030	1.80
TDA2530	2.20
TDA2532	2.80
TDA2560	3.20
UPC575C2	1.45
UPC1350C	4.05
UPC1182H	2.75
UPC1208C	1.25
UPC1356C2	3.00

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FERGUSON/JVC Drum Motor 3V00-3V22	35.00
SANYO Reel Motor VTC5150	9.60
SHARP Reel Motor VTC5150, VC9300	18.45
SHARP Reel Motor VC483	18.45
SONY DC Motor BHF/1100D C7	30.50
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IDLERS

FERGUSON/JVC Take Up Idler 3V00-3V16	4.80
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HITACHI F/Fwd Rewind 6886971	1.90
HITACHI Idler 6413663	2.25
SANYO Reel Idler Assy VTC 5150 143-0-662T-01201	5.95
SHARP Idler NiDL 0005 GE22	1.90
SHARP Idler NiDL 0006 GE22	1.90
SONY Rewind Kit A-670-634-8B	4.95
SONY Rewind Kit A-670-639-1B	4.50

VIDEO BELT KITS

AKAI	9300/9500/9800	2.00
HITACHI	5000	1.35
	8000	1.05
JVC	HR7650-3V31	.68
PANASONIC	NV7000/7200	1.04
	NV2000B	1.07
	NV300/333	1.22
	NV777	1.16
	NV8600/8610/VO11	1.45
SANYO	VTC5000	.90
	VTC5300	1.80
	9300P	2.00
	5500	1.00
SHARP	VC7300	1.29
	VC8300/6600	1.57
	8300	1.70
	9300	1.10

VIDEO BELT KITS (Cont.)

SONY	SLC5/7	1.64
	SL8000/8600/8600	2.60
	SL3000UB	2.05
	SLC6	1.85
	T9	2.15
THORN	3V29/HR7200	1.70
TOSHIBA	V8600	1.40
	V7540	1.50
	9600	1.15
AMSTRAD	7000	1.40
JVC	HR3300/3320/3360	2.00
	HR7000	.90

GENUINE HEADS

FERGUSON	8903/3V00/3V01/3V06/3V16/3V22/3V23/3V24/3V29/3V30	39.50
JVC	All sets	39.50
PANASONIC	NV-2200/3000/7000/7200/8400/8600/8170/8610/8620	39.50
	VEH0120/31	39.50
	VEH0218	38.35
	VEH0177	52.50
SANYO	VTC9300/9455/9500	52.50
	VTC5000/5300/5400	52.50
HITACHI/GEC	VT5000E	35.50
	Original/8/93/95	35.50
	Original/VT111E	35.50
	Original/VT33E	35.50
SHARP	Universal	55.00
SONY	C5/C6/C7/SL8000/8800	47.75
	Original/SLC9	48.00
	Original/SLC20/30/40	48.00
	Original/SLC5/6/7	48.00
	Original/8000	48.00
TOSHIBA	V5470A/B/D/P	48.00
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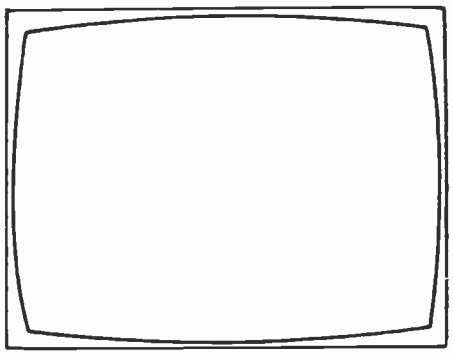

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COVER PHOTO
This month's cover photograph shows the new Ferguson TX99 CTV chassis, a compact single-panel (plus c.r.t. base board) concept designed to drive a range of 90° tubes. See article on pages 764-8.

The Broadcasting Debate

The last few weeks have been notable for the number of statements and reports that have appeared on the future of TV broadcasting in the UK. We have had the suggestion that BBC-2 and Ch. 4 might be made into satellite TV only services so that their terrestrial transmitter networks could be freed for additional advertisement-funded national and regional channels, the Home Secretary Douglas Hurd has been openly questioning the funding of the BBC via the licence fee and the role of the IBA, the Commons all-party Home Affairs select committee's report on the future of broadcasting has been published, and plans for considerable expansion of satellite TV services have been announced. All this comes as the government's White Paper on the subject is awaited in the autumn.

The government has called for discussion and debate on the future of broadcasting arrangements in the UK. How much notice it will take of views put forward remains to be seen. The Home Affairs committee's 195-page report *The Future of Broadcasting* presents a cogent case for leaving things much as they are at present. In welcoming the report, Mr. Hurd commented that "I can understand the uncertainty that's unsettling the broadcasting institutions as fresh ideas are put forward and examined". Well he would say that – after all it's the government that has all along been pressing for change.

Two factors suggest a possible need for change. First, developments in technology are bringing about change anyway. Secondly, the fact that the BBC and IBA have been around for a considerable time in their present form may mean that they have outlived their usefulness.

The technology argument means cable and satellite TV of course. These are already giving viewers greater choice. Cable TV in its new form, as opposed to the old relay networks, has been around for some time now but has hardly led to a revolution in TV. Things might change when Murdoch and Maxwell get going with their satellite TV services – British Satellite Broadcasting's services are also due to start late next year. So the public is going to be given a considerably wider choice quite soon regardless of the amount of debating that goes on. In which case, why all the fuss?

If the BBC and the IBA could be shown to be providing inferior services, there would certainly be a case for change. The only yardstick for such an assessment is by way of international comparisons. These always highlight the superiority of the established UK broadcasting services. Some members of the government may feel that the idea of a publicly funded service such as that provided by the BBC does not fit in with current thinking about a market led economy. The case has been forcefully argued in some quarters that the BBC should seek its money through subscriptions, pay-to-view or whatever rather than taking its money and providing what it thinks fit. But this could jeopardise a perfectly good system – as viewing figures attest – for the sake of ideology. Hardly a wise course.

The Home Affairs committee came to the conclusion that the BBC, funded by its licence revenue, was "remarkable value" and should continue much as it is. Its main TV recommendations are as follows: that there should be no change in the basic role of the BBC; that Ch. 4 should remain substantially as it is; that a fifth terrestrial TV channel based on a network of local stations should be established as soon as possible; that the IBA should be replaced by a new Commercial Television Authority that would regulate the ITV, cable and satellite TV services; that a system of regulated tendering should be used when the current ITV franchises come up for renewal in 1992; that British Satellite Broadcasting's DBS services should be given a fair trial; that separate night-time TV franchises, from midnight until 0600, should be introduced in 1993; that franchises for the two remaining DBS channels should be awarded as soon as possible after 1993; and that the newly set up Broadcasting Standards Council should base its findings on proper research rather than the representations of pressure groups. The Committee spent six months on its deliberations and members visited the USA and Italy to sample the offerings of overseas TV broadcasters. It might seem that the IBA has come out of all this badly, but the committee's chairman John Wheeler pointed out that the proposal for a new Commercial Television Authority had not been made because of any shortcomings but because "a new body is required for a wider and more flexible task". The IBA has proved itself to be flexible in the past however, and there is no reason to think that it couldn't cope with any added responsibilities given to it. Finally, Mr. Wheeler suggested that public service broadcasting should remain at the centre of a recast UK TV service, with the interests of viewers rather than advertisers at the forefront. "In the medium term" he continued, "we think that the majority of viewers will still watch the same four channels as they do now. We don't want the success of new services to be at the expense of the present much-valued ones." A rather more down-to-earth view than that of the Peacock Committee, and non the worse for that.

Thanks!

There was an incredible response to our questionnaire in the June issue – we received several thousand completed forms. Our thanks to all who assisted in this way. A computer analysis of the results is under way and will help us in determining future policy.

Long-distance Television

Roger Bunney

At first there seemed to be a poor start to the 1988 Sporadic E season. During the latter half of May however there was a considerable improvement, with a number of exotic signals being logged and several intense openings. The log is as follows:

6/5/88 An aurora on the 5th extended into the 6th, giving auroral TV reception that included RAI (Italy) ch. IA and unidentified signals on chs. E3 and 4. It gradually developed into an SpE opening, with signals in the UK noted from RAI chs. IA, B; TVE (Spain) E2, 3, 4; RTP (Portugal) E2, 3; JRT (Yugoslavia) E3, 4; TVR (Rumania) R2; TVP (Poland) R1; ARD (West Germany) E2, 3, 4; DFF (East Germany) E4; TSS (USSR) R1, 2; CST (Czechoslovakia) R2; RUV (Iceland) E3; TDF (Canal Plus) L3; RTT (Tunisia) E4.

7/5/88 TVE E3, 4; RAI IA, B; JRT E3; ARD E2; ORF (Austria) E2a; +PTT (Switzerland) E3, 4; TDF (France) L2, 3, 4.

8/5/88 TVE E3, 4.

9/5/88 SVT (Sweden) E2.

10/5/88 SVT E2; NRK (Norway) E2.

11/5/88 ARD E2, 3, 4; RTB-F (Belgium) E3; +PTT E2, 3; RAI IA; DR (Denmark) E3, 4; ORF E2a, 4; TVE E2; RTP E3; CST R1; TSS R1; TVP R1; NRK E2, 3, 4; SVT E2, 3, 4.

12/5/88 EPT (Greece) E3.

13/5/88 RUV E4.

14/5/88 SVT E2.

15/5/88 TVE E2, 3, 4; TVE-2 E2; RAI IA, B; ORF E2a; JRT E3, 4; EPT E3; RTP E2, 3; TDF L2, 3, 4; +PTT E2, 3; TVP R1, 2, 3; NRK E3; SVT E2; MTV (Hungary) R1, 2; Tele-Uno IA (Italian free station).

16/5/88 TVE E2, 4.

17/5/88 CST R2; TSS R1; TVE E2.

18/5/88 RAI IA, B; TVR R2; CST R2; NRK E2, 3; Tele-Gralano E2 (Italian free station).

19/5/88 RAI IA, B; NRK E2, 3, 4; SVT E2, 3; RUV E4; TSS R1, 2; TVR R1, 2; CST R2; +PTT E3; JRT E3, 4; TWM IA (Italian free station).

20/5/88 TVP R1, 2; TSS R1, 2; TDF L2; +PTT E2; CST R2.

21/5/88 TVE E2.

22/5/88 RAI IA, B; TSS R1, 2, 3; TVP R1, 2; NRK E2; SVT E2, 3, 4; TDF L2, 4; TVA IA (Italian free station).

23/5/88 RAI IA, B; TVA IA; MTV R1; TVP R2; TSS R1, 2, 3; JRT E3, 4; SVT E2, 3, 4; NRK E2, 3, 4; CST R1; DR E3, 4; RUV E4; RTS (Albania) IC; YLE (Finland) E3, 4. A coloured announcer was seen on ch. E3 at 1800, the signal (NTV?) being from the south.

24/5/88 TSS R1, 2; SVT E2, 3, 4; NRK E2, 3, 4; YLE E3, 4; CST R1; JRT E3, 4; TVE E3, 4;Syria E3 from 1505-1815 with long, fading weak signals in southern UK.

25/5/88 EPT E3; CST R1, 2; TVP R2, 3; JRT E3, 4; TSS R1, 2; NRK E2, 3; SVT E2; RAI IA.

26/5/88 RAI IA, B; EPT E3; RTS IC; CST R1, 2; ARD E2, 3, 4; DR E3, 4; NRK E2, 3, 4; SVT E2, 3, 4; YLE E3, 4; TSS R1, 2, 3; TVP R1, 2; JRT E3, 4; TVE E2, 3, 4.

27/5/88 RAI IA; RTP E2, 3; TVE E2, 3, 4; TDF L2; +PTT E4; ORF E2a, E4; ARD E2, 3, 4; MTV R1, 2; TVR R1, 2; JRT E3, 4; CST R1, 2, 4; TSS R1, 2, 3, 4; TVP R1, 2, 3; RUV E3, 4; DR E3, 4; YLE E3; NRK E2, 3, 4; SVT E2, 3; JTV (Jordan) E3 from 0720-0845.

28/5/88 TSS R1, 2; JRT E4; RAI IA; SVT E2; TDF L2; TVP R1; ZTV (Zimbabwe-Gwelo) E2 at 1910.

29/5/88 RAI IA; Syria E3.

30/5/88 RAI IA, B; TVE E2, 3, 4; TDF L2, 4; JRT E3, 4; Syria E3 at 1900; ZTV Gwelo E2 at 1820.

31/5/88 RTP E2, 3; TVE E2, 3, 4.

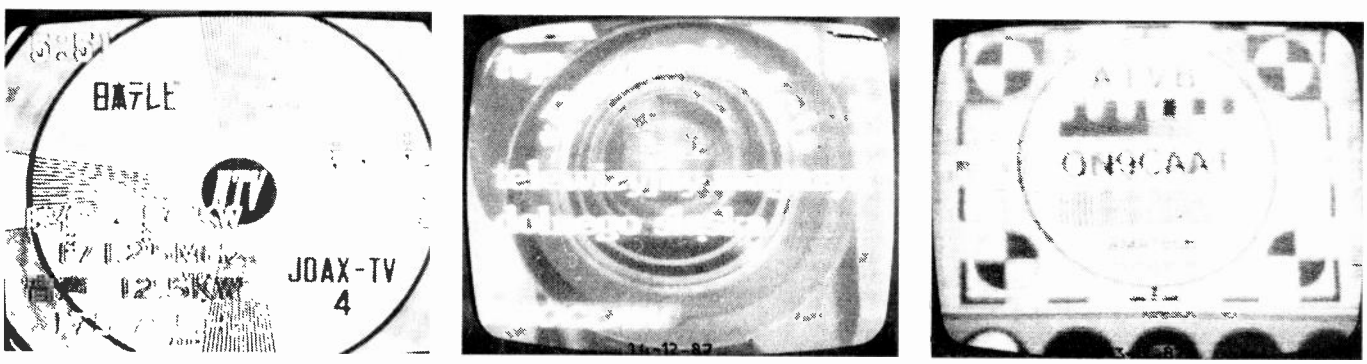
1/6/88 RAI IA.

3/6/88 TSS R1.

There was a remarkable all-day SpE opening on June 6th. At about 2300 system M signals from the USA/Canada were noted on chs. A2, 3, 4 and vision only on ch. A5 (77·25MHz!). More details next month.

There was a minor tropospheric opening on the 7th and a major one that lasted from the 14th to the 17th. Quite remarkable Band III reception from the Low Countries, France, West Germany, Denmark and the nearer Scandinavian stations was experienced. The first two days were best in northern parts of the UK, but conditions later improved in the south, giving DR chs. E5, 8, 10, NRK E9, 11, SVT E8 and RTL E7. Simon Hamer did extremely well in north Wales, logging every ITV region including the Channel Islands. Interesting that he received Radio Jersey and Radio Guernsey on the 17th.

The Syrian ch. E3 SpE signals on the 24th/29th were logged by Tim Anderson in Hastings, Dave Shirley in St. Leonards and, on the 30th, by Cyril Willis at Kings Lynn – a corner-screen logo made identification possible. Cyril logged Gwelo, Zimbabwe (ZTV) ch. E2 on two occasions, on the 28th from 1910-1930 with a dark skinned lady announcer and on the 30th with English language sound, followed by Syria ch. E3! The Jordanian ch. E3 reception on the 27th consisted of a weak PM5544 test pattern followed by an English-language police-type programme from 0800-0845 – an Arabic caption was seen floating over the Jordanian signal at 0845! The ch. E3 Greek (EPT) reception on the 26th also produced a PM5544 type pattern, with the white background grid intermittently flashing, from 0745-0800 after which the display stabilised. On several occasions the FUBK pattern



Left: JOAX-TV 4 (Japan) test card photographed by Fred Robins during a recent visit. Centre and left: TVP Wrocklaw ch. 38 and an amateur TV test pattern received by Ryn Muntjewerff (Holland) during a tropospheric opening last December.

was seen on ch. E4 carrying the identification NEI I: it's thought that this is NDR Flensburg carrying a test transmission sourced from Niebuell. Back-scatter SpE was noted on several occasions, producing very short-skip signals such as Copenhagen ch. E4 noted in Essex.

French radio amateurs have been heard via SpE at 50MHz, though they don't at the time of writing have authorisation to be on air. The 50·032MHz Ascension Is. beacon ZD8VHF was heard at high levels in the southern UK on May 15th, and again next day in central UK. On both days the signals were present at 1700 onwards. Obviously this is the time to look for African Band I signals from Nigeria, Ghana and Zimbabwe. Finnish amateurs will have access to the 50MHz band from the end of June. During April a Johannesburg amateur (ZS6WB) reported reception of European ch. E2 TV signals at around 1910 GMT.

Personally I'm finding that Band I is becoming cluttered up – in the more built-up areas it's becoming an r.f. dustbin! Apart from computers that radiate spurious signals throughout the v.h.f. spectrum, over quite some distance, (it seems that the UK is well behind the FCC standards) the 49MHz segment is becoming choked with baby alarms, toy walkie-talkies, pagers and cordless phones. I've even seen a 49MHz f.m. radio three-channel intercom system for domestic use. A local baby alarm radiates over a half mile radius, producing a noise-free raster here. Despite all this the DTI seems to be quite happy.

My thanks to the following for sending in reception reports to add to my own meagre loggings: Dave Shirley (Hastings), Tim Anderson (St. Leonards), Roger Fussell (Torpoint), David Oliver (Birmingham), Simon Hamer (Powys), Ryn Muntjewerff (Holland), Tim Healey (Plymouth), Dr. Eric Duncan (Fife), Peter Schubert (Rainham), Bill Cotterill (Tipton), Iain Menzies (Aberdeen), Mark Baldwin (Rushden), Mel James (Anglesey) and Cyril Willis (Kings Lynn).

News Items

UK: The late-night British Medical TV service test transmissions continue, with Canal Plus type scrambling. Apparently the BBC is working on a different scrambling format which will be used when the service starts in the autumn. It's understood that the programmes will be transmitted during the very early morning period, before the BBC-2 Open University programmes.

Denmark: Test transmissions from the new Hove (Copenhagen West) ch. E31 and E53 outlets started on May 9th. Programmes in ch. E31 are due to start on June 1st – the PM5534 test pattern carries the identification DR at the top and KBH VEST at the bottom. The E53 outlet is due to start transmitting DR-2 on October 1st.

Austria: There has been an expansion of regional TV programming and in some areas two regional services can be received.

India: Band III rather than Band I is likely to be used for future extension of the networks. The Delhi based second channel, which at present covers seventy per cent of the country, is to have more regional opt-outs. Major network linking across the country will not be complete until the Insat II series is in operation from 1990 onwards.

Satellite TV: Launch of the Scandinavian TELE-X project has been postponed until late 1989 at the earliest. With Denmark unlikely to participate it seems that only two

Above: Test pattern being used during an EBU news transmission via the ECS satellite at 7°E. Off-air photograph from Ian Waller (Lincoln).

programmes will be carried. NRK (Norway) can now be seen via the Intelsat satellite at 1°W: tune to 11·45GHz, horizontal. The DTI is making available to multipoint satellite telecommunications services six uplink points: applications have been invited for twelve-year licences and services could include sound/TV entertainment.

Satellite Dishes

I've received several queries on the use of dishes for home satellite reception, in particular as to whether planning permission is required. The regulations are laid down by the Town and Country Planning General Development Order 1985 – Amendment No. 2. This permits the installation of a receiving dish not exceeding 90cm in diameter on or about a domestic/residential/industrial property, or at chimney/eaves height providing the system is attached no higher than the highest part of the roof. If the location is designated as one of outstanding beauty however, or is a conservation area, planning permission must be sought before a dish is mounted on a building or fixed to a stable/permanent foundation. Since the main requirement is a clear view of the sky, reasonable reception should in many cases be possible with the aerial at ground level, in a discreet location such as a rear garden. The system is unlikely to be more than 4-5ft high and thus unseen, so my own reaction would be to go ahead and instal. The patio mount system I described in recent issues is less than 42in. high above ground level in its wheeled rotating frame. Interesting to note that several satellite TV suppliers now offer wall; balcony and chimney mounting dish systems.

From our Correspondents . . .

Two letters in particular heartened me this month. J. Walley wrote from the Birmingham area: he's eighty years young, completely deaf and has read this magazine from issue no. 1! He recently bought a basic 90cm TVRO satellite system from Alston-Barry (Cambridge) who pretuned the receiver and described where to tune and look. Mr. Walley is now receiving numerous satellite signals. His basic patio mount is similar to mine but he moves his dish with the aid of lawn markers and a cheap gun sight for location. Sky, Super and RAI-UNO all carry teletext, which helps with his deafness – RAI even has English news. Tim Healey, a veteran DX-TXer, has been ill with a heart condition: a recent aortic valve replacement has made him feel a new man and he's now back DXing and keeping busy in Plymouth. Our best wishes to these two active gentlemen!

VHF TV – the UK decision

As mentioned briefly last month, the government has decided against reintroducing Band I/III TV transmissions in the UK. Consideration had been given to this possibility as a means of adding extra TV services, sharing the bands with the newly established PMR and other services that now use these frequencies. The feasibility study that had been undertaken came to the conclusion that Band III couldn't accommodate a new broadcast channel while living in harmony with its mobile radio neighbours. Band I could perhaps have provided a service for the major population centres (but not all of them), but the coverage would have had to be at the expense of moving the newly arrived mobile and other services, at a high compensatory cost. Ironic perhaps is the comment that re-establishing high-power TV transmissions in Band I could have upset our European neighbours who've made their r.f. management plans on the assumption that the UK has opted out of v.h.f. TV. The SpE phenomenon was given as a further reason for not returning to Band I, because of the high-level interference problems that prevail during the summer months. Finally the Civil Aviation Authority suggested that harmonic interference could be a problem.

The 405-line v.h.f. TV system officially closed down on January 6th, 1985, though several relays continued for a few days. Bands I and III are still allocated to TV broadcasting in the European broadcasting region, and are extensively used by countries in both west and east Europe. Will the newly established Band I mobile radio services be subjected to severe disruption during the summer months as a result of SpE propagation?

Airborne TV

We have previously described the activities of the Blue Eagle flight, which during the Vietnam war provided wide TV coverage from transmitters aboard high-flying aircraft. Recently (April 1988) the US magazine *Popular Electronics* described a series of tests that were carried out much earlier, in the mid-1940s, with a view to achieving wide TV coverage from airborne transmitters.

Staff of Westinghouse Radio designed a prototype system in July 1945. The "Stratovision" project would use aircraft equipped with f.m. radio and TV transmitters, flying at 25-30,000ft. Narrow beamwidth signals would be received on a particular channel and retransmitted on another channel with coverage over a vast area. Details were shown to the Glen L. Martin Aircraft Company, which by spring 1946 had equipped a World War Two surplus bomber with Band II (107·5MHz) and ch. A21 (515MHz) transmitters. Initial test flights proved that successful reception was possible over an area of about 250 miles. Areas flown over during these tests included Philadelphia, Wilmington, New York, Washington, North Carolina, Baltimore, Pittsburgh and Detroit. It seemed that eight Stratovision aircraft would give coast-to-coast coverage while fourteen would cover three-quarters of the US landmass. The transmitting aerials were mounted on a 10ft mast that hinged down from the bomb bay.

The encouraging results led to the conversion of a much larger B29 airoplane. In a 1948 test at Pittsburgh it relayed signals uplinked from Baltimore over an area that extended from south Virginia to New York state. At about this time the US airforce also experimented with airborne TV transmissions. The Stratovision project was considered to be a success, but was overtaken by progress with land-based communications technology, in the shape of a nationwide microwave network. The experience gained was however put to use in the very successful Blue Eagle service of the late 1960s.

This same magazine mentions that the first terrestrial u.h.f. TV transmitter, KC2XAK at Bridgeport, Connecticut, was tried out in December 1949. The vision carrier frequency was 530·25MHz (approximately ch. A24). Ch. A4 programmes from WNBT-TV in New York were relayed over a distance of 45 miles via a 2GHz link between the 85th floor of the Empire State building and a 9ft dish mounted at 180ft up the 250ft transmitting mast at Success Hill. Transmitter power was 1kW peak vision with 500W sound, the omnidirectional aerial providing a gain of 20dB. The results were found to be equal to or better than existing v.h.f. services, and following this experiment the FCC opened up u.h.f. for TV broadcasting, with channel allocations made in 1951/2.

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Video Tape Types and Characteristics

George Cole

The video tape market has come a long way since the time when all that was on offer to the consumer was standard-grade, ferric oxide tape. These days tape manufacturers offer a bewildering variety of tapes, using various materials including cobalt doped ferric oxide, chromium dioxide and pure metal particles. Furthermore there are numerous grades of tape within the ferric oxide group. Metal evaporated tape may yet appear on the domestic video tape market, and perhaps even 4mm tape.

Ferric Oxide Tape

A high-coercivity tape is required for video signal recording. Most video tape is made from gamma ferric oxide, which has a natural coercivity of around 400 Oersteds. This isn't a high enough value for successful video recording, so the coercivity is raised by doping the oxide particles with cobalt and reducing the particle size. The particles are acicular (needle shaped) and, in VHS standard-grade tape, are around 0·4 microns in size.

Most ferric oxide tape is made up of several layers – seven-layer tape is not unkown. The first layer (see Fig. 1) is the back coating, which is made from carbon and is about 1 micron in thickness. Its job is to reduce the static build up that attracts dust and degrades performance. Next comes the tape's "backbone", the polyester base film that supports the magnetic coating. This layer is around 13 microns thick and needs to be flexible, strong and non-elastic. The magnetic layer is an emulsion around 5 microns thick. It consists of a complex mix of ingredients comprising magnetic powder, binder, colouring pigment, anti-static agents, abrasive material (for head cleaning and good tape-to-head contact) and solvents. Every manufacturer has his own secret recipe, and you won't find many ingredients listed on the tape package!

Video recording makes heavy demands on the tape. In the VHS system for example the magnetic particles must be able to record wavelengths as short as 1·3 microns. The emulsion must be highly resistant to flaking, otherwise dropouts will occur. Head-to-tape contact must be good, but at the same time sticking must be avoided. And so it goes on. The performance of video tape depends on a large number of factors, including temperature, humidity and the condition of the deck's mechanics.

Using tape specifications to compare one manufacturer's tape with another's is not an accurate way of assessing performance. For one thing all tape manufacturers use their own reference tape as a yardstick for tape standards. There's no standard reference tape, and what's more the reference tapes are regularly upgraded. That's why you sometimes find that a new set of tapes appears to have a worse specification than the older ones they've replaced!

Table 1: UK video tape market shares

Type of tape	*Market share*
Standard VHS tape	87%
High-grade VHS tape	3%
VHS-C tape	1%
Standard Beta tape	8%
High-grade Beta tape	<0·5%
8mm tape	1%

Source: 3M/trade estimates

Tape Manufacture

Video tape manufacture is a demanding business. Most makers will tell you that production is part chemistry, part technology, part cookery – and part luck.

The various ingredients of the magnetic layer are mixed to form an emulsion which is spread on to a jumbo sized polyester base that runs along a conveyor belt system. The coated base next passes through an orientation magnet which aligns the metal particles in the same direction. This is followed by drying, after which the coating is polished to produce a smooth top surface. This smooth surface improves the tape-to-head contact and reduces the degrading effect known as modulation noise. With VHS tape the surface irregularities are limited to around 0·05 microns. The tape is finally slit into half-inch wide strips, tested and spooled into cassettes.

VHS Tape

Ferric oxide and chromium dioxide tapes are used with the VHS format. The ferric oxide tapes are available in a number of different grades.

The standard VHS grade is also sometimes called regular or normal grade tape (but never low grade!) and is by far the largest seller (see Table 1). Quality brand E180 tapes are now available for as little as £2·50. One welcome result of this is the virtual disappearance of dodgy brands which could produce poor picture quality, clogged VCR mechanics and head damage.

The VHS tape specification (see Table 2) was set over ten years ago. Since then, tape and head performance have far outstripped the original specification. The performance of JVC's current standard-grade tape is included for comparison – but remember the point made earlier about performance comparisons.

High-grade Tape

Although today's standard-grade tapes perform much better than older ones, various developments of the VHS system have led to a demand for higher specification tapes. VHS long-play operation increases the recording time by halving the video tracks to 24·5 microns. The system is very intolerant of tape dropouts. Depth multiplex recording is used for VHS hi-fi. This calls for a thick, even coating with improved audio response. Since the audio tracks are 40 per cent narrower than the video tracks, accurate tape tracking is essential. With the VHS HQ system the white clip level is

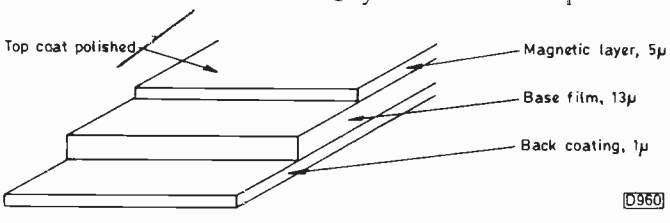


Fig. 1: The layers of a typical ferric oxide video tape.

raised from 160 to 200 per cent, so a better frequency response is required. As a result of these developments tape manufacturers have introduced all manner of tape grades including high grade, extra high grade, super high grade, ultra high grade, master grade, hi-fi grade, library grade and pro-grade.

Audio tapes conform to an IEC standard classification, but this does not apply to video tape. The International Tape Association (ITA) tried to set such a standard a couple of years ago but met with little success. Part of the problem is that while audio tapes are grouped according to the materials used for the coating, e.g. chrome, metal, etc., all these different video tape grades use ferric oxide. The problem is further compounded by the fact that when you test the tapes you can on some occasions find that there's no difference between a high-grade tape and its standard counterpart. Also, it's not unknown for standard-grade tape to out perform the high-grade type!

Early high-grade tapes were simply standard-grade tapes with a better than average dropout performance. Today's high-grade tapes incorporate a number of real improvements however. First, particle size is reduced to around 0·24 microns, which greatly improves the information packing density. The BET value is defined as the surface area covered by one gram of tape particles. With standard-grade VHS tape the BET value is around $30m^2/g$, which means that one gram of particles occupies $30m^2$ of space. High-grade tape has a BET value of between $40\text{-}50m^2/g$. This increases the coercivity to over 700 Oersteds, greatly improving the frequency response.

Many high-grade tapes have additional coatings and new formulations. For example, to achieve improved high-frequency response JVC's new pro-grade uses barium ferrite in addition to ferric oxide. The coating process is also more tightly controlled, so that whereas with standard-grade tapes the average number of dropouts is around 15-20 per minute with some high-grade tapes the dropout rate is as low as three per minute.

Overall, high-grade tapes have a higher f.m. output, better signal-to-noise ratio and lower modulation noise than standard-grade types (see Table 2). The cassette shells are also made to finer tolerances and the boxes are often more robust. They incorporate features such as anti-static treatment and magnetic protection.

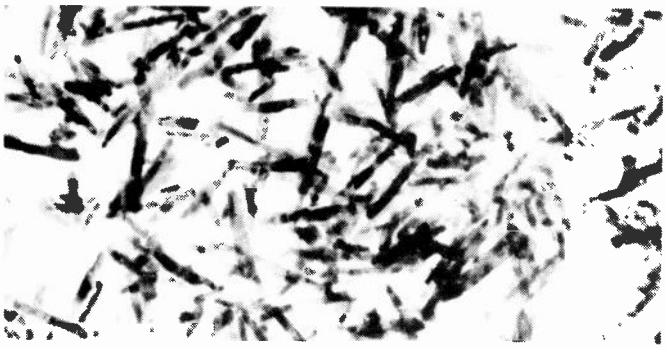
Tape manufacturers recommend the use of high-grade tape for long-play operation, hi-fi recording, archiving and recordings that are to be edited on to another tape. But, as Table 1 shows, the general public appears to be more interested in economy than performance.

S-VHS Tape

With the S-VHS system picture detail is greatly increased by shifting the f.m. carrier to 5·4-7MHz (deviation) as opposed to 3·8-4·8MHz. With the wider bandwidth that this makes possible, some of the higher frequencies have wavelengths as short as 0·8 microns. At these dimensions there's a danger of self-erasure, and to reduce this risk tape with a higher coercivity than that of high-grade tape is required.

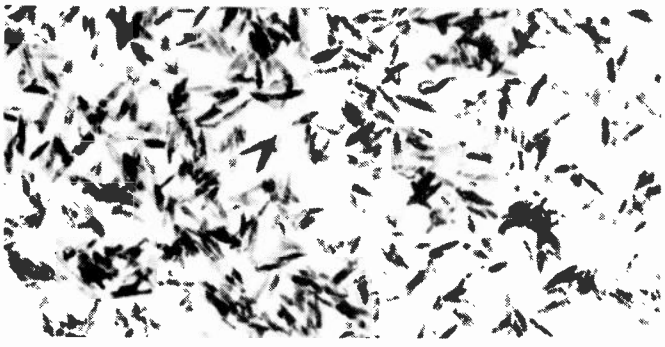
The use of high-coercivity metal tape was proposed when JVC first began research on S-VHS. Eventually JVC settled on a special grade of ferric oxide tape. The coercivity is raised to 900 Oersteds by reducing the particle size to just 0·18 microns, enabling the tape to record the higher frequencies.

To ensure that only S-VHS tape is used for S-VHS recording, the cassettes have an identification (ID) hole on the underside. If a VHS cassette is inserted the machine's S-VHS recording mode is rendered inoperative. VHS recordings can be made on S-VHS tape, and there has been some controversy as to whether ordinary VHS machines will be able to record and erase S-VHS tapes. JVC, 3M (Scotch), TDK and others have carried out extensive tests using blank S-VHS tape in old-style piano-key VHS machines, camcorders and hi-fi machines, using both the

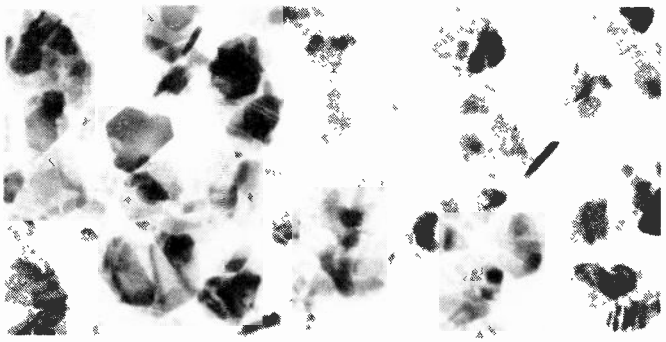


Standard-grade cobalt-modified gamma ferric oxide tape, with magnification of 30,000.

SHG cobalt-modified gamma ferric oxide tape, with magnification of 30,000.



S-VHS cobalt-modified gamma ferric oxide tape, with magnification of 30,000.



Tape using hexagonal barium ferrite particles for vertical recording. Magnification 100,000.

Table 2: VHS tape specifications

Characteristic	*Basic specification*	*Current JVC standard grade*	*JVC Pro-grade tape*	*Chromium dioxide tape*
F.M. output	−2dB	0·5dB	3·5dB	4dB
Chroma output	−2dB	0·5dB	2dB	—
Video s/n ratio	−2dB	1·1dB	3·2dB	0dB
Chroma s/n ratio	−2dB	1·7dB	3·9dB	0dB
Audio frequency response	±2dB	0·5dB	2dB	2dB
Coercivity	600 Oersteds	680 Oersteds	approx. 1,450 Oersteds	600 Oersteds

The remanence for chromium dioxide tape is quoted as 1,450 Gauss. There is no specification for the remanence of ferric oxide tape but the figure for most standard-grade tape is between 1,200 and 1,400 Gauss.

standard- and long-play modes where applicable. No erasure problems were encountered. 3M has gone as far as suggesting that S-VHS tape improves VHS picture quality subjectively. As S-VHS tape will cost between three and four times standard-grade tape however it's unlikely that many VHS users will be tempted into using it for day-to-day recordings.

Chromium Dioxide Tape

Chromium dioxide was first used in audio tapes. It initially found its way into video tape as an abrasive additive in the tape emulsion. BASF however markets a range of "chromdioxid" tapes in a variety of grades. To start with there was some controversy as to whether their use would accelerate head wear, but BASF claims that its chromium tapes actually increase head life. A tape life of over 500 passes (most ferric oxide tapes have a life of 100-300 passes) is quoted. Table 2 includes the specifications of a typical chromium dioxide tape, but for the reasons previously given comparisons with ferric oxide tapes are again difficult.

Metal Tape

Ferric oxide tape development has probably reached the end of the road with S-VHS. To record even shorter wavelengths than with S-VHS requires the use of tape with a higher coercivity, and that means metal tape.

Metal tape is widely used in professional formats such as the M11 and Betacam SP camcorder ones and for the D1 and D2 digital video recording systems. Domestic systems that use metal tape include the 8mm and Extended Definition (ED) Beta formats. It's also used with the Digital Audio Tape (DAT) system. Several VHS manufacturers, notably Matsushita (Panasonic) and Hitachi, have developed digital VHS recorders which make use of the high-density feature of metal tape, but such machines are unlikely to appear on the market for some time.

Metal tape has a far higher coercivity (typically 1,500 Oersteds) than ferric oxide tape and a much greater remanence value (some 2,500 Gauss), which means a far higher signal-to-noise ratio (around 10dB higher). The tape can record wavelengths as short as 0·3 microns. For a given area, metal tape offers four times as much storage capacity as ferric oxide tape.

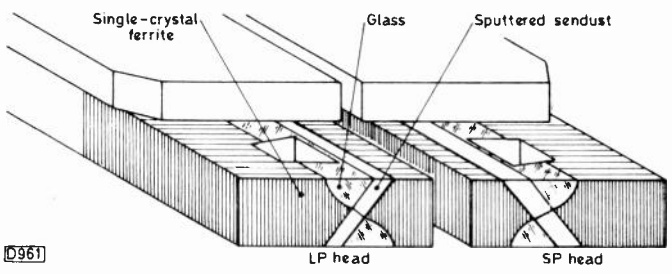


Fig. 2: Sputtered sendust heads for use with metal tape.

There are two types of metal tape, metal particle (MP) and metal evaporated (ME). In both cases the metal consists of an alloy of iron, nickel and cobalt.

MP tape is made in much the same way as ferric oxide tape, the base film being coated with the metal particles. The resulting tape has an overall thickness of around 13 microns – a 1 micron back coating, 9 micron base film and 3 micron metal coating. For increased playing time MP tape that's just 10 microns thick is also available.

One of the problems with MP tape is that the high coercivity and relative thickness of the metal coating mean that a high recording current is required. As a result there's a danger of the ferrite video heads saturating. To overcome this the ferrite heads are sputtered with an alloy of iron, aluminium and silicon called sendust (see Fig. 2). This greatly improves the recording characteristics.

ME tape is made by passing the base film through a vacuum chamber and heating the metal alloy with an electron beam until it boils. The metal vapour condenses on to the film, forming a very thin layer just 0·15 microns thick. Coercivity is much the same as with MP tape, but the thinness of ME tape gives much longer playing times. ME tape is expensive to produce however: all current formats that require metal tape use the MP type.

Video-8 Tape

The 8mm format has a low writing speed (just 3·12m/sec) and uses an audio-sized cassette. The system would not be possible without the use of high-density, high-coercivity metal tape. With the 8mm system wavelengths around 0·6 microns are recorded. Tapes that provide playing times of 15, 30 and 60 minutes are 13 microns thick while 90 minute tape is 10 microns thick. Technical problems have so far thwarted the introduction of 120 minute tape in the PAL markets.

The recently announced high-band 8mm format will use a special type of tape, but no details of this have been announced so far.

Developments

The ED Beta format has a carrier deviation of 6·8-9·3MHz and uses half-inch MP tape. Tape thickness is 19 microns – a 1 micron back coat, 15 micron base film and a 3 micron magnetic layer. Coercivity is 1,450 Oersteds and

remanence 2,500 Gauss. ED Beta tape cannot be used with standard Beta recorders.

Samsung has developed a video recording format that uses 4mm DAT tape. This is an MP type with similar remanence, coercivity and tape thickness to 8mm MP tape. The DAT cassette is about half the size of a conventional audio cassette. It offers great portability and a recording time of 80 minutes, nearly three times that of a VHS-C cassette. The system is unlikely to be launched without widespread industry support.

The next stage of development is likely to be a move away from tape with longitudinally orientated particles to vertical recording with the particles standing upright. This would greatly increase the recording density. JVC's work on vertical recording has resulted in the development of hexagonal barium ferrite particles – the accompanying photo gives an idea of the kind of particle shape this work is producing.

Acknowledgements

I would like to thank BASF, JVC, Maxell, Scotch, Sony and TDK for their help in providing information that has been used in this article.

Teletopics

SKY TELEVISION

Rupert Murdoch's News International has announced a major extension of its subsidiary Sky Television plc's satellite broadcasting interests. The company plans to start a four-channel satellite TV broadcasting service via the Astra satellite, which is due to be launched this November. A ten-year lease has been signed for three of Astra's transponders, which will be used for a general entertainment and arts channel, a news channel and a feature film channel. An option has been taken on a fourth transponder for a sports channel which would be a joint venture with a consortium of EBU members. The services will be uplinked by British Telecom and will be regulated by the Cable Authority. Transmissions are due to begin next February, following tests in December. The services will be free, supported by advertising, so there will be no question of scrambling. A 24-hour radio service will also be offered, with stereo sound quality, presenting non-stop music from compact discs. Sky Television will be operated from a new facilities centre in the UK: it will include news studios, transmission suites, post-production facilities and offices. The services will be known as Sky Channel, Sky News, Sky Movies and Sky Radio.

To coincide with the start of the new services Amstrad will be entering the satellite TV market with an Amstrad Fidelity branded 60cm dish and receiver package aimed at the mass market, with a £199 VAT inclusive price tag. This low price is helped by the fact that the transmissions will be to the PAL standard, with no scrambling or access control. The company is tooling up for production of up to 100,000 units a month, with deliveries scheduled to begin in the first quarter of 1989. Assembly is planned in the UK though certain key components will be sourced in the Far East. It's understood that an agreement has been reached with GEC-Marconi for the supply of one million LNBs. The basic model will be known as the SRX100, but there will be a series of models with extra features including a £259 unit with remote control. Distribution will be via the company's traditional High Street and independent outlets. Aerial contractors are expected to charge £40 or so for an installation.

SES, the Luxembourg company that owns the Astra satellite, has decided to order a second satellite which will be launched in 1990. This will provide a back-up for Astra and will increase the total channel capacity to 32.

Maxwell Communications, W.H. Smith and British Telecom have jointly announced their intention to start a satellite TV service with probably six channels. Either the Astra satellite or a second-generation, medium-power Eutelsat satellite will be used and the transmission standard will be D-MAC. The companies control or are major shareholders in the Premiere film channel, the Home Video Channel, Screensport, Lifestyle, MTV and Children's Channel. Direct-to-home transmissions are expected to begin early next year.

BROADCASTING CHANGES SUGGESTED

Several suggestions for major changes to the present UK broadcasting arrangements have been made recently. The Home Office is studying the idea of making BBC-2 and Ch. 4 available via satellite only in order to increase the number of national and regional channels, the aim being to give the viewer a wider choice and advertisers a better deal through increased competition between broadcasters. The government has stressed that the scheme is still at an exploratory stage, and that terrestrial BBC-2 and Ch. 4 transmissions would continue for a number of years. One suggestion would be to use the two spare transponders on the BSB satellite.

In a recent speech the Home Secretary Douglas Hurd called into question the traditional licence fee. He is reported to have commented that "as the viewer has more and more channels to choose from it will become less and less defensible that he should have to pay a compulsory licence fee to the BBC regardless of the extent to which he watches its programmes". It seems that the alternative would be a subscription scheme. The Home Secretary also questioned whether the role of the IBA in setting detailed schedules would in future be necessary, and put forward the suggestion that transmission and the provision of programmes should be separated.

MICROWAVE TV

GEC-Marconi has been advocating the use of microwave TV services in the UK. The firm estimates that 80-90 per cent of the population could be provided with up to 30 channels at a relatively modest cost – transmitters could cost as little as £30,000 and receivers less than £100. The 2·5GHz band would be used for such MMVD (multichannel microwave video distribution) services, with low-power transmitters each covering an area with a radius of 30km. A demonstration of the technique was given recently at the Chelmsford headquarters of Marconi Communications Systems. The firm points out that distribution of TV services via a microwave network would be a much cheaper solution than either cable or satellite systems.

TELEVOX

A new teletext-based service for advertising holidays, houses, jobs etc. has been introduced by McCallum Televox. Subscribers phone the Televox Centre at Cam-

bridge, where voice recognition equipment is used for identification. Pages of teletext can then be requested – there are at present 400 pages of advertising and the target is 4,500 pages by the end of the first year. The pages are transmitted by the IBA, using part of the Oracle space reserved for subscription services. There's an average delay of four seconds between page selection and the page appearing on the screen. A legal dispute between Televox and Oracle, which is at present being forced to transmit the pages, could bring the service to an end.

HIGH STREET CHANGES

Thorn EMI subsidiary MultiBroadcast is starting a retail chain which will trade under the name Value Vision. One of its main activities will be the sale of reconditioned ex-rental equipment. The first two shops are in Nottingham and Wolverhampton. Ten or so more outlets will be opened during the coming year, in the midlands and south. Servicing will be looked after by MultiBroadcast's service organisation, which is being expanded to take on contract work.

Woolworth's electrical subsidiary Comet has bought from Granada fifteen Connect outlets in Northern Ireland.

JOB LOSSES IN MANUFACTURING

Both Philips and Thomson have announced substantial staff cutbacks. Philips will be shedding 900 jobs at its Eindhoven consumer electronics division, the largest single reduction to be announced by the company in fifty years. Most of the cuts will be made next year. The move is part of an overall plan to cut 20,000 jobs and close at least 70 factories world-wide. Philips' aim is drastic cuts in production costs and more rapid product development from initial idea to market launch. The company has already shed over 4,000 jobs this year, mainly in the consumer electronics division. More redundancies could follow.

Thomson's newly formed Thomson Consumer Electronics subsidiary is expected to announce shortly plans for large-scale job reductions world-wide. The division has 40 plants in 17 countries and a workforce of over 50,000, including the GE-RCA operation in America.

1988 HAM EXAM

A Radio Amateurs' Examination course is to be held at Paddington College commencing at 6·30 p.m. on September 13th. Enrolments take place during the week commencing September 5th, between 1-4p.m. in the afternoon and 6-8p.m. in the evening, on the third floor of the college at Paddington Green, London W2 1NB. Because of ILEA economies this is likely to be the only ILEA sponsored RAE course to be held in the ILEA area during the academic year 1988-9. The Paddington course covers the City and Guilds RAE exam syllabus and also makes use of the College's facilities to enable students to carry out practical experiments in the electronic theory covered, the aim being to provide a grounding in electronics as well as an Amateur Radio licence. The course tutors are David Peace (G4KKM) and David Hunt (G6MFR). Further information can be obtained from the college on 01-402 6221 or David Peace on 01-892 7585.

END OF RTS

This year will be the first since the early fifties that does not see the publication of an annual volume of *Radio and Television Servicing*. In the early days the books were published by Newnes; for the last decade or so they have appeared under the Macdonald imprint. At one time your editor used to compile the TV section. There's good news however for those who still want a book of circuits etc. U-View TV Tubes of 29 Warmsworth Road, Doncaster, South Yorkshire DN4 0RP, which has been acting as a main distributor of these books, will this year be publishing its own *Television Circuit Book* – a quality hard-bound book in A4 size. No clock radios or record players, but more TV circuits. A *Video Circuit Book* is to follow. We understand that both books should be available by the end of the summer.

SPARES NOTES

Following the recent changes at Fidelity Radio, reported in this column last month, SEME Ltd. point out that these will not affect the spares situation. SEME will continue to fulfill Fidelity's obligations for the supply of spare parts, in particular the policy of maintaining supplies for major products for five years. The company will also continue to provide technical advice on spare parts. SEME Ltd. is located at Unit 2E, Saxby Road Industrial Estate, Melton Mowbray, Leicester LE13 1BS, telephone 0664 65392 or 66881.

HRS Electronics Ltd. has moved to Garretts Green Lane, Garretts Green, Birmingham B33 0UE. The new premises give the firm a five-fold increase in space, to 109,000 sq. ft. The new telephone numbers are: sales 021 789 7575; accounts 021 789 7676; general 021 789 7171. Note that this firm operates a trade only policy.

NEW CATALOGUE

The summer 1988 edition of the Cirkit constructors' catalogue is now available, featuring many new products in its 184 pages. Items featured for the first time amongst the 3,000 lines include a low-cost 10MHz oscilloscope, the Easiwire fast circuit prototyping system, an automatic nicad charger-cycler and two new hand-held scanning receivers. There are also additions to the components range, including scart and mains connectors, r.f.i. filters, ABS and 19in. rack cases and cyno adhesive. The catalogue costs £1·30 and is available from Cirkit Distribution Ltd., Park Lane, Broxbourne, Herts. EN10 7NQ, telephone 0992 444111 (sales desk) or 0992 441306 (other departments).

IN BRIEF

Sony has launched in Japan a video version of its Walkman. The combined display unit and tape deck is housed in a casing the size of a fat paperback and sells for around £550 . . . Agreement has been reached between European consumer electronics manufacturers and the EBU on the specification for the Eurocrypt satellite TV scrambling and conditional access system . . . Under proposals that have been added to the Copyright, Designs and Patent's Bill, users of VCRs will have to wipe out their recordings within 28 days. The aim is to stop viewers building up home video libraries. It's not certain how such a regulation could be enforced . . . The IBA's engineering division has completed the installation of replacement high-power u.h.f. transmitting equipment at Mendip, Somerset. It's the first station to be re-equipped in a major modernisation programme. All the original u.h.f. colour transmitters will be replaced over the next ten years. The new transmitters at Mendip use pulsed klystrons for high electrical efficiency and low maintenance, and will be capable of providing high-quality NICAM digital stereo sound. Stereo sound will be available in London and parts of the Yorkshire region from autumn 1989: the full ITV and Ch. 4 service will begin in 1990.

TV Fault Finding

Reports from Dave Dulson, W.H. Clarke, Hugh MacMullen, Philip Blundell, Eng. Tech., Roger Burchett, Nick Beer, Jim Rainey and J. Olijnyk

Amstrad CTV2200

There have been various comments on this set in recent issues. I've found that the main reason why it self-destructs at switch on or soon after, blowing Q501 (2SC3156), Q802 (2SD139B) and sometimes Q503 (2SA916), is dry-joints on the line driver transformer T801. They can also be responsible for reduced width at one side, sometimes intermittently. Also check the h.t. smoothing capacitor C520 (100μF) which works very close to its tolerance of 160V. If you don't have a 2SC3156 to hand a BU208A will work quite happily as a replacement. **D.D.**

Ferguson TX9 Chassis

The customer complained that faces were green, which is not acceptable even here in Ireland. On checking the grey scale everything seemed to be normal, so it was a case of straight into the colour decoder to look for the cause of the phase reversal. The chip (IC52) was changed first, with no luck. Balance control RV67 which has been known to cause this trouble, also the chroma delay line and the components in the ident circuit, were then tried. Still no luck. The voltages and waveforms all looked fine. With despair setting in I rang friend Snow, who is never stuck with Ferguson sets. "Have you checked the degaussing circuit?" he asked, "if not try it now." I'd spent a whole day trying to find the fault in the decoder, but three seconds with a degaussing coil cleared the green faces. The culprit was the posistor. **W.H.C.**

Some Quickies

Waltham W350: This set had reduced width when warm and sometimes failed to start when cold. Without being in any way intermittent, the line oscillator transformer could be removed by hand without the use of a soldering iron.
Philips K30 chassis: A noiseless raster was cured by changing the i.f. module, but this turned out to be a red herring. R1412 (12Ω) which smooths the 12·5V supply for the tuner and the i.f. module was intermittently open-circuit. When disturbed by changing the i.f. module it was o.k. for a while.
NordMende 4230: This 16in. colour set uses the same chassis as the **Ferguson Model 3878.** When the mains supply was applied via our variac we found that it wouldn't operate with an input of more than 150V. It took us a considerable time to discover that CA13 (0·47μF) which couples the drive to the line flyback thyristor was slightly leaky. **H.MacM.**

GEC C2000

This and other Tatung models that use the TDA4503 signal processing chip seem to give a crackling noise on sound during video search. The only cure found so far is to alter the value of R106 to give 3·7-4·2V at pin 28 of I101 when the AV position is selected. This usually calls for a resistor value in the range 150kΩ to 180kΩ. **P.B.**

Grundig CUC2401 Chassis

If you find that the sound mutes on playback of a prerecorded tape, check which type of ABL module is fitted. If it's type 29504-107-31, change it for a 29504-007-28 or disconnect the link from the TDA8185 chip to pin 9 of the ABL module. Removing the link disconnects the mute, so the self-seek tuning won't stop when a station is found etc. **P.B.**

Finlux 9000 Series

You sometimes get failure to start from cold with these sets, especially in cold weather. We've come across two causes of this trouble. Either Ru17 (270kΩ) has been intermittent or Cu6 has dried up. **P.B.**

Grundig CUC2600 Chassis

I've had this fault on two occasions now. From cold the set gives either a blank raster or snow on the screen, with no sound. The slightest movement of the chassis will cure the fault for days. On both occasions tuner replacement has provided a permanent cure. **P.B.**

Amstrad CTV1400

These sets are very prone to developing dry-joints on one or all of the line driver transformer's pins (T701). If the owner doesn't bother to do anything about the resultant intermittent faults (they very seldom do) the first thing the service engineer knows about it is when he's presented with a set with a dead line output transistor (Q705). The original is a 2SD904 but Amstrad now supply a 2SD822. Incidentally, take circuit details on the panel and in the service manual with a pinch of salt. The LA7800 sync/timebase generator chip IC701 has pin 8 marked correctly on the underside of the panel but pin 16 is marked pin 1. In the manual the voltage at pin 12 of this chip is shown as 1·2V instead of 12·2V.

Q705's collector connection to the print is via a stud that's soldered in. This is not very reliable. An extra lead from the connecting nut through one of the convenient holes in the board to the print land is a good idea.

In my experience these sets benefit from having the board cleaned up and coated with circuit varnish. **R.B.**

Rank T20/22 etc Series

This one should appeal to those who, like me, delight in minimal cost repairs. The ultrasonic remote control handset used with these sets has a phosphor-bronze leaf spring that not only returns the switch to the off position but gives an audible click when doing so. After a number of years the spring fractures. There are several ways to restore operation without the click, but if you wish to retain this feature

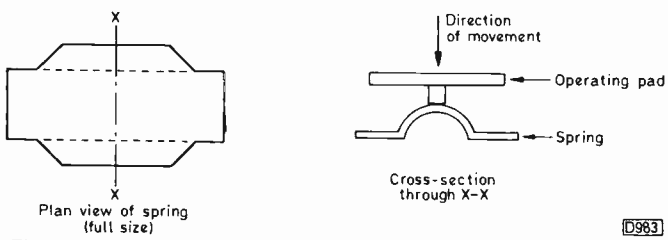


Fig. 1: Making a replacement leaf spring for the remote control handset used with the Rank T20/22 series chassis.

you either need a new spring (if you can obtain one) or you must improvise. If you don't have phosphor-bronze of the right flexibility, here's a free source of substitute material: cut up a drinks can! These are made of spun aluminium which is already work hardened. Cut out the required shape (see Fig. 1) and hammer it over a suitable rod or tube to get the spring to rest in the off position. The spring doesn't have any electrical function – this is taken care of by separate fingers. Only time will tell how long this repair lasts, but it takes just a few minutes to do and must be a cost-effective solution. **R.B.**

Ferguson TX90 Chassis

The fuseholder for FS102, the secondary fuse on top of the mains transformer, tends to overheat and cause intermittent operation. It's of the type with a Paxolin base, and you'll find this scorched. As this is the fuse that blows when the mains rectifier diodes short — often intermittently — the problem could be due to regular fuse changing before the fault is tackled properly, i.e. change all four diodes to type BYD33G. The fuse has been uprated from T1A to T1·6A. **R.B.**

Decca/Tatung 145 Series Chassis

For chopper transistor failure in this chassis check R808 (100kΩ) and R810 (82kΩ). **R.B.**

Ferguson TX9 Chassis (PC1001 Panel)

If the BZX79C4V7 zener diode W54 goes open-circuit the result is flyback lines at the bottom of the screen, increasing in size over the bottom third. The lines are always green – perhaps someone can explain why? W54 is the blanking input clamp diode at pin 2 of the μPC1365C colour decoder chip IC52. **R.B.**

Thorn 3500 Chassis

One of these elderly sets began to eat chopper transistors, always when no one was watching it. The only fault I could find in the power supply was a suspect joint at one end of the 30V line fuseholder. Flexing the board quite hard in a darkened room enabled me to see a spark. I'd previously seen the picture fluttering, and tapping the panel had caused line collapse, but the joints all looked reasonable. Going over all possible bad joints in the area seems to have put matters right. **R.B.**

Salora 1F3

In the June issue John L. Howard mentioned condensation as a cause of field slip from cold in these sets. What often happens is that condensation on the tripler causes tracking which in turn upsets the field sync. **N.B.**

Bang and Olufsen 4402 (35XX Series)

The width varied intermittently, accompanied by a nasty crack of e.h.t. followed by line collapse. A dirty connection on the scan coil plug, at the coil end, was responsible. It had started to arc and burn the plastic plug casing. **N.B.**

Panasonic TC2061 (U5 Chassis)

This set was reluctant to change channels. When it did there was bad picture distortion (lines) for five-ten seconds, and when tuning the set wouldn't lock to the optimum point. The fault was not affected by temperature changes or time. A check on IC171 (SAB3035) and the connections to the associated crystal X171 seemed appropriate steps. We've had several cases where poor joints on X171 have caused misoperation of IC171. In this case replacing the chip restored correct operation. **N.B.**

Panasonic TC2205 (U2 Chassis)

Stuck on standby is a fairly common fault with these sets. I dived for the chopper power supply rectifier diodes D852/3 etc., the usual cause, but they were all intact. After much time spent checking around I decided to replace the line driver transistor Q501. This restored a bit of life but the trouble was by no means cured. In the end I came to the conclusion that the line output transformer was probably faulty, something that's virtually unknown in Panasonic sets. Fitting a replacement cured the trouble. **N.B.**

Panasonic TC381G

After thirty seconds the picture would flare up bright green and the set would then trip. The cause of the trouble was traced to a grid-cathode short in the 320BTB22 tube. This is an expensive item to replace, so I played around with my newly acquired B and K 467 tube restorer and cleared out the short, thereby saving an otherwise first class set. **N.B.**

More Quickies

Sanyo CTP7130/1/2: If the line output transistor fails at switch on or some time later check for a dry-joint on the heatsink support tag. Resoldering provides a cure.

Thorn 1615 chassis: For reduced field scan check whether the HT2 rectifer diode W34, type BY210-600, is open-circuit.

Grundig CUC70 chassis (Model C7400): We've had a couple of faults recently with these sets. Field collapse was due to D353 being short-circuit – the 26V +D supply was missing. A white raster with high first anode voltage occurs when R723 goes high-resistance or open-circuit.

Grundig CUC41 chassis (Model C2112): For intermittent mains fuse failure replace D657 (MZD160). **J.R.**

Triumph CTV8520

The fault report said "crackles" and it turned out that the tripler was duff. I hadn't got one so, after moving a few components to the copper side of the board, a universal tripler was fitted. These sets have an unusual focus arrangement, built into the tripler, so I left the focus lead off. When I switched on there was e.h.t., closely followed by an out-of-focus picture. So far so good! Numerous focus units were then tried. The one that eventually worked was for the Thorn 9000 chassis. I fixed it on to the plastic chassis and gave the set a long soak test. It's since gone back to the customer and there have been no complaints to date. **J.O.**

Hitachi CPT2064

This set came in dead, with fuse F901 blown. We found that IC901 (STR440) and Q781 (2SD898B) were both short-circuit. Everything seemed to be all right when these items were replaced but the set was back with us next day, the complaint this time being that the set couldn't be operated by remote control. The handset was working so we replaced the M58485P chip IC3003. This restored normal operation. **J.O.**

The Importance of VCR Back Tension

Nick Beer

Back tension in a VCR is the reverse force encountered by the tape when threaded up. My reason for writing this short article on the subject is to help engineers who may be nagged by odd intermittent deck faults in playback/record or encounter machines with a tendency to premature head wear. The importance of correct back tension seems to be either unknown or ignored. It's amazing how many workshops that have a fairly large throughput of VCRs don't possess any method of back tension measurement.

Back tension is provided by braking (the soft brake band) on the supply reel and the back-tension lever, see Fig. 1. Usually one or other of these can be adjusted to obtain correct back tension.

Without back tension there would be no control over the tape as it passes the entry guide to go round the head drum, i.e. the tape would be slack, not taught as it should be. The tape would therefore loop into the mechanism and the picture would be severely impaired – in fact the machine would be unusable.

Incorrect Back Tension

Very low back tension is not a common problem except in the Mitsubishi Model HS303 where the back-tension lever has a tendency to stick in its rest position, usually giving the impression that one of the heads has failed (back tension is still partially present due to the effect of the soft brake).

Slightly low back tension usually means that the tape snatches or loops as it passes the back-tension lever, particularly in the forward search mode and just after completion of threading.

Excessive back tension is by far the most common condition. Unfortunately it often goes unnoticed because the machine has come in for some other reason, for example a worn head, though excessive back tension is very often the underlying cause of the trouble. The reason for excessive head wear is that the back tension opposes the take-up torque. It therefore directly affects the pressure exerted by the tape on the head drum, by determining how tightly the tape is wrapped round the drum. Thus constant operation with too much back tension will lead to premature head failure.

Some Panasonic machines provide good examples of this

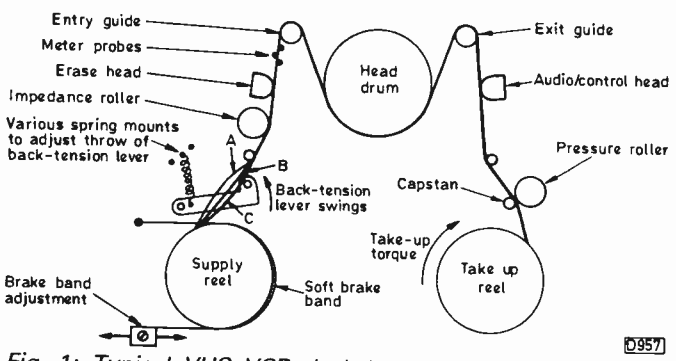


Fig. 1: Typical VHS VCR deck layout, showing the main mechanical components and the point at which to check the back tension when using a Tentelometer. A shows correct back tension, B low back tension and C very low back tension (the tape would unravel round the drum). The usual problem is excessive back tension.

sort of thing. When head wear is mentioned the NV730 springs to mind. This is a two-speed machine with super still, so the heads are pricey – about £75 retail plus VAT for a new drum, though MCES now do excellent rebuilds. A high proportion of these machines have had to have new heads after eighteen months to two years' use. Some are coming in for head replacement yet again. In most cases a check on the back tension would have showed the basic cause. I'm not saying that incorrect back tension is in every case the cause, but the machines I've adjusted haven't been back.

In older Panasonic VCRs back tension is generally 25-30g, but with most of the NV730s I've had in it has been between 50g and 60g! Only the other day one came in with duff heads. The customer said he knew it was the heads because he had had the same trouble 12-18 months previously. Someone else had fitted a new drum and when I measured the back tension I found that it was 56g.

Staying with the Panasonic range, I've had head failure with a number of NV-G21s and NV-G25s – under guarantee of course. In all but two cases the back tension was over 45g. With these machines it should be 20-25g!

I must apologise to Panasonic for keeping on about their machines, but they do provide good, well-known examples of the problem – other manufacturers are guilty of inaccurate setting up at the factory.

Measuring Back Tension

Having made the case for checking the back tension, how do you measure it? We use the Panasonic Tentelometer (see Fig. 2). It's a hand-held meter with three probes through which the tape runs, as shown in the accompanying diagrams. It comes with a calibration weight and instructions and is a superb device for the purpose. Place the three probes around the tape, as shown, at a point between the erase head and the entry guide. Take measurements with an E120 cassette, approximately half way through, ensuring that the meter's probes are kept vertical with respect to the tape. The device works by calculating the tension as the amount of force the tape applies to the middle probe and this probe's movement with respect to the other two probes.

There are cassette type meters like the type you use for fast forward/rewind and take-up torque measurement. An example that's as good as any is available from Willow Vale under part no. 20-998A – it's a Thorn unit. Use is by playing the tape as usual and reading off the scale.

Adjustment

Back tension adjustment is carried out by one or other of the following methods – the service manual will tell you what to do:

(1) Adjustment of the supply reel soft brake tension.
(2) Adjustment of the landing position of the back-tension lever, by increasing or decreasing the actuating spring pressure for correct tension.
(3) As (2) but using a jig with marked graduations and ensuring that the lever falls within a specified area – there is no need for a tension measuring device in this case, which applies for example with some Sanyo models.

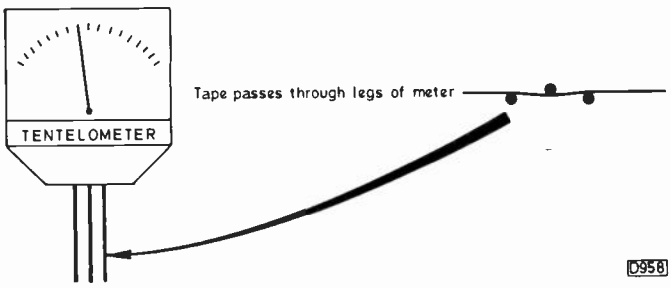


Fig. 2: The Panasonic Tentelometer and its use.

I hope I've said enough to stress the importance of back tension, and that you'll accordingly check this point. The price of a meter or a cassette meter will soon be recouped, especially if you care for a number of rental machines.

The Blaze

Les Lawry-Johns

A red Consul drew up outside. Its driver came in to collect his set which, on investigation, had turned out to be not worth repairing. He carried the set out, put it in the car, closed the boot and got in behind the driving wheel. His wife and two children were with him. I heard him trying to start the car, but it didn't want to know. Next thing I knew they were all coming into the shop. "Call the fire brigade, my car's on fire!"

So I dialled 999. When I got through to the fire people I told them there was a car on fire outside my shop and they promised to be there in a moment. As I turned from the the phone I saw Phil, who comes in on Saturdays, struggling with the shop fire extinguisher. I took it from him, whipped out the wire and went out to the car. Flames were coming from under the bonnet. So I bashed the top of the extinguisher and directed the spout up near a front wheel. The extinguisher gushed out a white cloud, and at that moment the car's starter started up. After a few more moments the white cloud stopped gushing and the flames were out – there was still a lot of somke, but the fire was dying down. H.B. shouted at me to get away from the car – she was leaning out of an upstairs window and thought it was about to blow up. It wasn't.

Just then the fire brigade arrived, along with a police car. The firemen lifted the car's bonnet and looked at the mess inside. It was a mess. I recognised the policemen as he got out of his car. It was Bill Bevan, whose wife is expecting. He took the car driver's name and address, and the number of the car. He suggested that when I got the bill for refuelling the extinguisher I should send it to the car's owner who would present it to his insurance company. When I got the estimate it was for eighty pounds plus VAT. I wrote to the address Bill gave me, but haven't had a reply. Oh well! And what did the local rag say next week? "Fire brigade puts out car fire." Thanks a million!

The Fidelity ZX2000 Chassis

I've serviced hundreds of Fidelity TV sets. In the earlier ZX2000 chassis failure of the line output transformer is the usual cause of R901 in the supply to the line output stage being burnt out. Normally you replace the transformer with the later type from the ZX3000 chassis, fitting the adaptor base, remove the focus and first anode controls as these are built into the new transformer, replace the resistor and everything works fine.

The last one I did this to came back a few days later. This time I found that the chopper transistor and the chopper circuit efficiency diode D24 (RGP15J) had failed. I must confess that the diagnosis and repair were not as straightforward as this account suggests – my muddled head is going to get me into some trouble soon.

How's This for Service?

Phil dropped in during the week to see if I had an SN76532N for an ITT VC300 monochrome portable he was repairing. I looked here, there and everywhere but couldn't find one. He left and enquired around the town but didn't have any luck. Someone told him that Gosling Electronics would have one, but they are in south London, some twenty miles away.

Not to be deterred, Phil jumped into his car and sped off there – after checking by phone to ensure that they had one. He found the shop, but the chip was in the outside engineer's van. Gosling drew a diagram to show where his calls were and Phil once more set off on the chase. First here, then there and eventually, would you believe it, Phil caught up with him. The engineer had the chip and let Phil have it (too cheaply I thought). When Phil got back and fitted the SN76532N sync was restored. You think you go to a lot of trouble to please your customers!

Two Old Dears

These old dears brought their white Ferguson 3848 (1690 chassis) along in a black dustbin bag. As I got it out they told me there was no sound or vision. While they nattered away I whiped the back off, releasing the aerial etc. panel for easier access. When I switched the set on there was slight sound and the tube's heater was dim. On removing the e.h.t. cap the set showed more life.

I switched the set off and clipped the e.h.t. lead. The right sort of e.h.t. diode wasn't in stock – the only one I could find was the little white Thorn 8000 chassis type. I screwed this on to the line output transformer's screen, then connected the line output transformer to it – after removing the new unit's stud and carefully insulating the connection. When the e.h.t. cap was connected to the tube the set sprang to life, with a good picture and full sound. I know I should have replaced the complete overwinding, but it wasn't necessary. Meanwhile the ladies were still nattering away as I replaced the cabinet etc. I heard one of them say "makes you wonder what it's all for".

"Don't you know?" I asked.

"No I don't" one of them replied.

So I explained to them what life is all about.

"When you're young you get a partner, then a child whom you bring up as best you can. When it has repeated the process it's time for you to go to make room for the newcomer. That's all there is to it, whether you like it or not. No point in belly aching about it."

They looked at me as though I was mad.

"I don't think much of that view of life – when will the set be ready?"

"It's ready right now and the charge is ten quid."

They paid up and departed, still thinking they were important, as we tend to do. When will we learn? From the red salmon for example, which dies after spawning. But why do some spirits survive – like the soldiers under the local fort. They keep on appearing, though their boss General Gordon never does. . .

Letters

SELLING PARTS TO THE PUBLIC

How interesting to read the letter (Sharp Spares, June) from a spares wholesaler on selling parts to the general public. Our firm is situated near a large electronics design and development facility, consequently we know what we speak about. Judging by some of the clear-ups we've had to perform, most qualified electronics engineers are incapable of carrying out simple TV and video repairs. I'm a qualified electronics engineer myself, but I chose to leave the industrial side because I found consumer electronics more challenging. From my experience in industry, I can say that many of my contemporaries there readily recognise that their skills are different from those required in the servicing profession. Not superior skills, but different ones.

More importantly, the wholesaler has not considered the practicalities of dealing with a customer of this type. He comes into service reception and says he wants say car audio spares. Has he got the part numbers? No. Has he got the manual? No. Call an engineer to discuss his requirements and add the cost of his time to that of the receptionist. Wade through the spares list and try to identify the spares by name alone. Remember that if you order the wrong ones the wholesaler won't give you a refund. Total the order. Find it incurs a small-order charge as well as a hefty post and packing charge.

Phone customer (more receptionist time) to tell him that the cost of processing his order on time and a 30 per cent mark up is more than £30 and see what he says. Charge him trade price for parts plus 30 per cent. Big deal, less than £5 profit which won't even cover the surcharge and postage, let alone staff time. What a cheek this wholesaler has! We're in business to earn a living as service engineers, not to act as wholesalers' middle men. If he wants this sort of trade he's welcome to it. Just a minute, the qualified electronics engineer has just come in again. He says one of the parts we supplied doesn't fit . . .

Jon D. Woodward, Proprietor, Technovision, Wookey, Wells, Somerset.

THE FULLY QUALIFIED ENGINEER PROBLEM

I have often come across letters complaining about the much-maligned retailer. The one from Willow Vale (Sharp Spares, June) is no exception. I'm not one of those Stevenage dealers, but if the "fully qualified engineer" had called at my shop he may have found me as equally unhelpful with regard to the sale of spare parts. You see, the problem of selling spares to an unknown visitor is fraught with problems. First I have to assess the reliability, ability, knowledge and common sense of the individual. We harassed, self-employed service engineers are at the sharp (no pun intended) end of life in general. We are squeezed between the massive general public, whom we try to please and who in turn patronise us, and its backing from such entities as the local consumer services, television and radio consumer programmes and various other organisations set up to help Joe Public, and on the other hand the suppliers of stock, parts and equipment, some of whom are helpful and some decidedly unhelpful, also the various government organisations that have been set up to remove our profits and the sometimes arbitrary controls, regulations etc. they see fit to impose. It amazes me how many truly independent shops remain in business, whether they deal with electronics or other goods.

Back to that stranger who wants us to order spares for him. Does he know what he's talking about? I'm not certain that I could myself name each and every item, component, assembly etc. in every piece of equipment that comes across the counter of my shop! I'm not so sure that the manufacturers of the equipment could do so either. The same item is often given a different name by different manufacturers, hence the plethora of computerised part numbers. If the wrong part is ordered I have to repack and return it.

Next, is the customer going to fit the part correctly? If he doesn't and the item is damaged the customer is likely to bring it back and say that it was faulty, demanding a replacement or his money back. This can be a particularly difficult problem as in many cases the item concerned may well have been faulty, a fact that's not always obvious on physical inspection, for example a defective i.c. Then what if the customer's diagnosis was wrong, something that happens to the best of us at times? He may well find that he doesn't need the part, bring it back and demand a refund – especially if it's an obscure item that one is never likely to need to use, and is now of suspect quality! Finally, and possibly with far-reaching consequences, what would my position be if in the process of fitting his spare part the customer injured himself? Could I be held liable for encouraging him to dabble with something dangerous, say an e.h.t. tripler?

As you can see, selling spare parts is often not worth the candle, especially as one sometimes makes only a few coppers out of the deal!

One of the many things I've learnt in this trade is to beware of the so-called expert. I've discovered that the more qualified and the more a customer proclaims to know the less he seems to be able to actually do the job! The local hobbyist on the other hand is usually far more practical, enjoys what he does and is generally all the more interesting to deal with.

A final point. It may take quite a time to establish what's wanted, then one has to look up the catalogues (even Willow Vale don't stock everything!) and ring up to find whether it's in stock, if so how much and not to forget to add the processing charge, the packing charge, the postage charge and of course VAT. Say I double the final sum and charge the customer accordingly, I'm not exactly going to be able to buy the baby a new pair of shoes! But if I were to take on the complete job and fit the item myself, then of course I would be much more interested: I would earn considerably more money in as much time as it has taken me just to order the required part! If Willow Vale feel piqued at producing such a costly catalogue, why don't they advertise in the press and deal direct with the public? I somehow feel that the reason is the points made above.

Adrian Irwin, Waltham Forest, London E17.

A SHARP DEALER REPLIES

In reply to Brian Tuckfield's letter (Sharp Spares, June) we, being in the service trade, have had several instances of so-called fully qualified electronics design engineers asking us to order parts. Invariably they ask for the wrong parts and we get lumbered with them. If we send them back to Willow Vale we are charged a 50 per cent restocking charge! If we complete the repair ourselves however we know that the work will be carried out to our mutual satisfaction.

In conclusion I'd like to ask three questions, bearing in mind that Willow Vale is "dealer bashing". (1) Is it policy to supply direct to the public? (2) Had they proof that the customer did approach a Sharp stockist? (3) Did the customer show his diploma?
Sharp Dealer, North Devon.

SERVICE COSTING

Brian Tuckfield of Willow Vale has written two letters recently attacking the service trade. In the first he criticised engineers for not being aware of what is available from his company. Have you tried to get a WVE catalogue?! We've been trying for at least eighteen months and have been told it's still being printed. On our last attempt the young lady, embarrassed at having to use the same excuse, suggested that it was being done by Mr. Caxton himself. It's also worth saying that parts lists are infuriating things to have to plod through: a well indexed catalogue giving say a section on reel motors with the total list of makes and models available would be much more helpful.

The second letter concerned Sharp spare parts. A recent costing of ours might indicate the type of problems faced by retailers and service departments. Initial customer enquiry (five minutes) followed by seven abortive attempts to phone WVE (six minutes), cost so far £2·74. Placement of order and stock availability check (3½ minutes), labour 87p, phone 51p plus VAT. Cost of part £3·50 plus VAT. Small-order surcharge £2·25 plus VAT. Total cost to ourselves £10·80.

Even if we added a mark up of 100 per cent on the cost of the part we wouldn't cover our costs let alone make a profit. The only way Brian Tuckfield's firm makes a profit on these small orders is to charge a small-order handling charge. Now according to the latest price information received from WVE (July 1986) we should have charged the customer £3·96 including VAT, which produces a nice loss on the transaction of £6·84. No wonder the Stevenage dealers didn't want to know. Like WVE, they would like to stay in business. We in the trade are used to these unfortunate small-order charges, but I would like to know what reaction Brian Tuckfield would expect from a member of the public who was told that his part should cost £3·96 but that a 250 per cent handling charge was necessary to give the retailer a very small profit.

We find WVE to be generally a useful supplier, though a better catalogue would help us both and I suspect many others. Also less knocking would be mutually beneficial.
L. J. Pitts,
Buckfastleigh, Devon.

COST OF REPAIRS

Two recent letters prompt me to write to you. First Bryan Magrath of Mastercare (May) seems to be happy charging £10 for a TV service manual. I also paid £10 for a Triumph colour TV service manual which consisted of eight pages of photocopies and a double page with the circuit. Photocopies normally cost 10p retail, so I assume that the manual would cost say 50p at trade prices. Adding about £2 for handling and 50p postage still leaves a handsome profit!

This brings me to Brian Tuckfield's letter in the June issue. He seems to imply that service departments have a moral duty to repair any equipment. Although I don't know the cost of the belts and wheels he mentions, the charge for handling them would be £2·50. The cost of a long-distance telephone call has to be added, and if we add a further £1 or £2 profit for the dealer the customer would end up with a bill of say £7 or £8. There's no guarantee that he would pay that amount for a few rubber belts and wheels. In many cases they don't consider it worthwhile and there is then no way in which the dealer can get his money back. He's stuck with the spare parts, all for the sake of £1-£2 profit.

If Mastercare doesn't find it viable to supply a photocopied service manual for less than £10, and Willow Vale charge £2·50 whether they supply a belt or £100 worth of spares, most dealers won't find it worthwhile selling small parts for a petty profit, let alone repairing that particular cassette player. The cost of repair in this case might be £20, which the customer might considere scandalous. Perhaps if suppliers reduced their handling charges for small orders it would be viable for the dealer and customer alike to have such equipment repaired. It would be very helpful if suppliers undertook field research, got to know their dealers better and found out why they don't bother about small repairs.

It seems that, with the cost of manuals and spares today, more and more dealers are turning away small, unprofitable jobs. I hear lots of customers complaining about not being able to find anyone willing to repair some brands of equipment sold by the large chain stores. The more shops that do so and stick with brands that provide good backing at sensible prices, the sooner the public will be educated into spending a few pounds more for good equipment. It's been said many times before in these pages!
C. Deus,
King's Lynne, Norfolk.

LACK OF HELP

I must agree with Mr. Barnes-Wallis's remarks (July). We all need help at some time or other, but in many cases the manufacturer/importer is most reluctant to give the information required. Blank refusals of help have come from both Sony and Grundig because I'm not an account holder, though I've bought replacement parts for their models over the years from wholesalers.

One fault that comes to mind concerned a Sony SLF1UB VCR. The problem was tape snatching, and it cost me dear. Not being familiar with the Betamax lace-up I misread the symptoms and deduced that the trouble was in the reel motor/servo control loop. Waveform checks seemed to confirm this deduction, but chip changing made no difference. At this point I suspected the reel motors, so a phone call was made to Sony to confirm the diagnosis and price the unit. Advice was refused, leaving me with a problem. I bought the reel motor PCB (expensive) but it didn't help. Your service bureau supplied the cure - shiny heads, creating a vacuum so that the tape sticks to them, now a common problem. Easy when you know, but I've ended up with a surplus reel motor PCB.

Only companies with a large throughput of equipment for repair seem to be able to acquire such information. A single engineer on his own, however good and well equipped with test gear, can never obtain it.

I've recently written to two companies asking for information on intermittent loss of colour when using a BBC or Amstrad/Sinclair Plus Two computer with Triumph CTV8209 series TV sets and their badge engineered counterparts, but have had no help. Can anyone assist?

Giving credit where it's due, a call to GEC Glasgow some years ago provided the answer to a problem I'd not have solved without completely rebuilding the power

supply. That help was welcome indeed.

Service manuals are another problem. Granted they cost money to produce, but without them service engineers cannot maintain equipment in a way that reflects manufacturers' standards and reputation.

Ray Crockit, Eng. Tech., Television and Video Services, Anglezarke, Thrumster, Wick, Caithness KW1 5TX. Telephone 095 585 214.

ORACLE PUZZLE

Could any reader tell me what's going on with HTV teletext? For some months HTV page 777 has consisted of a continuously-changing display of jumbled numbers and figures, but now there's an intermittent flash of a text page. I've recorded this with a camera and on playing it back with pause I find that the page heading has "Televox" or "Myrzad". It appears to be a computer service of some sort. Any ideas would be welcome.

Chris Plaice,
DER, Swansea.

FS TUBE SETS

I feel I must reply to the reader who complained about a Toshiba FST model. I've been a retailer/service engineer dealing with Toshiba sets since 1973, and have taken delivery of FST models since 1984. The quality of the convergence, grey scale, purity and focus has been excellent with all models. I demonstrate the conventional tube 222T series alongside the FST 212T series and customers all comment on the superb results with these models. I would be interested to know which model your reader has, and would be only too pleased to sort out the problems. Toshiba offer a two year parts and labour guarantee, and to date I've had only very minor problems such as the odd tuner etc. despite having sold a large number of sets. All customers – and they are the best judge – are delighted with the product.

John Wakely,
Colliers Wood, London SW19.

With reference to Colin McCormick's complaint (June) about the convergence/focus/purity/grey scale with sets that have FS tubes, we've had a Sony set with convergence errors and an Hitachi set with convergence/purity/focus errors, but these have been the only two sets out of thousands. A check in the showrooms under the right conditions suggests that FS tubes are very good. Some of us, I suppose, are just unlucky.

Paul C. Rowe,
Camborne, Cornwall.

LOW PRICES

I can only assume that whoever wrote your July leader is either a major shareholder in Amstrad or has never had to try to earn a living in the TV service industry. Manufacturers seem to have a kamikaze obsession with cutting each other's throats, and expect the dealers and service engineers to join them.

In the coronation year, 1953, a 9in. monochrome set that received a single channel cost approximately £100. Today, in spite of years of inflation and technological advances that have added many features, a colour TV set which can receive at least four channels can cost as little as £140 - a little extra secures remote control, a larger screen size, teletext, etc. Not content with this, the manufacturers now supply household goods, free licence stamps and five-year guarantees with their give-away sets. To be fair, they do pay the dealer the princely sum of £8 for a major repair under guarantee. These prices have created a "throw it away" age, and it's little wonder that the service industry is suffering in the way it is.

As you say, Amstrad assemble some equipment in this country, from imported parts. I suggest that this is in effect dumping from the UK instead of the Far East. Alan Sugar has made for himself and his shareholders a great deal of money, but he's not doing the TV trade or the service industry any good at all, and neither he nor your editorial can expect any applause from me.

R. A. Holmes,
Enfield, Middlesex.

Editor's note: The editor does not hold shares in Amstrad or any other consumer electronics company, and has never done so.

WYLEX MAINS PLUGS

I read Brian Renforth's letter (June) on Wylex mains plugs with interest. These plugs and sockets, and variants, are still widely used in the Manchester area. In fact the Wylex company is only a few miles away from here, at Wythenshawe, South Manchester.

In addition to the normal 5A and 13A types there was a variation with offset live and neutral pins, also a 13A plug that allowed a 5A one to be plugged in piggy-back style. There must be thousands still in use, judging from the number of homes in which I've encountered them. Every so often a bag of plugs and adaptors appears for sale in the under £50 domestic sales adverts in the *Manchester Evening News*. I understand they are rapidly disposed of!

Roderick Ballardie,
Timperley, Cheshire.

NOISY HITACHI VT63/64

Keith Pemberton (July) mentioned the use of Hita-sol grease to cure a noisy Hitachi VT64 VCR. A permanent cure for this problem is to fit the flywheel holder used in the earlier VT33. This has a nylon bearing that requires no lubrication. GEC also issued a technical bulletin for Model V4005H (March 1986) explaining in detail how to overcome this problem. The GEC part number for the flywheel holder is V7386832.

Don McDonald,
Bargoed, Mid-Glamorgan.

MISCELLANY

A couple of points relating to my article on the Decca 80/100 series chassis (June) should perhaps be clarified. First the section on power supply faults rather suggests that R801, the 6·8Ω section of the dropper, is on the power supply PCB. It isn't, of course. Replace it for intermittent fuse blowing or bridge rectifier faults if all else fails. Secondly, in nine times out of ten you'll find that the field output transistors in the 100 chassis are BD707s rather than BD278As. Common spares such as tuners, button units, volume controls, triplers, LOPTs and smoothing capacitors are available from Willow Vale, HRS etc.

In connection with my report on the Panasonic NV-G25B in the same issue (page 605), Panasonic do provide details on setting up the mechanics, including the mode switch, in a separate G Mechanism manual which we'd not received at the time of writing. The manual has some errors

however, so my notes may still be helpful – but note that the pip is about 100° clockwise from the slots in the mode switch, not 180° as shown in Fig. 2.

I'd like to applaud Brian Tuckfield's concern (letters, same issue) and interest in the matter of the customer from Stevenage. If I was one of those "dealers" I would be thoroughly ashamed of myself. Here we are trying to uphold and improve the image of the trade and these dealers let us down badly. We are trying to root out the cowboys and the "couldn't care less" brigade and need all the help we can get. My WVE representative tells me that though non-technical he always reads *Television* to pick up any problems or grievances he may be able to sort out and put right. He's certainly helped us in the past. I hope the retail trade, particularly it seems in Stevenage, will take notice.

Also a quick note on Philip Blundell's reference in VCR Clinic to non-genuine belt kits for the Sharp VC6300. We've had identical troubles with the Hitachi VT5000 and Sony SL8000 series machines. The moral is – fit genuine belts!

Nick Beer,
Bideford, N. Devon.

JAPANESE SYMBOLS PREFERRED

The Japanese practice of using the same symbols in layout diagrams as in circuit diagrams is to be commended. It's so easy to locate components – zigzag resistors, parallel-plate capacitors and spirals for coils. The UK system is much harder to follow, with all components shown as rectangular boxes. German diagrams are even worse, with thick straight lines for wound components. The weakness of Japanese service manuals is their lack of description of how circuits work.

Although conductance is rarely used, I think the mho was a far more practical unit. It was simplicity itself, which is surely what standards should be.

K. J. Treeby,
St. Judes, Plymouth.

HELP WANTED

I've a Rigonda VL100M (one of the Russian 5in. TV sets) which I have been using for DX-TV reception – it has good sensitivity and rock-steady sync that seems to be able to cope with the dirtiest signals. Unfortunately the LOPT has developed shorted turns in the heater winding, rendering the set useless. The importers tell me the part is no longer available, and the only other source of supplies (Star Radio) I know of seems to have gone out of business. I would be grateful if anyone who has a transformer or knows of a source would get in touch.

J. C. Chandler, 1 Bramhall Moor Lane, Hazel Grove, Stockport, Cheshire SK7 4AJ.
Telephone 061 428 0811 Ext. 297 day, 061 483 9659 evenings.

Editorial note: We receive other letters from time to time asking about spares for these sets. If there are any sources, we'd like to know too.

FOR DISPOSAL

I have for disposal a home-constructed, 405-line single-channel (London) TV receiver in a cabinet. It was working when put in the loft some years ago. Would anyone like it?

A. Newton, 9 Millais, Horsham,
West Sussex RH13 6BS. Telephone 0403 66 018.

Satellite TV Filter Unit

Roger Bunney

In the April 1988 issue I described a very simple bandwidth limiting filter that can be used to reduce noise/sparklies with very weak/marginal signals. The filter is inserted in the 70MHz i.f. in/out loop that's present at the rear of many imported satellite TV receivers and is intended for descrambler use. Since then I've built a more versatile filter unit with three switched positions, see Fig. 1. This gives either straight through operation, amplification without bandwidth limiting, or bandwidth limiting with amplification. On its own the filter introduces a loss of 3dB which is more than compensated for by the amplifier.

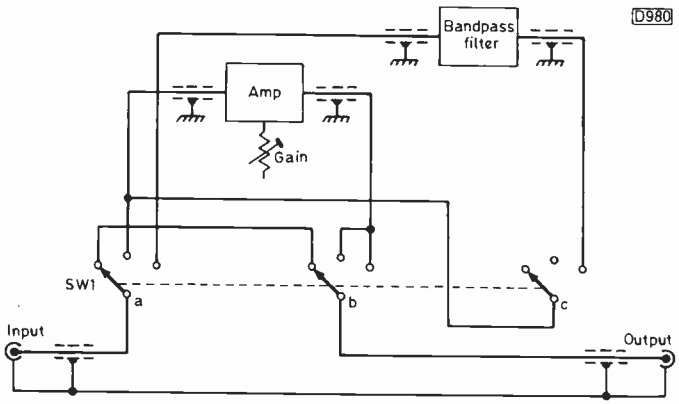


Fig. 1: Block diagram of the filter/amplifier unit.

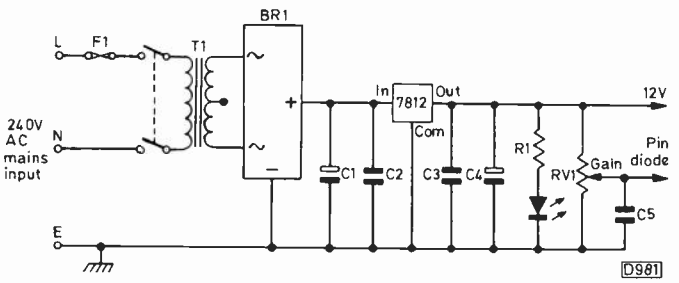


Fig. 2: The power supply circuit.

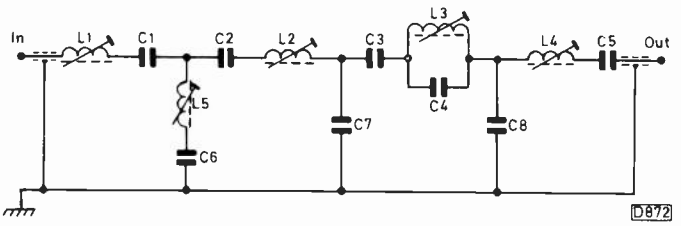


Fig. 3: The bandpass filter circuit. L1 6·5 turns (Toko blue r.f. moulded coil), L2/4/5 8·5 turns (Toko white), L3 5·5 turns (Toko green).

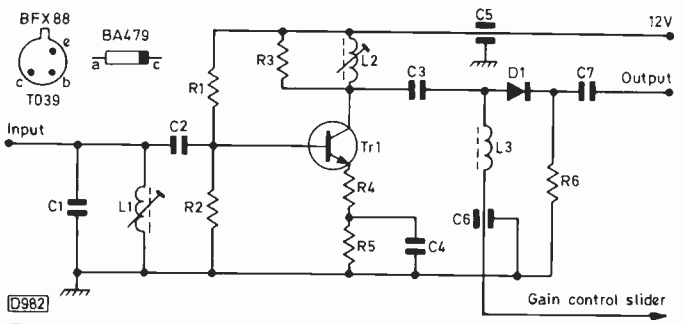


Fig. 4: The amplifier circuit, with BA479 pin diode signal attenuator.

The system is simple and requires little explanation. Fig. 2 shows the power supply which provides a regulated 12V output. In my case I also use it to power an outboard System I sound/vision modulator. This is a compact, steel-cased unit made by Technicolor for its now obsolete video format. It's currently available from Star Satellite Systems Ltd., 27 Galgate, Barnard Castle, Co. Durham (tel. 0833 38385) at £13 plus £1·50 post and packing. The output is variable over chs. 30-39.

The filter circuit itself is shown in Fig. 3, while Fig. 4 shows the amplifier circuit. The latter uses a low-cost BFX88 transistor and has minimal filtering. Gain is controlled by means of a BA479 pin diode (D1) which gives a variable attenuation of up to 28dB. The amplifier's gain is 12-15dB.

Construction is generally non-critical, though as with all v.h.f. circuitry a compact layout should be adopted. As shown in Fig. 1, the main connections use thin coaxial leads with the screens earthed: it's not necessary to use coaxial leads for the switch pin cross connections. The BA479 is available from Cirkit by mail order while the Toko moulded r.f. coils can be obtained from Maplin.

The two coils in the amplifier circuit provide a degree of selectivity – you'll find that they give a vague peak. The main selectivity is provided by the filter unit of course. This has five coils which are tuned to the spot frequencies listed in Table 1, giving a bandwidth of 16-18MHz. Having made

Components list

Filter unit:

L1	UF67X	C1, 4, 7, 8	22pF
L2, 4, 5	UF69A	C2	18pF
L3	UF66W	C3, 5, 6	33pF
Maplin UF series		100V ceramic	

Amplifier:

C1	5·6pF silver mica	R1	12k
C2, 3, 4, 7	0·1μF 100V ceramic	R2	2·2k
C5, 6	1kpF feedthrough	R3	10k
L1, 2	UF69A	R4	150Ω
L3	V.H.F. choke	R5	270Ω
Tr1	BFX88	R6	1·5k
D1	BA479	All 0·25W,10%	

Power supply:

BR1	1A, 100V p.i.v. bridge
T1	9-0-9V sec., 200mA
C1	1,000μF, 63V
C2, 3, 5	1kpF, 100V
C4	470μF, 40V
R1	1·5k, 0·5W
RV1	5k linear
F1	250mA

LED, DPDT switch and 7812 regulator

Table 1: Alignment frequencies

Adjust for maximum output		*Adjust for minimum output*	
L1	76MHz	L3	85·5MHz
L2	70MHz	L5	54·5MHz
L4	64MHz		

these adjustments you may well find that a further peak-up is beneficial: slightly retune while watching the picture.

In the absence of upmarket test equipment alignment can be carried out in either of two ways. Use a signal generator to inject the appropriate frequencies, with a field strength meter to observe the output. Alternatively, use a signal generator and feed the unit's output to a receiver such as an Eddystone 770R, a scanner, etc., preferably with the a.g.c. off. Use the S meter for peaking, reducing the sensitivity as levels rise.

The unit was built into a diecast box which, with adhesive feet, sits atop the satellite receiver. It's a simple but very effective arrangement.

Practical Computer Programming

Part 6

Mike Phelan

Next on the list of topics comes the user interface. By this we simply mean the bits of the software the user actually sees, that is the screen displays and the printed material produced. Most of the inner workings of the software need not be known or understood by the person who enters data via the keyboard or interprets the output on the screen or on paper.

As most of us who design systems do it for our own use, you might think that the general rules would differ from those of commercial software. This is not really the case. Bad habits and sloppy design are as much an inconvenience when it's your own fault that the program crashes or the screen display is hard to read! Then again, could you guarantee that no one else will ever use your system? You may pass it on to a colleague or, if it turns out to be very useful, place it in the public domain or even market it! So a code of practice of some sort is advisable. This should cover all aspects of the design, not only the user interface.

In previous articles we have considered the basic problems and suggested ways of deciding whether the use of a computer is an appropriate solution. We followed this by outlining a suitable data structure or dictionary, which lays down the data items we need to store, their types and sizes. The next stage is design of the screen displays or prints.

There are four basic types of display: (1) pure text, e.g. help screens, instructions, etc.; (2) menus to enable the user to select a choice from several options; (3) data entry screens; (4) reports. In this context a report means any output from the system, whether on the screen or a hard copy print-out. Types (3) and (4) can sometimes overlap: for example the data entry to a database system can allow the user to see previous inputs. We'll deal with these types of display in turn.

User friendliness is a good thing to aim for, within reason – a system that explains every move on the screen, and asks for confirmation of every entry, is rather tiresome to use.

The next step is to make a list of the screens and print required and to draw them all on paper. Layout grids are available to make this job easier, but are not essential. At this point you will need to decide what menus, if any, you require, and whether any help screens should be included. The rest of the process consists of establishing the design rules. Some of the latter are the writer's own personal preferences, but others are established practice.

We'll split the guidelines into those for menus, data entry and report design, though some of the points to be made apply to all three. One common requirement is consistency. If for example you call something a "service docket number" in one place, don't call it a "job number" somewhere else. Make a note of such conventions on paper. Indeed keep all the notes you make during the design, and convert your rough notes into more readable form as the design progresses. Otherwise if you need to extend or change the system in say twelve months' time you will have forgotten most of how it was designed! In the design of a small to medium piece of software, as in my current role, I usually get through a few A4 ruled pads and a few dozen screen layout grids.

General Rules

I'm going to lay down some general rules, also some specific to our requirements. No excuses will be given for the fact that some of the guidelines may appear to be too exacting for "own use": when we come to the design stage I shall be advocating simplicity. This may sound like a contradiction in terms, but the two principles can and do go together.

The first rather obvious point about screen displays is that they should be readable. As most microcomputers can have a colour monitor with a capability of sixteen colours or more there's a great temptation to use them all. Don't! A maximum of four colours should be sufficient for most purposes. If you must have frames round things on the screen, use the 8-bit frame characters (if your computer supports them). Alternatively, home computers without these characters in their sets usually allow some sort of line drawings in BASIC. Frames made from asterisks look amateurish, as do those made from the bar and minus sign characters. A wide frame can be made by changing colour and printing a series of spaces. A few examples are shown in Fig. 1. If frames are not needed or are impractical, horizontal lines can be drawn using the minus (——) or underline (___) characters.

Don't clutter the screen with rubbish. Does the user

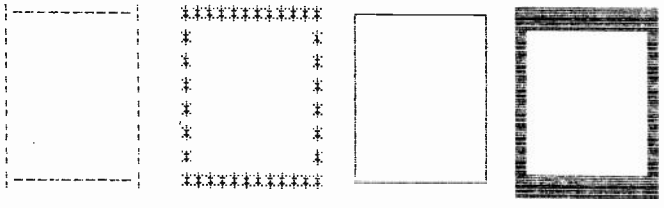


Fig. 1: Bad and good ways of making frames.

really need to know that NURDLE.BAS is currently running, or that there is 17K of memory free? Do not display everything in upper case (capitals): this makes reading difficult, though you can use upper case for headings etc.

When using colour, choose ones that are easy on the eye. Personal taste probably plays a part here, but good combinations are white, cyan, light green or light blue with black, either colour being used for the foreground.

Printed Reports

The most important factor with printed reports is the layout. Don't have too much spacing between rows, and take care to justify numeric and character data correctly. This means lining up the right- or left-most digit. Generally, character fields should be left justified, numeric fields right justified. Underline the column headings to the width of the heading, not the data. The remarks about the use of lower case apply equally to printed reports. Here are some examples:

Name	Address	Make	Labour	Materials
Bloggs	12 High St	Toshiba	22·50	58·00
Smith	3 The Avenue	ITT	100·25	0·50

Here's how not to do it:

NAME	ADDRESS	MAKE	LABOUR	MATE-RIALS
Bloggs	12 High St	Toshiba	22·50	58·00
Smith	3 The Avenue	ITT	100·25	0·50

The second example is untidy and if there were more than a few lines it would be difficult to read.

Don't use fancy printer tricks, i.e. different fonts etc. These are more suited to desktop publishing than business reports.

Putting a date on the report is useful. And give it a title, especially if more than one type of print is used.

Always give the user an option to confirm that the printer is on and the paper lined up before printing. If printing the report changes any of the data or clears it out, allow for printing the report as many times as required before updating anything. This takes care of the paper running out or jamming in mid-print.

Menus

Menus allow the user to choose an option, which can be a further menu, but try to avoid too complicated a menu hierarchy. If the number of options is three or less a menu might not be necessary: a simple prompt with three possible replies would do just as well.

There are basically two types of menu, the lightbar type and the older format where the choices are displayed with a letter or number against each item. There is a always a quit or exit option to return to the previous menu or out of the program. It's best to use letters with the letter or number choice type of menu – this will give you 26 possibilities for a single key press. To trap invalid choices, make the program ignore them rather than bothering with an error message. The key used for exit should be consistent if there are several menus. In such cases it's a good idea to make the choice default to the exit character, say "X", so that it's only necessary to hit return to go to the previous menu, but for the first menu to default to a space so that a definite effort has to be made by the user to type in a letter. This avoids problems caused by typing ahead or holding the return key down.

It's a good idea for all the menus in a system to look alike, and for the name or title of the menu to appear at the top. The items should be centred and left justified, with the choice letter prominent. Here's an example:

SERVICE HISTORY SYSTEM MAIN MENU

(A) . . . Enter data from service docket
(B) . . . Clear completed jobs
(C) . . . Reports menu
(D) . . . Back-up data
Please enter choice from above or Q to quit.

A very readable screen with only the required information present.

The lightbar menu is a slightly different animal – the choices are selected by using the cursor keys to highlight choices with inverse video, then using the return key or space bar to confirm. Further enhancements are to print an on-screen explanation of each choice – known as expansion – and to allow selection by the initial letter of the choice. The latter assumes of course that the initials are unique. Unless the language you intend to use supports lightbar menus they take quite a lot of programming, though it can be fairly simply done with BASIC or C and dBase III plus has its own function to make them easy to produce. Enhancements can be added after the system has been tested and the bugs have been ironed out.

We cannot leave the subject of lightbar menus without mentioning pull-down menus, though these are really outside the scope of the article. A typical pull-down menu has an initial row of choices across the top of the screen. On selection by initial or cursor plus return a small lightbar menu appears giving further options from the initial choice. Moving right or left changes the pull-down menu to a different one relevant to the choice that appears below. All very sophisticated.

Data Entry Screens

With a screen-based system a data entry screen looks like a form to be filled in, rather then prompting for items one at a time. The ideal is also to have "full-screen editing", where the user can move around the screen using the cursor keys, possibly correcting previously entered items. dBase II etc. allows for this without need for any extra programming, but it can be done in other high-level languages.

Give the screen a name or title.

Prompt the user to fill in the items in a logical order, and always start at the top left corner. Proceed either by row or column.

Try to arrange the items so that they are left justified. The prompts should also be left justified. If the prompts are

of different length, so that a prompt is far from the item box, use a row of dots to connect them. As follows:

Name of customer ..... [_____]
Date ..... [__/__/__]

There should be no need for more than three pairs of foreground/background colours, one for the normal text, one for the data windows and one for any error messages, in ascending order of visibility. Flashing error messages are acceptable. Where a limited number of choices is available, display them. For example:

Colour, mono or video? (C/M/V) [_]

Note that [_] means a data entry window in which a cursor will be visible.

Again, if there's more than one data entry screen, give each one a title. Don't get carried away with drawing boxes etc., and if you must do so make them consistent throughout the system. For example, a double line box for the title, single lines elsewhere, or simply a row of minus signs above and below the title.

Make the data entry screens of similar appearance to your menus, and preferably of the same colour.

The matter of validating inputs, i.e. checking for user errors, really comes in at the program design stage and will be left until then.

Screen Reports

Screen reports can be used as an alternative to printed reports, and are in some cases preferable. For example, suppose that you have a database of suppliers and part numbers by model. It would be a waste of time printing these every time you want to order a part! In other cases you might want the choice between screen or hard copy: this may take the form of first providing a screen report then asking the user if he wants a print. The two versions might appear like this:

Screen or print? (S/P) [_]

before printing, or

Print this screen? (Y/N) [_]

after the screen display.

Don't lose sight of the fact that there are fundamental differences between screen reports and hard copy. You must bear this in mind when using the same chunk of program to perform both. Screen reports must stop when the screen is full, awaiting a key to be pressed (preferably any key), but printed ones must perform a form-feed or "page throw" after the appropriate number of lines have been printed. If the report is of any length page numbering (pagination) needs to be done, with the title and column headings repeated on each page.

Most screens are limited to 80 characters per line (CPL), as is A4 paper, but wider paper with 132 CPL is in common use – provided your printer can handle it. The normal size of print is ten characters per inch and six lines per inch. The latter very seldom needs to be changed, but printing a fairly wide report on A4 sometimes calls for condensed print, usually 17 CPI. With most matrix printers this can be selected by a switch, or the software can send a control code – normally ASCII 15 – to do the job.

Design Progress

If you are designing a system you should by now have a large collection of bits of paper, among them a rough draft of the system requirements, a data dictionary or structure, and the screen and print layouts. In the next instalment we should be able to sort them out in order to start on the program design and the choice of language to use.

Servicing Notes on the Luxor SX9 Chassis

J.R. Trimmer

The Luxor SX9 chassis was introduced in late 1983 and is used in various models including the 5634, 5639, 6734, 6739 etc.

The most common problem is caused by the two copper heatsinks in the power supply. Unfortunately in early production sets they were used to bridge parts of the circuit. They quickly became dry-jointed, giving rise to a number of different symptoms – intermittent loss of picture, faint bars running across the screen, failure of the line driver (more on this below), failure of the line output transistor, and any fault that cannot easily be explained. They must be resoldered using a large iron, after which they normally give no further trouble.

The mains on/off switch can go short- or open-circuit: replacements are of a better quality. Tuning and memory faults are caused by the back-up battery going down and the earthing points inside the tuner. If the set changes channel on its own, or for that matter performs any other function on its own, the cause is likely to be air trapped in the touch membrane. This can be proved by wiping across it, when the fault will be temporarily cured. Replacements come with the plastic framing and have a green connecting strip.

As mentioned above the BD419 line driver transistor TH01 can fail, going short-circuit. This will in turn burn up RH03 (6·8Ω) and RN19 (1Ω). If these resistors, which are safety types, start to cook again the most likely cause is LH01 shorted: be warned – it may read o.k.!

Power supply faults are rare, but a strange fluttering noise followed by the set going into standby is caused by lack of heatsink compound on the TDA4600 chopper control chip IN01. The trip circuit puts the set in standby through TN02 removing the 12V supply.

Recently we've had several cases of line output transformer failure. If you find that the h.t. is only 30-40V, disconnect RH07. This should restore sound and full h.t. (121V or 142V depending on version). Failure of the line output transformer usually takes the line output transistor as well. Note that there are 90° and 110° versions of the chassis.

Whenever a set is serviced it's worth checking for dry-joints around the line linearity coil, the line driver transformer, RH07 and the chopper transformer. Dry-joints are by far the most common problem with these sets, often causing the microcomputer control chip to lock up.

Poor operation of the remote control can be cured by washing the rubber pressure pad and handset board: they tend to become sticky due to a reaction between the pad and board. At the same time it's best to disconnect the store button on the handset by sticking tape under the pad: this saves a lot of service calls for sets tuned to the same channel.

A Tifax/VM6101 Conversion

John de Rivaz, B.Sc. (Eng.)

Although there are now many teletext-equipped TV receivers on the market, some being available at relatively low cost secondhand, a teletext adaptor is invaluable to the aurally handicapped who wish to record subtitled programmes. For some years Manor Supplies sold an adaptor which used the Tifax XM11 decoder module. As has been pointed out in previous letters and articles in *Television*, the XM11 was designed before the UK teletext specification had been finalised. For this reason it now gives trouble. I decided to have a go at removing the Tifax module from my Manor Supplies adaptor and fitting in its place a Mullard VM6101 decoder module. Previous articles (December 1986/January 1987 and September 1987) have described ways of using the VM6101 with an 8748 programmable microcomputer chip to provide keypad/decoder module interfacing.

My Manor Supplies adaptor was still in use despite the missed lines. It had developed a further fault: with multiple pages, such as page 502 C4, it would skip to a following page when the subpage changed. Rather than using the microcomputer chip solution to the problem of providing control signals for the VM6101 decoder module I decided to make a simple unit from TTL chips and some diodes. This has the advantage that the user can select what codes are chosen and what codes go to what key, enabling the Manor Supplies unit's key configuration to be retained. If the constructor already has some diodes and some of the chips, this will probably be the cheapest solution.

Modifications to the VM6101 Module

As noted in the previous articles, some minor modifications to the VM6101 unit have to be carried out (see Fig. 1). These consist of reversing the polarity of the 1μF video input coupling capacitor, adding a 4·7kΩ resistor to pull up the superimpose line to 5V, and adding a link between pins 4 and 5 of PL3. The VM6101 unit I obtained from Sendz Components had plugs with it and a small board with transistors was plugged into PL5. This small board was removed and jumpers were connected to bring out the RGB and blanking signals from spare pins on PL4. I found that the link on PL3, for the sync supply, was already in place.

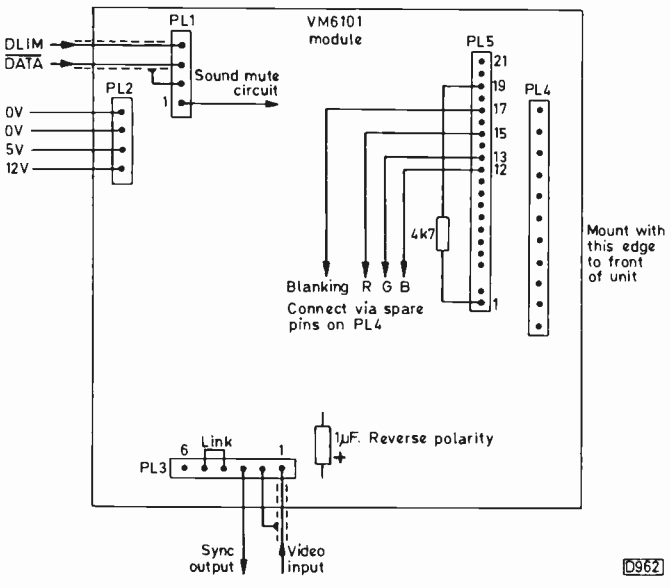


Fig. 1: VM6101 decoder panel connections and modifications.

Modifications to the Manor Supplies Unit

The wiring harness in the Manor Supplies unit was modified as follows: everything to plug A on the video/pulse board was disconnected, as were the RGB wires from plug B on this board to the encoder. The RGB wires were also removed at the encoder end.

An additional couple of transistors (see Fig.2) were added in order to make use of the sound mute on text feature. This arrangement sets the d.c. volume control connection to the TBA120SQ chip (pin 5) low when text is selected. One of these transistors was fitted to the VM6101 panel, using the panel's 5V supply, the other transistor being fitted on the receiver module's sound subpanel. The input to the first transistor was taken from pin 1 of PL1.

Power for the VM6101 module and the interfacing circuit was taken from the regulators already present in the Manor Supplies unit – the 5V supply was taken from regulator no.

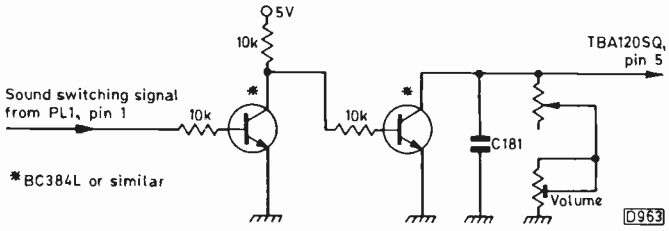


Fig. 2: The sound mute circuit.

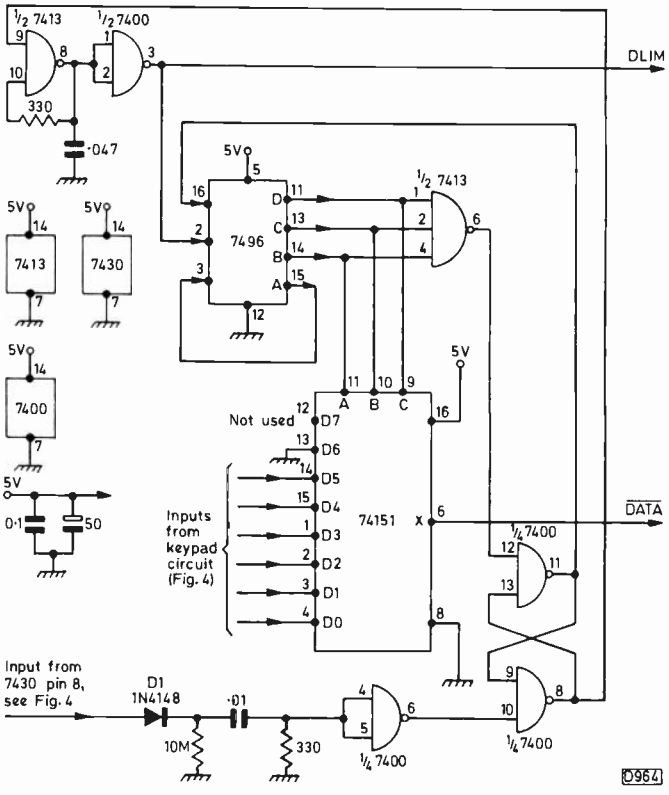


Fig. 3: The TTL keypad-decoder interfacing circuit.

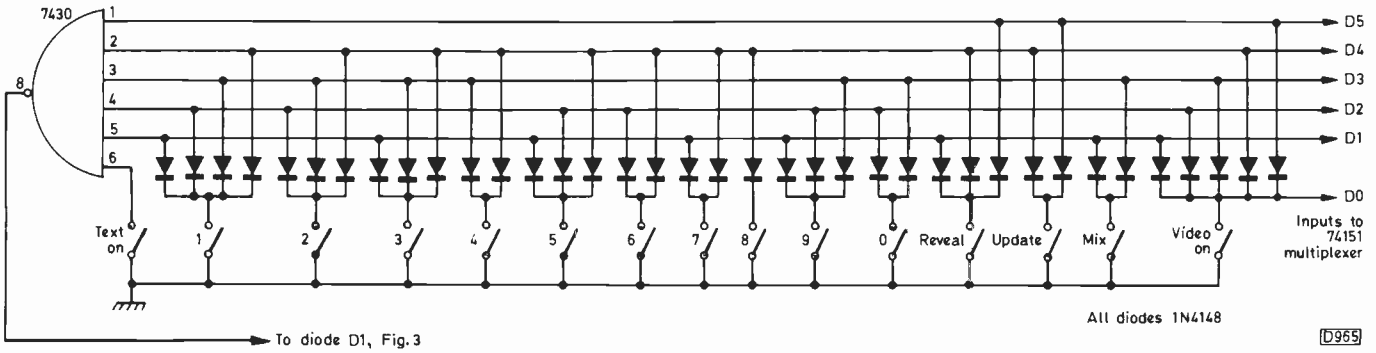


Fig. 4: The keypad switching circuit.

2. The VM6101's video input was taken from pin 7 of PLA on the video/pulse board. The RGB outputs from the VM6101 module were connected to the encoder's RGB inputs, the inverters previously required being left out of circuit. The blanking output from the VM6101 module goes to the video/pulse board, which also receives a sync input from pin 3 of PL3 on the VM6101 module – disconnect the end of R7 previously connected to R5 and connect it to the VM6101's sync output. This latter modification overcomes the annoying fault of teletext judder when a bright, nearly white picture is transmitted.

Keypad and Interfacing Circuitry

The interfacing arrangement I used (see Fig. 3) has the advantage that the circuit can be built in stages, each section being tested before proceeding. The start is the oscillator, which uses half a 7413. Its output is fed to a 7400 nand gate used as a buffer. The output from this is the DLIM input required by the VM6101 module and is also fed to the 7496 counter chip. For testing, earth the reset pin 16 so that the counter free runs. The 7496's A output is connected to the B input while the B, C and D outputs go to the 74151 multiplexer's A, B and C inputs. At this point it should be possible to earth one or more of the multiplexer's inputs and observe the output, thus checking the circuit so far.

Further gating is required to make the unit operate in a one-shot mode. An 8-input nand gate (see Fig. 4) with five of its inputs connected to the 74151's bit 1-5 inputs generates a pulse whenever a key is pressed. We also require a 00000 signal, so a further input is connected to the text-on key. The output from this gate was initially fed direct to an inverter driving a latch which is reset by a 3-input gate connected to detect number 8 going into the multiplexer. This however would cause each key to repeat if held down. A differentiating network (0·01μF plus 330Ω) was therefore added to give a "one-shot" effect. With this the keys were found to suffer from bounce, so a diode and 10MΩ resistor were added. When the 0·01μF capacitor charges, a current pulse is sent to the latch. If another key press follows quickly, the capacitor is still charged and the second pulse is ignored. Only when the capacitor has discharged will a further pulse be passed. The latch switches off the oscillator and resets the counter, except when a key is pressed. The circuit is thus dormant when no key is being pressed, minimising possible interference to the rest of the unit

The keyboard was connected via a ribbon cable. One end of each key is connected to chassis (see Fig. 4), the other end going to various numbers of diodes. As previously mentioned the text-on key is connected to one input of the 7430 nand gate to generate a 00000 signal. The video-on key is connected via diodes to the multiplexer's bit 1-5 inputs and directly to the bit 0 input. Table 1 shows the connections to each key.

The modified adaptor has been in use now for several months, giving excellent results. VM6101 modules can be obtained from Sendz Components and Manor Supplies.

Table 1: Keypad connections

Key	*Multiplexer bit connections:*				
	1	*2*	*3*	*4*	*5*
1	D	D	D	D	x
2	x	D	D	D	x
3	D	x	D	D	x
4	x	x	D	D	x
5	D	D	x	D	x
6	x	D	x	D	x
7	D	x	x	D	x
8	x	x	x	D	x
9	D	D	D	x	x
0	x	D	D	x	x
Reveal	D	x	x	D	D
Update	x	x	x	D	D
Mix (= set small)	D	x	D	x	x
Video on	D	D	D	D	D
Text on	x	x	x	x	x
P	Not used.				

The mix key is used to set to small characters. This is done in case any glitches would make the large character set appear. Connect the video on key to bit 0 as well. Connect the text on key to pin 6 of the 7430 i.c. See Fig. 4.

Additional keys that could be used are:

Time on	x	x	x	x	D
Time off	D	x	x	x	D
Top	x	x	D	x	x
Bottom	D	D	x	x	x
Hold	x	D	x	D	D

D = diode present, x = no connection, see Fig. 4. Press any key for the same effect as originally.

Book Note

Video Handbook, second edition, by Ru van Wezel. Published by Heinemann Professional Publishing Ltd. at £30.

The second edition of this book has been virtually rewritten, such is the rate of progress in the video field. It contains a great deal of information on almost everything that could be roughly classified as video, including television standards etc. The book does not seem to have a very clearly focused readership, dealing as it does with subjects as diverse as professional video equipment, community TV services and TV production techniques.

VCR Clinic

Reports from Eugene Trundle, Ian Bowden, Philip Blundell, Eng. Tech., Dave Dulson, Alfred Damp and Nick Beer

Sharp VC386

This is a nasty fault which we've had twice so far. It appears only when channel change is attempted, and then only intermittently, the symptom being no signals with the tuner's varicap control voltage awry. The cause is a dry-joint at socket TA on PWB (printed wiring board!) T. This removes the pulses on the control-1 or control-2 line, whereupon IC1401 throws a wobbly. **E.T.**

Mitsubishi HS338

If the proffered cassette goes in at an angle and is then almost immediately ejected, the cause is probably that the cassette drive cog on the left-hand side of the front-load housing has jumped a tooth or two – check that the housing is parallel with the front of the machine in the ejected position. Like many such troubles this is probably brought about by the owner using excessive force. **E.T.**

Blaupunkt RTV321

There was weak sound on E-E and record. Replacing the i.f./tuner board brought the level back up, so attention was turned to the circuitry around IC751 (AN5215). Transformer T752 wouldn't peak up as C755 (39pF) was open-circuit. When T752 is off adjustment the voltage at pin 7 of IC751 changes from the 3·5V usually present. **P.B.**

Ferguson 3V57

The part of the display that shows fast forward, play etc. didn't work though the clock part did. IC301 (MN1250) drives the faulty part of the display. Its serial data lines (pins 14 and 17) had the same signals on them, which seemed odd until we found that they were shorted together by a solder bridge across pins 7 and 8 of CN304. **P.B.**

Grundig VS180

There appeared to be a tape path fault. The off-tape f.m. at the start of the rotation of the heads was very low, though the last half was o.k. The paint seals on the guides were unbroken, the tape tension was normal and a replacement tension arm had no effect. A new head drum was finally tried and this restored normal operation. **P.B.**

Samsung V1-621

"Whirring noise, horrid smell of burning and won't load the tape" was the way the customer put it. The noise was the loading motor running while the smell came from the plastic pulley on the motor shaft – it had almost slipped off the end and had become stuck against a plastic moulding. The pulley's centre hole was sealed with plastic which had melted. We had to order the pulley by description as Samsung have left out the part number list for the main mechanism exploded view. **I.B.**

Panasonic NV730

When the on/off button was pressed all this machine did was beep and light the on LED. The fluorescent display was out due to loss of the −45V supply and hence the −30V supply to the display. There was also no power-on signal at the main regulator chip IC5001. This was because the 45V supply was missing. Both these supplies are derived from a common winding on the mains transformer via a 4·7Ω safety resistor (R1002) which had gone open-circuit. **I.B.**

Panasonic NV-G7

This machine was dead apart form the clock display. The digital counter display appeared when the on/off button was pressed, but there was no channel number, no on LED display and no mechanical functions worked. A faulty STK5331 main regulator chip (IC1001) was responsible. **I.B.**

Amstrad VCR4700 and Hinari VXL5

These VCRs have very similar cassette decks and seem to suffer from the same fault. When play or record is selected they may operate for about twenty seconds then shut down. In all cases to date the cause has been the take-up reel sensor. The clue to the fault is to select tape counter on the front panel then press play: the numbers displayed will be very erratic and irregular. **D.D.**

Ferguson 3V35,36/JVC HRD120,225

A number of these machines are coming in with loading belt faults, the complaint being intermittent failure to play or record. The belt is the same as the one in the 3V29/3V30 and is just as difficult to replace. The Ferguson part no. is 01X1-040-006. **D.D.**

Akai VS4

The fault report on this machine was "rewinds then dead". On the bench we found that it was totally dead, with no functions whatsoever and no channel display number. Our first check was on the power supply. The 12V and 14V outputs from the STK5325 regulator IC1 were missing because the control line (pin 9) was at 4·5V instead of 0V. I've had this before when the cassette deck lamp has been open-circuit. A quick check confirmed that it was, but a replacement left things as before. We decided to short-circuit pin 9 of IC1, and when this was done we had 2V and 3V respectively on the 12V and 14V lines. As there didn't seem to be excessive current a new STK5325 was fitted. This produced the 12V and 14V supplies – but only with pin 9 held at 0V. Also the reel motor went into continuous rewind. With the short-circuit removed from pin 9 of IC1 the machine stayed dead.

There was no response when the function-on button was pressed, so a check around the key scanning chip IC3 seemed to be a logical course of action. A scope showed that there were no key scanning pulses on pins 12-15. Replacing the MB88401 microcomputer chip restored the scanning pulses, but I still had no 12V and 14V rails. Back to system control chip IC5, another MB88401, that provides the turn on control signal for the regulator. Scope and meter checks here were inconclusive, so the chip was replaced. When the function button was pressed the function LED and the channel display lit, but the reel

motor still went into rewind for a few seconds after which the machine shut down again.

Time was wasted on a fruitless search through the motor and system control circuitry before we found that the cause of the final fault was a slipping loading belt. Somehow it managed to get the system control confused. Once it was replaced everything worked correctly. I assume that this was the original fault and that a second fault, the defective regulator, had killed the lamp and the two microcomputer chips. Just my luck! **D.D.**

Philips VKR6800 Camcorder

This camcorder displayed and recorded only in blue. While filming a colour bar chart (actually a TV set displaying colour bars) we were able to trace the blue and red signals through the various processing circuits to IC401. All the inputs to this chip, i.e. B – Y, R – Y, the burst and 4·43MHz carrier, were correct. Replacing the chip (AN2431) put matters right and when the circuitry around it was aligned the camera produced excellent results. **A.D.**

Mitsubishi HS349

We've had two of these machines that were faulty from new. The first had an intercarrier buzz on all channels in the E-E mode, with the difference that the buzz was being recorded. Component checks in the sound i.f. circuit revealed that C307 was open-circuit. It's one of those capacitors that look like a resistor.

The fault with the second machine was no picture, only lines. When a test tape was tried it was obvious that the drum speed was wrong. We found that D4A4 in the drum servo circuit was broken, a new 1N4148 putting matters right. **A.D.**

Sanyo VHR3300

This brand new machine would intermittently go into standby. You could tap the case anywhere and it would turn off, but the fault could be provoked more easily on the servo/syscon board. On removing the bottom cover the cause of the problem was obvious – the board had jumped out of its retaining clips during transit, and was shorting to chassis via the bottom case. **A.D.**

Ferguson 3V29/JVC HR7200

The capstan motor wouldn't start: the VCR would load the tape, then after five seconds it would unload. We found that the "motor stop control" input from the mechacon board was high, as though the machine was in pause. Pin 22 of IC4 on the mechacon board should be at 0V during play and at 10V in pause. It was actually at 5·6V, which was high enough to change the state of the following gate. Replacing IC4 restored normal operation. **A.D.**

Samsung V1-626

Rapid drifting off tune was traced to a number of dry-joints on the tuner – it seemed as if it might have had a fair knock from above. We've traced a number of faults in these machines to dry-joints. **N.B.**

Panasonic NV-G25

Having cleaned the heads, a field engineer brought this one in for the following faults: the noise bars on cue and review were wider than normal (they are usually almost invisible); at 1/25th speed every other frame was obliterated by noise; odd frames were noisy with the 1/5th and 1/10th speeds; and the still frame was very poor. On examination we found that the heads were faulty. When I used the special Panasonic tool – wonderful machine – to replace the heads I noticed that all the relevant adjustments (tracking fix, head frequency response etc.) had been set at one end of their tracks. Presumably the original head had been a borderline one. **N.B.**

Salora SV8500

This Mitsubishi clone would erase and play sound but wouldn't record any. The trouble was traced to Q302 and Q304 which were both leaky. It's a major job to dismantle this machine for service! **N.B.**

Sony CCDV8AF

New heads had been fitted but within a week this camcorder was back because the zoom motor ran all the time, keeping the lens fully out. We found that there was a break in the print around the zoom motor circuitry. **N.B.**

Ferguson 3V35/JVC HRD120

The customer's complaint was that the machine would occasionally stop as soon as play had started. After many hours of soak testing we found that the cause of the trouble was a lazy drum motor. With no drum rotation, the machine stopped. **N.B.**

Panasonic NV333

Until recently the cause of the tape riding up and spooling into the machine in the review mode has always been a worn upper drum. Recently however we've had some machines where the same end result has been caused by the lower drum becoming too smooth. Sometimes a good rub with Brasso will provide a temporary cure, staving off replacement for a while. This is worthwhile as the cost of a new direct drive unit is considerable. **N.B.**

Sony CCDV100E

Field buzz on sound when recordings are made with the built-in microphone is usually caused by the microphone harness being too close to the deflection yoke leads. **N.B.**

Sharp VC8300

No display was fairly quickly traced to an open-circuit digitron heater. A simple fault, but one that in practice is not as common as you might expect. **N.B.**

Panasonic NV-G12

Tuning problems due to IC7551, D7555 and Q7551/2 going short-circuit have been a problem with these machines. Some guidance has now come from Panasonic. It seems that all machines with the serial number prefix E7 can be affected. Resistor legs around the i.c. were bent over during assembly, before soldering, and they can intermittently touch lands on the PCB. The cure is to straighten suspect legs. Some machines have already been done by Panasonic themselves. **N.B.**

Sony CCDV8AF, EVA300 etc

If replacement of the tension regulator arm is required because the shaft slips out of place be sure you fit the modified type, part No. X-368-652-84. **N.B.**

ECONOMIC DEVICES PO BOX 15, WOLVERHAMPTON, WV2 4AZ

15/80H	3.30	2SC1826	0.67	AN206	2.58	BC207	0.14	BDX54B	2.16	BU205	1.15	HA1196	7.43	MC1351P	2.96	SAS560T	5.42	STR440	4.78	TBA940	1.87	TDA4431	2.27
15/85R	3.30	2SC1829	2.22	AN208	3.55	BC212B	0.26	BDX62A	2.15	BU206	1.27	HA13001	1.73	MC1352P	2.50	SAS570T	5.42	STR451	5.36	TBA950	1.84	TDA4440	3.26
17052	5.61	2SC1875	4.50	AN210	2.28	BC213L	0.10	BDX63A	1.96	BU207	1.65	HA1306	2.26	MC1357P	2.15	SAS570S	2.61	STR453	8.16	TBA970	3.56	TDA4442	4.15
17053	5.61	2SC1893	3.02	AN211	3.25	BC214	0.10	BDY20	1.21	BU208	1.20	HA13402	7.87	MC1358P	1.35	SAS580	2.25	STR454	4.95	TBA990	1.98	TDA4500	4.75
17074	9.30	2SC1906	0.98	AN214Q	2.40	BC225	0.40	BDY81	1.05	BU208/02	1.97	HA13342	2.65	MC14001	2.40	SAS6600	1.33	STR6020	5.25	TBA990Q	1.68	TDA4600-2	2.10
17089	3.45	2SC1921	1.37	AN234	5.92	BC237	0.10	BF115	0.40	BU208A	1.12	HA13365	4.02	MC14013	0.41	SAS660	2.97	T6029V	5.75	TCA270Q	1.86	TDA4610	6.88
17127	2.50	2SC1923	0.30	AN236	3.78	BC238	0.10	BF117	0.66	BU208D	1.95	HA1366WR	1.51	MC14493P	7.65	SAS6700	1.33	T6035V	0.73	TCA270S	0.95	TDA4620	4.78
17376	1.58	2SC1929	2.25	AN240P	1.25	BC238B	0.08	BF118	0.67	BU209	1.50	HA1367	2.75	MC14494P	2.15	SAS670	3.96	T6036	0.67	TCA270SQ	1.05	TDA5500	6.20
1N4001	0.04	2SC1942	1.65	AN241	1.71	BC239B	0.25	BF121	0.25	BU226	2.45	HA1368R	2.45	MC14497	3.46	SAS6710	2.21	T6037	2.11	TCA290A	2.39	TDA5700	2.75
1N4002	0.06	2SC1959	0.26	AN245	4.50	BC251A	0.31	BF123	0.21	BU326	2.00	HA1368	1.76	MC14510BAL	3.75	SBA750	1.61	T6044V	0.97	TCA420A	2.16	TDA7270S	2.25
1N4003	0.06	2SC1957	1.09	AN253	1.80	BC294	0.50	BF127	0.13	BU326A	2.20	HA1370	3.30	MC14511BCP	1.10	SC84203	19.35	T6045	1.20	TCA440	2.25	TDA8190	2.75
1N4004	0.05	2SC1953	1.93	AN260	3.85	BC300	0.35	BF137	0.29	BU406	1.49	HA1374	4.80	MC14528BCP	2.15	SC9504P	1.46	T6049	1.45	TCA530	2.24	TDA9403	3.15
1N4005	0.05	2SC1962	1.93	AN272	8.25	BC301	0.45	BF153	0.58	BU406D	1.79	AA117	9	MC1712	3.88	SDA2006	17.95	T6052V	0.87	TCA640	2.25	TDA9503	1.95
1N4006	0.08	2SC1969	2.04	AN295	5.52	BC302	0.53	BF154	0.26	BU407	0.82	HA1377	1.75	MC5192	19.50	SDA2112/2	12.85	T6058	3.08	TCA650	3.05	TDA9513	3.15
1N4007	0.07	2SC1983	2.21	AN301	2.00	BC303	1.04	BF157	0.33	BU412	5.29	HA1389R	2.05	MC7724CP	3.49	SG264A	6.45	T6059	2.77	TCA660B	2.60	TDB1033	2.68
1N4148	0.03	2SC1985	1.56	AN302	1.93	BC307A	0.08	BF158	0.18	BU426A	1.13	HA1389	2.39	MC7818C	2.18	SG613	10.75	T9003V	1.25	TCA730	3.81	TDE1081	7.05
1N4448	0.05	2SC2009	0.34	AN305	3.20	BC308A	0.11	BF159	0.18	BU500	1.45	HA1392	2.17	MCR106-5/6	0.95	SG629	8.27	T9005V	2.38	TCA750	2.25	TEA1002	2.30
1N5401	0.14	2SC2029	2.33	AN315	1.29	BC309	0.17	BF160	0.31	BU508A	1.25	HA1394	1.95	MCR220/7	2.28	SG6533	11.96	T9011V	1.40	TCA800Q	6.95	TEA1009	1.50
1N5402	0.15	2SC2028	2.11	AN316	3.50	BC317A	0.13	BF167	0.38	BU536	1.65	HA1397	2.17	ME0411	0.28	SI1125H	7.50	T9013V	4.95	TCA830S	2.38	TEA1014	2.50
1N5403	0.16	2SC2063	0.99	AN318	4.41	BC327	0.15	BF173	0.34	BU608	1.80	HA1398	2.29	ME6002	0.26	SI1225HD	18.35	T9014V	2.42	TCA890	5.44	TEA1020SP	8.21
1N5404	0.15	2SC2078	3.11	AN320	5.47	BC328	0.10	BF177	0.35	BU705	2.95	HA1406	1.30	ME6102	0.28	SI1630HD	20.50	T9016	1.02	TCA900	2.04	TIC106C	0.61
1N5408	0.35	2SC2073	2.25	AN321	2.25	BC337	0.09	BF178	0.40	BU806	1.79	HA1452	0.85	ME8001	0.34	SKE2F1/04	1.39	T9019W	1.98	TCA910	2.04	TIC106M	0.77
1N914	0.04	2SC2085 Q	1.65	AN322	5.85	BC338	0.10	BF179	0.36	BU807	0.80	HD14538	2.07	ME0411	0.75	SKE2G3/04	0.85	T9034V	1.45	TCA940	2.47	TIC44	0.72
1S1555	0.31	2SC2091	1.30	AN337	5.37	BC368	0.24	BF180	0.36	BU826A	1.95	HD38702-A2	7.95	MJ2501	3.30	SKE4F1/06	0.35	T9035V	1.95	TCA940E	2.93	TIC45	0.50
1S44	0.10	2SC2141	2.44	AN340P	1.17	BC440	0.69	BF181	0.32	BUW84	1.39	HD38750A53	10.44	MJ3001	1.76	SKE4F2/08	1.07	T9051	6.95	TD3F800R	3.66	TIC47	0.35
1S921	0.10	2SC2166	1.98	AN355	5.98	BC441	0.44	BF182	0.34	BUX84	1.00	HD38750A 7	7.25	MJ481	1.53	SKE4F2/06	0.44	T9054V	5.34	TD3F900H	4.16	TIP120	1.06
2N2219A	0.33	2SC2216	0.69	AN362	1.32	BC454	0.36	BF183	0.39	BUX85	1.10	HD38800A50	14.09	MJ802	4.90	SKE4F2/10	1.24	T9057V	0.70	TD62706P	4.50	TIP110	0.45
2N3053	0.35	2SC2233	1.80	AN370	3.95	BC460	0.42	BF184	0.43	BY126	0.13	HD44801A05	19.98	MJE2955	1.89	SKE4G2/02	0.96	T9062V	0.49	TDA1001B	2.31	TIP112	0.54
2N3054	0.99	2SC2236	1.65	AN5111	3.43	BC461	0.35	BF185	0.39	BY127	0.08	HISH1010	8.59	MJE3055	1.25	SKE5F3/10	1.60	T9064	1.25	TDA1003A	2.25	TIP117	0.50
2N3055	0.61	2SC2278	1.69	AN5120N	4.50	BC462	1.15	BF194	0.14	BY133	0.12	HISH1004	6.00	MJE340	0.49	SKS1/10	2.15	TA7027	4.80	TDA1005A	2.38	TIP121	0.50
2N3442	1.56	2SC2314	2.17	AN5132	5.39	BC463	0.64	BF195	0.14	BY164	0.44	HISH1002	9.50	MJE520	0.49	SL1310	3.14	TA7050	1.74	TDA1006A	2.11	TIP126	0.73
2N3702	0.14	2SC2335 + Kit	12.95	AN5250	4.40	BC478	0.22	BF196	0.17	BY176	0.52	HM6231	9.81	ML231	3.33	SL1430T	0.89	TA7051	1.74	TDA1010AF	4.25	TIP132	0.99
2N3703	0.18	2SC2551	1.26	AN5610	5.50	BC479	0.41	BF197	0.18	BY179	1.08	HM6232	5.25	ML232B	3.01	SL414	3.69	TA7054	0.80	TDA1011	0.95	TIP137	1.50
2N3705	0.16	2SC2565	3.92	AN5612	2.30	BC532	0.28	BF198	0.17	BY182	0.95	HM6251	5.25	ML237B	2.51	SL432A	3.44	TA7060AP	0.71	TDA1010	1.28	TIP29	0.84
2N3706	0.14	2SC2570	2.88	AN5613	4.20	BC546	0.08	BF199	0.17	BY187	0.77	HM7103	4.85	ML238	5.77	SL439	2.48	TA7061AP	1.27	TDA1011A	1.03	TIP2955	0.95
2N3707	0.16	2SC2577	1.60	AN5630	3.95	BC547	0.10	BF200	0.37	BY189	1.79	HM9032	9.98	ML923	3.00	SL471	2.50	TA7069	3.13	TDA1028	2.45	TIP29A	0.46
2N3711	0.13	2SC2578	6.75	AN5701N	1.66	BC548	0.12	BF218	0.36	BY198	1.62	HM9012	3.22	ML926	3.98	SL480	3.98	TA7070P	1.83	TDA1034B	2.42	TIP29B	0.63
2N3771	0.70	2SC2671	1.99	AN6250	0.33	BC549	0.10	BF224	0.17	BY207	0.22	HM9015	3.24	MM5314N	8.99	SL490	1.25	TA7072P	2.57	TDA1035S	2.95	TIP29C	0.40
2N3772	1.71	2SC288A	1.85	AN6300	4.40	BC550	0.10	BF237	0.65	BY208	0.46	HT4207	17.16	MM5316N	9.16	SL901B	6.95	TA7074P	1.98	TDA1035T	1.85	TIP29D	0.75
2N3773	2.00	2SC3153	6.84	AN6310	4.54	BC556	0.10	BF240	0.17	BY210-400	0.19	HT4208	20.65	MM5318N	3.11	SL918A	9.07	TA7076P	7.80	TDA1037	1.95	TIP3055	0.75
2N3819	0.54	2SC372	1.40	AN6340	10.14	BC557	0.10	BF241	0.15	BY210-600	0.27	KA2101	2.92	MM5369N	2.01	SN16861AN0	1.95	TA7089P	2.82	TDA1037D	2.05	TIP30A	0.41
2N3823	1.17	2SC373	1.16	AN6341	1.43	BC558	0.10	BF245	0.50	BY210-800	0.30	KC581C	7.60	MM5387AA/N	6.20	SN16862AN	2.98	TA7092P	8.65	TDA1044	1.95	TIP30C	0.16
2N3904	0.62	2SC383	1.33	AN6363	16.00	BC559	0.10	BF245B	0.49	BY218	1.64	KC582C	3.97	MM5841N	6.64	SN16966N	10.25	TA7093P	3.99	TDA1047	3.25	TIP31A	0.34
2N3908	0.62	2SC388	0.50	AN6531	1.95	BC560C	0.14	BF246A	2.52	BY223	1.23	L200CV	1.69	MN1400VL	13.65	SN29717N	7.19	TA7102P	5.88	TDA1059B	0.98	TIP31B	0.38
2N4101	1.73	2SC394V	0.81	AN6551	1.35	BC635	0.36	BF255	0.20	BY224-600	1.88	LA1201	0.75	MN1405	12.50	SN29716N	3.66	TA7108P	1.61	TDA1054M	1.35	TIP31C	0.50
2N4240	3.30	2SC403C	0.60	AN6552	0.68	BC636	0.28	BF256	0.38	BY226	0.25	LA1210	1.33	MN1435VX	12.40	SN29715N	6.04	TA7109	3.71	TDA1060	2.60	TIP32A	0.35
2N4444	0.99	2SC458	0.15	AN6610	2.40	BC637	0.24	BF257	0.34	BY227	0.20	LA1230	1.05	MP1192	5.07	SN29722	11.95	TA7122B/P	0.92	TDA1082	3.25	TIP32B	0.69
2N5293	0.50	2SC495	0.92	AN7111	1.25	BC639	0.20	BF258	0.36	BY228	0.60	LA1320	2.87	MP2794	4.00	SN29723AN	8.77	TA7124P	2.34	TDA1151	1.22	TIP32C	0.40
2N5294	0.50	2SC515A	2.85	AN7115	3.38	BC640	0.24	BF259	0.34	BY229-1000	1.12	LA1357N	11.07	MP2812	5.07	SN29764AN	1.65	TA7129P	1.50	TDA1190	2.11	TIP33	0.85
2N5296	0.49	2SC535	0.79	AN7145	1.68	BCX34	0.18	BF262	0.28	BY229-600	0.92	LA1363	1.05	MP8512	1.57	SN29767	4.90	TA7130P	0.63	TDA1190Z	3.96	TIP33A	1.05
2N5297	0.50	2SC536	0.45	AN7146	2.05	BD115	0.34	BF263	0.57	BY255	0.66	LA1364	3.02	MPC596	2.13	SN29770BN	1.95	TA7136AP	1.89	TDA1200	1.51	TIP33C	0.80
2N5298	0.61	2SC537	0.54	AN7151	2.37	BD116	0.70	BF271	0.34	BY295-600	1.03	LA1365J	2.08	MPF256C	0.60	SN29772BN	4.91	TA7137P	0.73	TDA1235	3.88	TIP34	0.50
2N6109	1.58	2SC605L	1.16	AN7156	2.85	BD124	1.31	BF273	0.20	BY298	0.36	LA1385	1.53	MPS6570	0.48	SN29771BN	1.65	TA7141AP	3.87	TDA1236	4.30	TIP41A	0.49
2N6130	0.80	2SC620	0.95	AN7158	2.34	BD131	0.57	BF274	0.20	BY299	0.45	LA1387	5.95	MPSA42	0.65	SN29791	2.98	TA7146	2.50	TDA1270	3.55	TIP41B	0.65
2N6133	1.25	2SC643A	1.54	AN7218	1.64	BD132	0.20	BF324	0.35	BY407	0.90	LA3350	1.00	MPSA56	0.27	SN29798N	5.56	TA7146P	4.23	TDA1327A	1.33	TIP41C	0.25
2N6180	0.95	2SC668	0.67	AN7223	4.25	BD133	0.53	BF336	0.33	BY409	1.49	LA3361	0.91	MPSA92	0.72	SN2709	0.44	TA7148P	1.67	TDA1412	0.92	TIP42A	0.49
2N6292	1.65	2SC681	4.40	AU107	3.50	BD135	0.36	BF337	0.45	BY448	1.35	LA3390	5.52	MPSU05	0.86	SN7400N	0.34	TA7149P	3.26	TDA1420	2.55	TIP42B	0.53
2SA1006	1.50	2SC682	1.88	AU110	2.25	BD136	0.26	BF338	0.33	BY713	0.65	LA4032P	1.40	MPSU10	1.45	SN7401N	0.36	TA7152P	2.72	TDA1440	3.45	TIP42C	0.25
2SA1011	1.65	2SC684	1.65	AU113	6.40	BD137	0.26	BF355	0.49	BYW56	0.14	LA4100	0.87	MPSU56	0.78	SN7402N	0.65	TA7161P	4.50	TDA1470	2.90	TIP47	0.37
2SA1015	0.49	2SC693	0.63	AY105K	2.08	BD138	0.33	BF362	0.62	BYX55-600	0.23	LA4101	0.94	MPSU60	1.98	SN7404N	0.52	TA7162P	3.61	TDA1470P	4.25	TIS43	1.43
2SA1012	1.25	2SC710	0.69	AY106	1.09	BD139	0.28	BF363	0.50	BYX71-600	0.85	LA4102	0.75	MR818	0.33	SN7408N	0.27	TA7172P	1.41	TDA1506	7.85	TIS90	0.28
2SA1020Y	0.89	2SC711A	0.50	BA524	8.21	BD140	0.29	BF371	0.50	BYX71-350	0.72	LA4112	0.56	MR854	0.85	SN7410N	0.27	TA7176P	1.54	TDA1510	4.60	TL011CP	0.95
2SA1027R	0.45	2SC717	1.28	BA310	0.14	BD144	1.70	BF391	0.25	BYY56	1.20	LA4125	1.88	MR914	1.20	SN74121	1.60	TA7193P	3.84	TDA1512	3.69	TL494CN	8.95
2SA473	0.75	2SC734	1.43	BA1310	1.98	BD150	1.25	BF417	0.84	BZY93C30	1.86	LA4138	4.55	MSM5816RS	17.35	SN7413N	0.74	TA7204P	2.16	TDA1515	2.60	TL072CP	2.55
2SA766S	4.95	2SC761-Y	0.95	BA1320	1.38	BD157	0.67	BF418	1.87	BZY88 RANGE	0.10	LA4140	0.70	MSM5840H	15.15	SN74141N	2.65	TA7206P	12.49	TDA1559	3.15	TMP4320	15.00
2SC1173Y	1.25	2SC783	3.98	BA1322	3.95	BD160	1.60	BF422	0.30	BZX61 RANGE	0.18	LA4192	1.55	MVS460-02	0.61	SN74151AN	1.51	TA7207P	2.34	TDA1670	4.48	TMS1024NLL	13.75
2SC1474	1.25	2SC790Y	1.85	BA1330	2.75	BD163	0.71	BF423	0.52	BZX79 RANGE	0.10	LA4220	1.04	NE542	2.65	SN74154N	1.27	TA7208P	1.12	TDA1770	6.85	TMS1025N	16.95
2SC1509	1.35	2SC828	0.28	BA145	0.19	BD166	0.42	BF450	0.35	C106D	0.46	LA4420	1.35	NE555	0.16	SN74190	1.35	TA7210P	1.45	TDA1905	1.27	TMS3720ANS	5.25
2SA1095	3.00	2SC867A	3.84	BA148	0.25	BD175	0.20	BF451	0.29	C106M	0.76	LA4422	1.72	NE556	0.65	SN7420N	0.55	TA7214P	3.63	TDA1908	2.98	TMS3748NS	14.95
2SA1103	6.55	2SC876	0.96	BA154	0.40	BD179	0.45	BF457	0.41	CA3046	1.55	LA4430	1.29	NP1106	7.25	SN7430	0.49	TA7215P	2.07	TDA1940	1.95	TMS3755	13.65
2SA329	0.40	2SC930	0.54	BA155	0.12	BD181	0.99	BF458	0.33	CA3089	0.83	LA4440	1.81	OA202	0.11	SN7440N	0.27	TA7217AP	1.45	TDA1950	2.95	TMS3894NL	19.25
2SA489	1.17	2SC935	4.13	BA156	0.05	BD182	0.99	BF459	0.52	CA3090AQ	3.25	LA4445	3.95	OA47	0.16	SN7472	1.54	TA7222	1.12	TDA2005	1.45	TMS5102NLL	6.25
2SA490	2.25	2SC940	4.68	BA159	0.08	BD183	0.99	BF460	1.45	CA3094	2.20	LA4460	1.47	OA91	0.14	SN7474N	0.44	TA7226	3.57	TDA2006	1.32	TUA2000	8.98
2SA493	2.25	2SD1128	2.90	BA182	0.24	BD184	1.21	BF469	0.22	CA3131EM	2.95	LA4461	2.95	OA95	0.13	SN7490AN	0.93	TA7229P	2.13	TDA2004	1.48	TY6010B	2.97
2SA562	0.57	2SD1138	0.94	BA222	1.66	BD187	0.53	BF470	0.55	CD4001	0.34	LA5112N	1.16	OC28	2.95	SN74LS26N	1.45	TA7230P	1.30	TDA2002	0.69	ULN2204	8.50
2SA564	0.75	2SD1273	1.56	BA302	1.24	BD189	0.69	BF471	0.33	CD4002	0.27	LA7020	13.86	OC29	2.15	SN76001N	1.65	TA7233P	1.67	TDA2003	1.00	UPA53C	4.94
2SA614	4.88	2SD1453	1.40	BA311	1.32	BD190	0.72	BF472	0.33	CD4008	1.35	LA7025	11.97	OC36	1.28	SN76013ND	3.50	TA7240AP	3.55	TDA2030	1.45	UPC1003	5.95
2SA628	1.14	2SD152K	2.64	BA312	1.45	BD201	0.65	BF479	0.35	CD4011	0.29	LA7027	10.92	OC44	0.35	SN76023N	2.75	TA7245P	3.55	TDA2140	1.68	UPC1009C	8.95
2SA639S	1.75	2SD198	4.20	BA313	0.76	BD202	0.60	BF480	1.38	CD4012	0.24	LA7040	9.20	OC45	0.18	SN76023ND	3.96	TA7310P	0.94	TDA2150	6.20	UPC1025H	2.20
2SA659	0.49	2SD234	0.49	BA317	0.08	BD203	0.50	BF491	2.20	CD4013	0.33	LA7042	3.90	OC72	0.44	SN76033N	3.65	TA7313AP	1.36	TDA2151	2.07	UPC1028H	0.86
2SA673	1.50	2SD235	0.60	BA318	0.02	BD204	0.41	BF506	0.43	CD4016	0.46	LA7800	1.00	OC75	0.44	SN76110N	1.13	TA7314	1.90	TDA2160	4.01	UPC1032H	0.62
2SA684	1.61	2SD24	2.29	BA328	1.65	BD207	1.79	BF532	0.45	CD4017	0.82	LA7801	1.30	ON236	1.06	SN76115AN	1.61	TA7323P	3.15	TDA2161	1.85	UPC1042C	8.95
2SA697	1.05	2SD257	1.98	BA333	1.37	BD208	0.34	BF596	0.18	CD4020	1.23	LB1274	3.61	ON782	1.98	SN76131	1.92	TA7325P	0.61	TDA2170	2.88	UPC1156H	1.45
2SA699	1.75	2SD292	2.59	BA335	6.27	BD222	0.50	BF597	0.27	CD4021	0.39	LC7800	9.20	OT121	1.45	SN76227N	0.85	TA7339P	1.85	TDA2270	2.25	UPC1161C	4.98
2SA715	0.95	2SD313	2.65	BA5102A	2.86	BD225	0.49	BF694	0.22	CD4023	0.28	LD3120	1.13	PT6042	2.45	SN76226DN	2.00	TA7340P	5.95	TDA2520	2.37	UPC1182H	1.50
2SA748	1.95	2SD325D	2.26	BA511	1.95	BD228	0.63	BF757	0.59	CD4025	0.64	LD3150	2.75	PT8504	4.98	SN76228N	3.27	TA7607AP	2.10	TDA2522	3.46	UPC1186H	0.79
2SA817	0.65	2SD350	5.20	BA514	2.20	BD229	1.05	BF759	0.47	CD4028	0.84	LM1017N	1.75	R1038	2.19	SN76242	8.95	TA7609	2.65	TDA2524	4.50	UPC1181H	1.03
2SA835	2.50	2SD353	7.50	BA521	2.52	BD232	0.50	BF761	1.05	CD4040B	0.85	LM1877	13.43	R1039	2.19	SN76243	8.50	TA7611AP	2.32	TDA2521	3.71	UPC1185H	2.10
2SA836	0.89	2SD389	2.41	BA524	8.94	BD234	0.42	BF762	0.50	CD4047	1.06	LM2808	6.25	R2008B	1.33	SN76396	2.90	TA7616P	5.25	TDA2525	3.80	UPC1188	7.40
2SA844	0.65	2SD401	1.40	BA526	7.98	BD237	0.47	BF869	0.47	CD4049	0.24	LM2877	7.45	R2009	1.98	SN76533N	2.47	TA7622AP	8.94	TDA2532	0.82	UPC1212C	1.72
2SA872	0.80	2SD414	1.98	BA527	2.98	BD238	0.39	BF870	0.30	CD4052	0.75	LM317CKC	1.08	R2010B	1.33	SN76532N	0.95	TA7628P	2.50	TDA2530	2.55	UPC1225H	3.25
2SA884	2.15	2SD471	2.13	BA532	1.50	BD239	0.45	BF959	0.42	CD4066	0.20	LM324N	0.98	R2029	1.33	SN76545	1.95	TA7629P	7.50	TDA2541	1.88	UPC1230	1.78
2SA937R	0.97	2SD560	2.95	BA536	2.05	BD240	0.57	BF960	0.49	CD4069	0.29	LM339N	0.35	R2030	1.33	SN76546N	3.30	TA7630P	0.95	TDA2540	0.66	UPC1238	1.15
2SA940	1.32	2SD600	2.98	BA6209	4.55	BD241	0.39	BF970	0.50	CD4070	0.66	LM340K	11.85	R2257	3.71	SN76549	2.59	TA7640AP	1.08	TDA2545Q	5.94	UPC1278H	2.15
2SA940-2	2.14	2SD601R	0.65	BA656	1.00	BD242	0.39	BFR39	0.44	CD4081	0.35	LM348N	2.15	R2265	1.49	SN76570	3.08	TA7672P	2.55	TDA2560	0.76	UPC1351C	1.81
2SA950	0.72	2SD613	1.03	BA7100	11.35	BD243A	0.35	BFR61	0.92	CD4093	0.72	LM380N	2.80	R2305	1.18	SN76611	2.59	TA7676P	2.81	TDA2575A	0.50	UPC1350C	1.00
2SA951	1.75	2SD636	0.55	BA841A	28.98	BD243C	0.29	BFR62	0.50	CD4511	1.10	LM384N01	3.25	R2322	0.59	SN76620	2.59	TA7726P	12.50	TDA2578A	2.57	UPC1353	1.40
2SA966-Y	1.16	2SD639-R	0.72	BA843	3.96	BD244	0.45	BFR79	0.29	CD4528	2.04	LM567CN	1.71	R2323	0.76	SN76660N	2.48	TAA320A	1.27	TDA2576A + Kit	12.35	UPC1355C	2.13
2SA999	1.36	2SD655	0.98	BA854	5.76	BD244C	0.79	BFR81	1.65	CD4556	1.47	LM6402/011	10.23	R2354A	2.01	SN76666N	1.20	TAA350A	6.45	TDA2581	1.60	UPC1363	1.00
2SB774	1.15	2SD657	3.50	BAV18	0.21	BD245C	0.99	BFR86	1.08	CR02AM-8	1.70	LM6402A093	10.15	R2354B	2.01	SN76708	4.86	TAA570	1.85	TDA2582	1.80	UPC1362	2.64
2SB185	1.13	2SD661A	0.80	BAV19	0.11	BD246C	0.77	BFR89	1.63	CV12E	4.09	LM748	0.69	R2443	0.88	SN76709N	3.30	TAA621AX1	4.85	TDA2591	2.50	UPC1365C	1.65
2SB375	3.87	2SD731	1.05	BAV20	0.35	BD253	1.05	BFR90A	0.90	CX095D	3.14	LM8360	3.87	R2461	1.50	SN76707N	5.11	TAA621A12	2.14	TDA2594	3.40	UPC1366	2.25
2SB400	0.40	2SD773	0.60	BAV21	0.12	BD278A	0.60	BFX29	0.34	CX104	9.64	LM8361	3.57	R2540	1.91	SN76705N	6.60	TAA661B	2.62	TDA2593	2.47	UPC1360C	4.51
2SB405	1.03	2SD811	3.30	BAW62	0.11	BD317	2.60	BFX84	0.37	CX108	12.48	LR3419	9.37	R2540X	3.30	SN76730	6.00	TAA691	8.58	TDA2595	1.69	UPC1378H	1.25
2SB511	2.50	2SD823	1.98	BAX12	0.48	BD318	2.00	BFX85	0.41	CX109	7.86	LR3471	9.37	R2615	0.67	SN76810N	0.60	TAA700	2.37	TDA2600	5.60	UPC141C	4.95
2SB54	1.39	2SD837	1.56	BAX13	0.11	BD375	0.42	BFX86	0.36	CX130	8.76	LU1141	7.27	RCA2060	2.00	SN76832N	1.35	TAA930	4.87	TDA2611AQ	2.98	UPC1458	3.34
2SB546	0.56	2SD841	2.60	BAX16	0.11	BD380	0.76	BFX87	0.55	CX134	12.32	LU52012	5.95	RGP01-15	1.65	SN94041	5.54	TAA970	2.83	TDA2612Q	4.68	UPC151C	2.95
2SB56	2.80	2SD856	1.25	BC107B	0.18	BD410	0.52	BFX88	0.34	CX136	11.49	LU52011	14.95	RGP10	0.30	SN94042	5.54	TAG626-600	1.20	TDA2611A	1.05	UPC2002	1.48
2SB618A	2.22	2SD857Q	1.84	BC108B	0.15	BD433	0.47	BFX89	0.44	CX139	11.83	LU03112	12.37	RGP30M	0.28	SP8385	0.55	TBA120AS	0.69	TDA2610	3.08	UPC30C	2.51
2SB631	1.45	2SD882	1.15	BC109B	0.15	BD434	0.56	BFY50	0.30	CX157	5.52	M193	6.83	RT402	1.58	SPS5384	1.98	TBA120SB	1.05	TDA2620	2.15	UPC324C	4.17
2SB643	0.50	2SD894	1.75	BC113	0.14	BD435	0.49	BFY51	0.25	CX158	5.50	M21C	1.13	RT905A	2.38	ST1702L	0.99	TBA120T	0.97	TDA2630	1.96	UPC32C	5.25
2SB669	3.67	2SD898	1.85	BC119	0.36	BD436	0.60	BFY52	0.27	CX177	6.46	M23C	1.98	S1299	5.34	STA401	6.76	TBA120U	0.62	TDA2631	2.73	UPC339C	4.35
2SB681	3.96	2SK105H	2.15	BC126	0.23	BD437	0.49	BFY79	0.49	CX187	6.84	M293	6.95	S2800D	5.54	STA441C	3.00	TBA120A	1.05	TDA2640	2.96	UPC41C	4.10
2SB695	1.98	7805-T022	0.63	BC132	0.14	BD438	0.40	BFY90	0.61	CX755	12.95	M51102L	1.86	S2802	3.47	STA471C	7.95	TBA1440	1.78	TDA2652	13.45	UPC4558C	2.15
2SB774	0.65	7808	0.85	BC135	0.14	BD441	1.42	BLY49	2.20	CX885A	6.85	M5115P	5.24	S2818	0.85	STK0029	3.33	TBA1441	1.62	TDA2653	2.95	UPC474	5.11
2SB819	1.13	7812-T022	0.35	BC137	0.18	BD442	1.41	BR100	0.29	E1222	0.40	M51203L	3.15	S3702S	6.15	STK0050	5.63	TBA240A	2.65	TDA2654	6.18	UPC554C	1.21
2SC1096	1.16	7815	0.64	BC138	0.34	BD509	1.65	BR101	0.65	E5024	0.28	M51231P	0.95	S40W	18.64	STK016	8.45	TBA395	1.10	TDA2670	2.54	UPC575C2	0.77
2SC1104	3.98	7905	0.80	BC139	0.28	BD510	0.62	BR103	0.55	E5386	0.25	M5134 9341	4.13	S6080B	8.80	STK022	5.25	TBA395Q	1.10	TDA2680	3.20	UPC580C	2.85
2SC1106	4.54	AC133	0.12	BC140	0.45	BD519	0.98	BR303	1.15	GD243	4.34	M51353P	5.25	SA8063	5.17	STK031	12.95	TBA396	1.20	TDA2740	6.00	UPC587C2	1.34
2SC1114	3.25	AC127	0.27	BC141	0.34	BD529	0.80	BRC84	2.08	GF758	0.84	M51381P	5.45	SAA1006	1.85	STK040	13.34	TBA400	2.39	TDA2780AQ	5.14	UPC592H	2.15
2SC1116	4.95	AC128	0.34	BC142	0.23	BD530	1.18	BRX44	0.60	HA11215	1.75	M51393AP	9.35	SAA1020	4.76	STK054	7.13	TBA440C	2.34	TDA2795	2.78	UPC595	1.15
2SC1124	1.28	AC138	0.24	BC143	0.19	BD533	0.67	BRX49	0.67	HA11211	2.53	M51394P	14.05	SAA1025	4.40	STK058	27.50	TBA480Q	1.30	TDA2791	2.5	UPC596	1.80
2SC1129	1.65	AC141	0.29	BC147	0.13	BD534	0.52	BRY39	0.69	HA11225	1.12	M5142P	6.85	SAA1024	2.81	STK077	5.96	TBA510	2.11	TDA2910	13.25	UPD1514C	4.76
2SC1131	0.64	AC142K	0.35	BC148B	0.13	BD535	0.45	BSS38	0.87	HA11229	1.96	M5144P	2.97	SAA1075	4.25	STK1039	5.10	TBA520	1.15	TDA3300B	6.98	UPD2819C	4.98
2SC1158	3.33	AC176	0.30	BC148C	0.11	BD536	0.61	BSTB0140G	5.25	HA11235	1.47	M51513L	1.56	SAA1121	7.44	STK2110	7.33	TBA520Q	1.68	TDA3330	2.95	UPD4013B	4.00
2SC1162	0.55	AC179	0.28	BC149B	0.13	BD537	0.80	BSTC0246	6.99	HA11124	5.25	M51515BL	2.15	SAA1124	3.30	STK2145	16.95	TBA530	1.30	TDA3506	4.40	UPD4066B	4.95
2SC1172	2.22	AC183	0.72	BC153	0.14	BD538	0.80	BSTC0233	7.25	HA1125	1.17	M51517L	1.61	SAA1130	4.99	STK2240	16.65	TBA530	1.30	TDA3501	7.25	UPD553-164	19.52
2SC1195	3.26	AC187	0.39	BC154	0.14	BD544B	0.83	BSTCC0143	3.07	HA1137W	1.26	M5192	2.20	SAA1174	7.77	STK2250	18.95	TBA540	1.15	TDA3500	4.25	UPD8049C-1	11.50
2SC1213	0.89	AC188	0.37	BC159	0.36	BD677	0.69	BSTD1043	2.85	HA1138	5.03	M5194AP	5.74	SAA1250	4.15	STK3042	4.95	TBA540Q	1.15	TDA3510	5.95	X0022CE	5.75
2SC1226	1.46	AC188K	0.43	BC160	0.40	BD679	0.57	BSV57B	3.49	HA11414	5.65	M5231L	1.95	SAA1251	3.20	STK3044	5.75	TBA560C	1.40	TDA3520	9.71	X0029CE	7.09
2SC1293	0.90	AD140	1.06	BC161	0.28	BD680	0.76	BSW68	0.60	HA1156	0.80	M53274P	1.33	SAA1351	8.11	STK4019	4.50	TBA560CQ	1.60	TDA3540	6.99	X0031CE	4.95
2SC1306	1.98	AD143	1.93	BC168	0.36	BD681	1.48	BSX19	1.29	HA1160	4.78	M54532P	1.88	SAA3027P	2.56	STK433	6.25	TBA570Q	1.35	TDA3541	2.22	X0035TA	5.98
2SC1317	0.50	AD145	1.60	BC169C	0.16	BD696	2.47	BSX20	0.30	HA1166X	6.43	M54544L	3.45	SAA5000	2.50	STK4332	4.30	TBA570A	1.71	TDA3560	4.25	X0040TA	4.50
2SC1364	0.49	AD161	0.30	BC170	0.16	BD699	3.49	BSY52	0.50	HA1167	6.45	M58478P	8.77	SAA5010	4.40	STK435	4.93	TBA651	0.87	TDA3571Q	2.83	X0042CE	4.35
2SC1383	1.20	AD162	0.30	BC171	0.11	BD700	3.70	BSY79	0.51	HA11706	3.61	M58485P	14.25	SAA5012	5.50	STK4352	1.95	TBA673	2.60	TDA3576	7.48	X0043CE	2.75
2SC1391	2.45	AF114	2.47	BC172B	0.27	BD707	0.98	BT108	1.45	HA11705	5.00	MA06	1.07	SAA5020	5.78	STK436	3.95	TBA700	1.85	TDA3590	5.79	X0056CE	6.25
2SC1398	0.75	AF115	0.79	BC173	0.17	BD709	1.05	BT119	1.76	HA11703	3.84	MA8001	0.82	SAA5030	8.25	STK437	5.62	TBA720	3.50	TDA3591	6.45	X0057GE	6.00
2SC1413A	3.05	AF118	1.20	BC174B	0.27	BD710	0.80	BT120	2.17	HA11701	2.98	MA8003	1.16	SAA5050	7.74	STK4372	11.15	TBA730	3.55	TDA3650	5.90	X0062CE	8.35
2SC1446	1.25	AF127	0.79	BC177	0.35	BD809	0.80	BT121	2.48	HA11710	3.13	MB3705	1.44	SAB1009B	5.98	STK460	7.02	TBA750Q	2.90	TDA3652	2.60	X0065CE	4.60
2SC1447	2.07	AF139	0.40	BC178	0.26	BD810	0.69	BT123	1.98	HA11713	9.75	MB3712	1.00	SAB3011	7.34	STK466	11.77	TBA760	1.71	TDA3651AQ	3.95	X0074GE	10.00
2SC1475	0.60	AF178	1.45	BC179	0.26	BD879	0.74	BT151-800R	0.89	HA11711	7.50	MB3713	1.69	SAB3013	3.76	STK4833	10.95	TBA800	0.92	TDA3651	2.95	X0077GE	15.96
2SC1505	1.00	AF179	0.56	BC182	0.05	BD895	2.31	BTT6018	2.42	HA11715	3.25	MB3730	2.09	SAB3021	7.90	STK501	5.28	TBA810S	1.61	TDA3651A	2.96	X0079CE	4.95
2SC1514	1.69	AF180	0.56	BC182LB	0.07	BD901	0.99	BU106	2.48	HA11714	9.75	MC13002	3.60	SAB3024	6.36	STK502	7.25	TBA810T	1.50	TDA3950	4.50	X0092CE	4.95
2SC1573Q	1.25	AF181	0.53	BC183LB	0.26	BD902	0.84	BU108	1.50	HA11716	13.10	MC1310P	0.58	SAB3209	5.82	STK5314	12.40	TBA810AS	1.00	TDA4050B	3.95	X0096CE	5.95
2SC1583	0.50	AF186	0.53	BC184	0.13	BDW83C	1.45	BU109	2.65	HA11725	18.26	MC1327P	0.40	SAB3210	3.10	STK5730	2.99	TBA820	1.52	TDA4280	5.95	X0109CE	11.25
2SC1617	3.89	AF239	0.43	BC184LB	0.26	BDW84C	1.56	BU110	5.69	HA11725MP	16.00	MC1330P	1.91	SAF1032P	3.58	STK7216	14.50	TBA820M	0.82	TDA4290	4.47	X0113CE	2.07
2SC1678	1.98	AF279	0.88	BC186	0.25	BDX32	1.75	BU125	2.48	HA117555P	6.23	MC1350P	1.66	SAF1039	2.95	STK772	6.95	TBA890	2.50	TDA4400	2.27	X0195CE	7.50
2SC1741	1.25	AN115	3.98	BC187	0.28	BDX53A	1.25	BU126	1.45	HA11781	19.90			SAS5010	8.39	STR1096	4.98	TBA920	1.53	TDA4420	2.55	X0204CE	8.74
2SC1810	1.70	AN155	1.89	BC204	0.16	BDX53B	1.85	BU137	6.53	HA1180	5.15			SAS560S	1.86	STR4090	10.55	TBA920Q	2.31	TDA4422	3.65	X0261CE	8.75
2SC1815	0.45																			TDA4427S	9.00	ZPY120	3.25

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Storing TV Pictures in Chips

Part 3: Picture-in-picture displays

Eugene Trundle

The systems described in Parts 1 and 2 of this series present the picture stored in memory as a full-screen display. This enables the video signal to be stored in composite form. To inlay a small picture in the main picture display calls for more complex digital and analogue circuitry. The inlay picture (PIP) is not presented in real time – its width is a fraction of the 52μsec active line period while its height is a fraction of the 18·4msec active field period. To achieve a PIP display a "time warp" in the readout from the memory is required. It's done by using different writing and reading rates. In addition the composite video signal for the PIP display must be decoded to YUV form (separate luminance plus U and V chrominance signals) before storage in digital form in the memory, then recoded to PAL (or whatever system is in use) form after readout from the memory and DA conversion. One advantage however is that the memory capacity required is not so great as with a full-screen display, since the information processed and stored occupies only a small area of the screen, typically one ninth.

The need for colour decoding/encoding becomes obvious when it's appreciated that for correct colour the processed PIP signal must be governed by the same subcarrier as that used for the main picture on the screen. The U and V components of the reconstituted PIP signal are PAL encoded, then added to the PIP luminance signal and finally the composite PIP signal is switched into the main-screen video signal in synchronism with the latter's line and field scanning. The timing of the PIP readout, in relation to the main-screen scanning, determines the position of the inserted PIP – it's usually placed in one of the four corners of the screen.

The Hitachi VT250

The description which follows is based on the PIP processing section of the Hitachi VT250 VCR. That used in the Sanyo Model CBP2146 colour TV receiver (see the photograph on the cover of the July 1987 issue) is similar in many respects.

Video Sampling

The first step in producing a PIP display is to sample the video waveform of the picture to be used for the purpose. Fig. 17 shows this process. The outer rectangle is 20msec high and 64μsec wide, embracing the entire field period. The longer dashed line shows the active (display) picture area, consisting of 288 lines each containing 52μsec of video information. The shorter dashed rectangle shows the part that's sampled for PIP use. It consists of 264 lines each of which contains part of the line blanking period (for clamping purposes) and all the picture information. Sampling is done at a frequency of about 10·74MHz (intervals of 93·122nsecs). Thus each line is divided into 687 samples. The first 32 samples of each line are discarded, leaving 655 samples. Two out of every three of these are discarded, the remaining 218 evenly-spaced samples being retained. Similarly, two out of every three scanning lines are discarded, leaving 88 lines.

We now have a rather coarse picture consisting of 88 lines each with 218 samples. This is what's committed to memory. When it's reproduced, the lack of detail (with a test card, the lack of some of the horizontal *and* vertical features!) will be consistent with its size in relation to the main picture. We can't anyway reproduce detail that's smaller than one standard scanning line. The original picture to be used as the PIP display has thus been compressed to about one ninth (one third by one third) of its original area.

Memory Capacity

After sampling, quantisation to give 64 possible levels of signal amplitude takes place, the result being an AD converted signal consisting of six-bit words. We can therefore calculate the memory capacity required for the PIP display. One field of 88 lines with 218 six-bit samples gives us a total of 115,104 bits. For reasons that will become clear shortly, it's necessary to store two such fields, so the memory must be able to store 230,208 bits. Two memory chips are used, each arranged in 64K × 4-bit form: this total of 512K is very sparingly used, in order to simplify the addressing and memory management. Writing into the memory takes place in real time, whereas the readout is three times faster in order to print the PIP in a small area of the screen.

Signal Processing

The PIP signal processing carried out in the Hitachi VT250 VCR is outlined in Fig. 18. The incoming signal is first fed to a PAL decoder which splits the composite signal into baseband Y, U and V outputs. It also produces an alternating V subcarrier for ident purposes. The YUV outputs are then bandwidth limited by filters, the Y signal to 1·3MHz and the U and V signals to 200kHz each. The alternating V characteristic (the PAL R – Y signal switching) is removed by a switched inverter that works at 7·8kHz. The three separate video signals are next applied to the "contacts" of an electronic multiplexing "rotary switch" that revolves at 3·58MHz (fs), which is one third of the effective sampling frequency of 10·74MHz. Thus this is the point at which two in three of the signal samples are discarded.

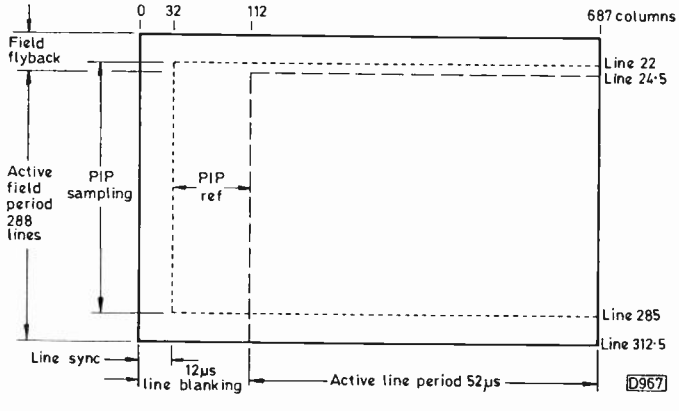

Fig. 17: PIP sampling area of the incoming picture. The area within the broken lines is processed in digital form. Sampling takes place during lines 22 to 285 inclusive, embracing vertical columns 32 to 687.

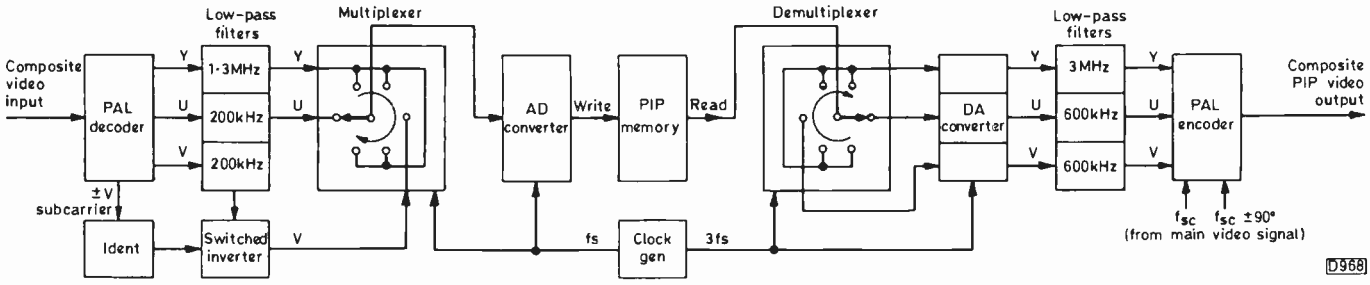

Fig. 18: Simplified block diagram of the PIP processing system in the Hitachi VT250 VCR.

The output from the "wiper" of the rotary switch consists of a time–division multiplexed sequence as follows: U,Y,Y,V,Y,Y. So the Y signal is sampled four times for each sample of U and V, giving a sampling frequency for the Y signal of about 2·4MHz and a sampling frequency for each of the U and V colour-difference signals of about 600kHz. Hence the need for the low-pass signal filtering: the sampling rate in AD conversion must be at least twice the highest likely frequency of the signal being sampled. Next comes a 6-bit AD converter, which again operates under the control of the 3·58MHz clock signal. Its output is passed into the memory.

PIP Readout

The sequential YUV digital data read from the memory passes to a demultiplexing rotary switch which this time works faster – at 3 × fs, i.e. 10·74MHz. Since the switch operates in synchronism with the memory readout, the YUV data is separated on a strobe basis. It's then passed to separate DA converters, which are controlled by the same 3fs clock signal. After passing through individual low-pass filters/integrators the analogue Y, U and V signals are ready for recoding into composite PAL form. Two subcarrier feeds from the main-screen video signal are used to govern this process, so that the colour of the PIP display is correct – the main-screen swinging burst signal acts as the reference for both.

Finally a white box (PIP outline) is generated, to emphasise the border between the inlay picture and the main picture, and added to the composite PIP signal. Gating then inserts the PIP signal into the video output while the main-screen display is blanked for the duration of the PIP.

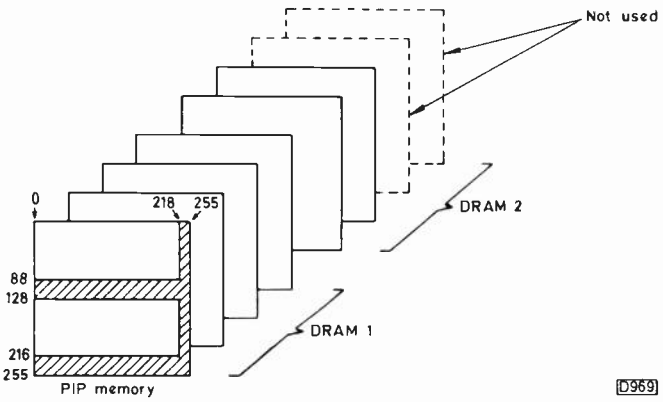

Fig. 19: Way in which the memory is arranged and used.

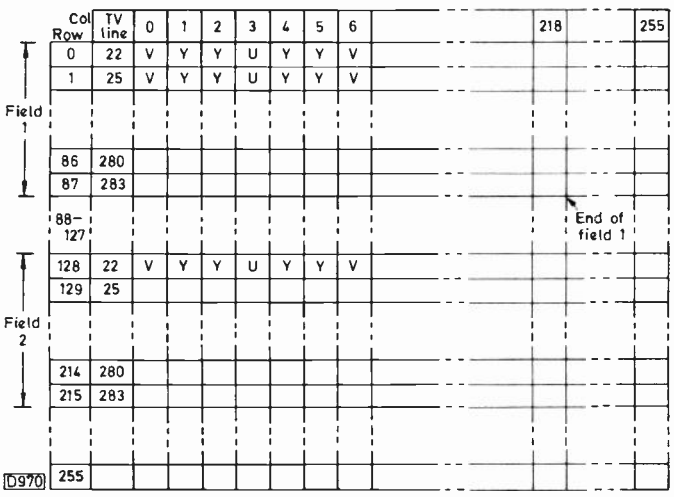

Fig. 20: Memory map for the storage DRAMs. All six memory pages (arrays) are laid out similarly.

The PIP Memory

Fig. 19 shows the way in which the storage DRAMs are arranged. We have to store six bits at a time, for which all four pages of DRAM one plus two pages of DRAM two are used. Each page consists of 256 × 256 cells, and is divided into two halves. The upper halves form one field store, the lower halves forming the second – as previously mentioned, two fields are stored. This need to store two fields arises from the fact that we must be able to write and read data simultaneously. As the upper store is being written into, the lower store is being read and vice versa.

Consider a field of incoming video being written into the upper half of the memory. It comes in on a unidirectional bus, with the first bits being stored at the top left-hand corner of each of the six pages in use. The first TV line to be stored is no. 22 (see Fig. 17). It starts at memory cell 0, with a V (R − Y) sample – a memory map is shown in Fig. 20. Next come two Y samples, then one of U (B − Y), two of Y and so on until the end of the PIP TV line is reached at memory column 218. The second PIP TV line ("real" line 25) is next stored in row two of the memory and so on until all 88 lines of the PIP field have been written in. We have now reached column 218 in row 87 of the memory page.

Memory rows 88-127 are not used. PIP field two is stored in the lower half of the memory page, on rows 128-215 inclusive. As PIP field two is being written in – in synchronism with its own line and field sync pulses – PIP field one is being read out of the memory. Each row of 218 bits passes into a 256-bit buffer memory within the storage chip. At the beginning of each main-screen line scan, one line (218 bits × 6) of PIP data is transferred from the main memory to the line buffers. It's then read out at 3fs to shorten the time-axis to one third. This ability to write and read at different rates is the key to TV standards conversion as well as PIP effects.

The memory system does not require a refresh operation since there's no PIP freeze frame facility with this design.

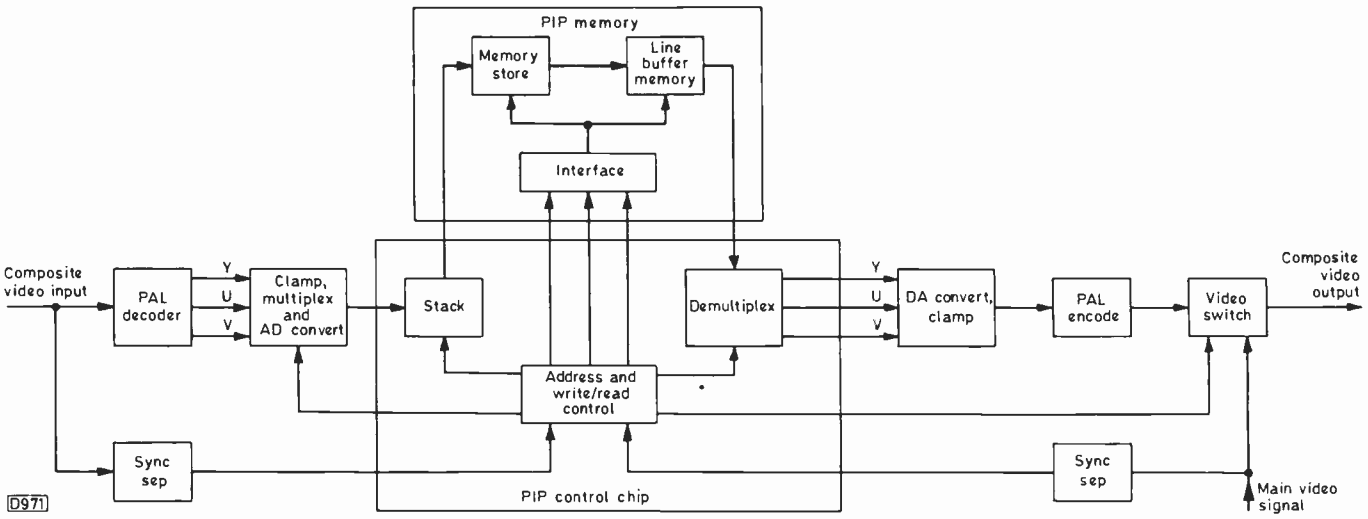

Fig. 21: Block diagram showing the PIP control chip and the associated PIP processing arrangements.

Thus the write/read cycle is continuous in 20msec periods, during which the data can be sustained in the DRAM cells.

PIP Control Chip

As with the previous systems we've looked at, the memory control chip is a complex gate array. It governs the write/read operation and provides clock pulses for the AD and DA converters, the multiplexer, the internal demultiplexer and the PIP-insert switching. A block diagram showing its main functions is provided in Fig. 21. The stack at its input data port is required because reading from memory is given priority over writing into memory. This calls for a temporary "queueing area" for the data to be written in. It takes the form of six pairs of memory cell arrays, in which the data to be written into the memory is held for a 1/fs period then released in the following cycle. The stack process is triggered by the main-screen display line sync pulses. Further functions carried out by the memory control chip are mode control, the provision of blanking and clamping pulses for the PIP analogue processes, generation of the pulses that provide the edge (white border) and PIP position control.

Next Month

In the concluding instalment next month we'll look at the multi-function memory that provides a comprehensive range of digital functions in the Sanyo VHRD500/700 series of VCRs.

The Ferguson TX99 Chassis

J. LeJeune

The TX99 is the latest development from Ferguson in the evolution of its TV chassis designs. It's partly a replacement for the popular TX90 chassis, which was originally introduced for small-screen colour portables and went on to drive tube sizes up to 20in. The TX85 (see *Television*, October 1987) has already been introduced to cater for small-screen colour portable use. The new TX99, which is very much updated in comparison with the TX90, is to be used as a basic 90° chassis capable of driving a wide variety of tubes, though most models will probably be fitted with 15, 17, 19 and 21in. FS tubes.

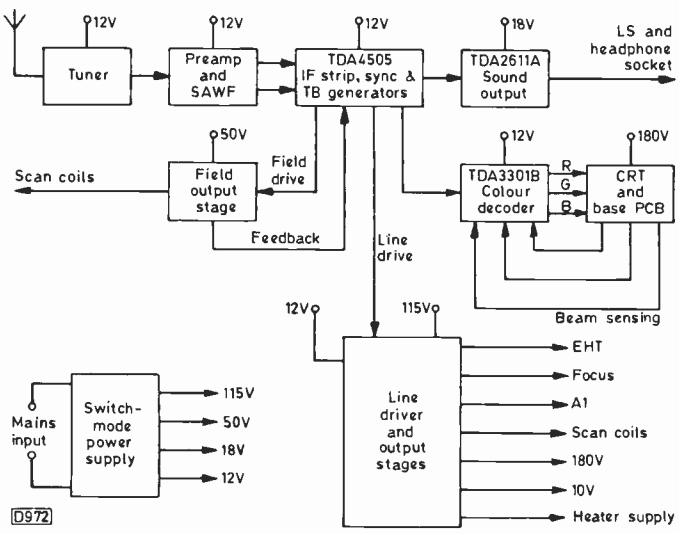

Fig. 1: Block diagram of the TX99 chassis.

Major improvements on the TX90 chassis are automatic grey-scale correction, non-interlaced teletext and improved line sync – there's a dual-loop oscillator in the TDA4505 chip. The customer controls are no longer fixed to the main PCB, giving greater freedom over cabinet presentation. The new chassis is SECAM/NTSC adaptable and has automatic 50/60Hz field rate switching. A free-running switch-mode power supply provides mains isolation and operation over a mains input voltage range of 175-265V a.c. r.m.s.

The c.r.t. base panel varies to suit the tube type. The following circuit description covers the basic PC1210 PCB. A block diagram of the receiver is shown in Fig. 1.

The Power Supply

The switch-mode power supply (see Fig. 2) is based on the well-known Siemens TDA4600 control chip, the circuit being very similar to that used in the TX100 chassis. A bridge rectifier produces a rough d.c. supply of around

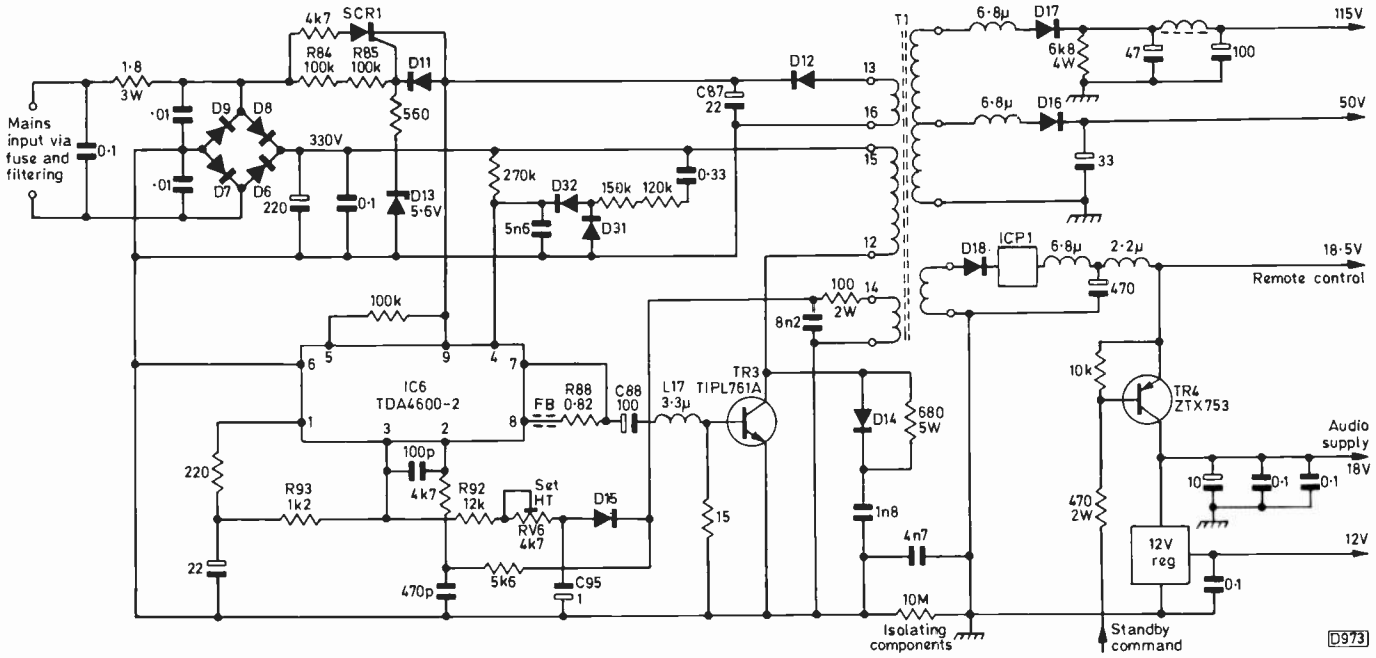

Fig. 2: The switch-mode power supply circuit.

350V from the mains input. The degaussing and mains filtering is conventional, the degaussing coils being double-insulated.

The chopper transistor TR3 is driven from pins 7 and 8 of the control chip. Forward drive to turn TR3 on is from pin 8 via R88 which is used to adjust the level of drive. The pull-down pin 7 ensures that TR3 turns off rapidly, preventing unwanted power dissipation.

A start-up voltage for the power supply is provided by thyristor SCR1. A.C. from one side of the bridge is fed to the anode of this device, whose gate is connected to the same source via R84/5. At switch on C87 will be discharged and the cathode of SCR1 will be at 0V. SCR1 charges C87, and when the voltage at its cathode is approximately 6·5V R84/5 can no longer turn the thyristor on because the voltage at its cathode exceeds the peak voltage at its gate. The voltage thus developed across C87 is applied to pin 9 of the chip. It's sufficient to bring IC6 to life, delivering short drive pulses to start up the chopper circuit. The pulses appearing at pin 13 of the chopper transformer T1 are rectified by D12: once the chopper circuit is running normally D12 and C87 provide a stable 12V supply for the chip. Pin 5 of the chip detects under-voltage conditions, shutting down the i.c. if necessary to prevent incorrect operation. Pin 4 senses changes in the mains supply and ripple on the unregulated input, the internal circuit cancelling these variations.

A 4V reference supply produced within the i.c. is available at pin 1. This reference voltage is coupled to pin 3 via R93. The output of a small winding on the transformer is rectified by D15 to produce a negative voltage which is also coupled to pin 3, via the set-h.t. control RV6 and R92. The effect of this is to offset the 4V reference voltage by about 1·5V so that the voltage at pin 3 is about 2·5V. It can be varied by RV6, which sets the outputs obtained from the power supply – the on/off times of TR3 determine the output voltages.

Pin 2 of IC6 is the input to a zero-crossing detector which senses, during TR3's off period, the point at which the voltages across the transformer's secondary windings fall to zero. When the a.c. at pin 14 of the transformer crosses zero and attempts to reverse, IC6 switches TR3 on to produce the next cycle of operation.

Three rails are derived from the chopper transformer, 115V for the line output stage, 50V for the field output stage and 18V for the audio circuit. This last rail also feeds a 7812 12V regulator which supplies the small-signal sections of the receiver.

Standby operation is obtained by turning TR4 off from the remote control unit. When its base goes high TR4 switches off, disabling the audio circuit, all the signal circuitry and the line and field oscillators. The switch-mode power supply keeps working in the standby mode, maintaining the supplies to the field and line output stages. Although there is a slight temperature rise within TR3 due to the high operating frequency in the standby mode, this is of no consequence.

Tuner and Signals Processor

The UK version of the TX99 comes equipped with a Ferguson SC4 tuner, the export versions having a combined v.h.f./u.h.f. tuner. The tuner's output is amplified by approximately 26dB in a single transistor (BF959) i.f. preamplifier stage which drives the i.f. bandbass shaping SAW filter. This is followed by a TDA4505-N4Y chip which contains most of the signal circuitry, apart from the colour decoder, and also the sync and timebase generator circuits. A pnp transistor (TR1) in the a.f.c. circuit clamps the a.f.c. line at 6V during setting up and channel changing.

A block diagram of the TDA4505-N4Y chip (IC2) is shown in Fig. 3. It contains the vision and sound i.f. amplifiers and detectors, the a.f.c. and a.g.c. systems, the sync circuitry and the line and field generators. The field output stage is driven directly from pin 3 but the line drive output at pin 26 goes to a conventional transformer-coupled driver stage.

The i.f. input is at pins 8 and 9. Synchronous detection is employed for low harmonic distortion and there's no a.f.c. coil, the 90° phase shift required by the a.f.c. detector being achieved within the chip. The detector tank coil L6 is set for a 6V a.f.c. output with a 39·5MHz carrier input; the sound detector coil L9 should be adjusted for best sound reception of an off-air transmission. A d.c. volume control sets the voltage at pin 11 of the chip and the audio output appears at pin 12 for feeding to a separate TDA2611A

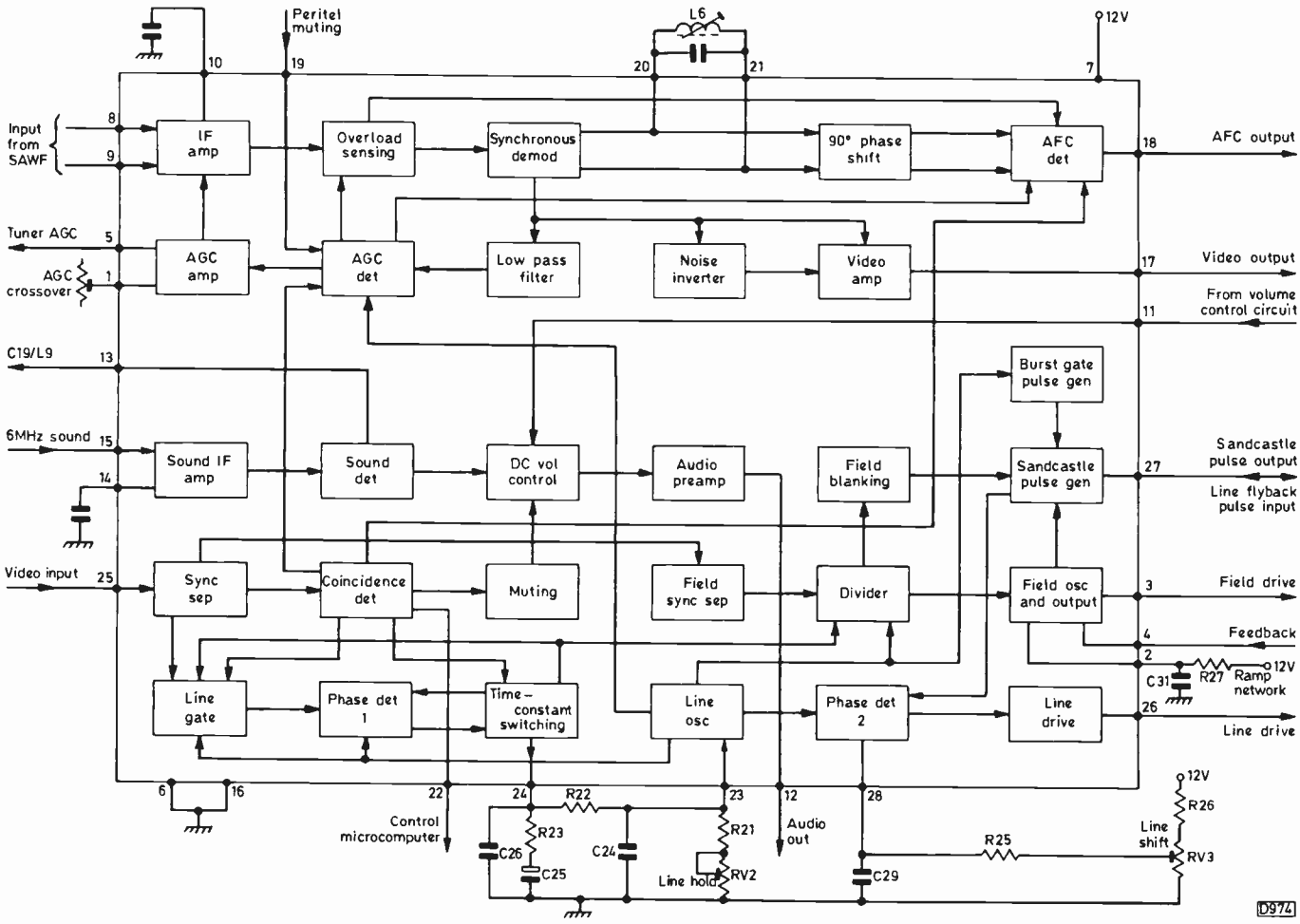

Fig. 3: Block diagram of the TDA4505 signals processor chip.

power amplifier (IC4). A.G.C. for the tuner appears at pin 5, an inverting stage (TR10, BC307B) being required with the SC4 tuner (but not with the UV411 v.h.f./u.h.f. tuner). The video output at pin 17 is fed to the colour decoder chip via an emitter-follower transistor (TR11, BC237B) and returns to the intercarrier sound section of the chip via a 6MHz ceramic resonator. A bridged-T filter in TR11's emitter circuit removes the 6MHz sound from the feed to the colour decoder chip and the return feed to the sync separator in IC2. TR11 is included to provide a low-impedance video source: this results in greater tolerance to stray capacitance effects, which can seriously degrade picture definition, in the PCB layout.

A flywheel sync circuit with two control loops maintains the line drive output at pin 26 in phase and frequency lock with the incoming line sync pulses. To set the line oscillator's free running frequency, the chip's sync input pin 25 should be linked to the 12V rail. The first control loop's error voltage appears at pin 24, where R23, C25 and C26 form a time-constant network. R22 couples this point to the line hold control network R21/RV2/C24 which sets the free-running frequency. The second control loop's error voltage output appears at pin 28 where the time-constant is set by C29 and R25. The earthy end of R25 is connected to the slider of RV3, which provides a means of varying the line phase for horizontal shift purposes.

The field oscillator makes use of a conventional *RC* network which is connected to pin 2 – C31 and R27 set the free-running field frequency, no field hold control being required. Field sync is achieved internally. A divide-by-312 circuit determines the window for the field sync pulse. Direct sync is used, the divider controlling the period during which the oscillator can be reset by a sync pulse.

A signal derived from the field divider is used to generate the appropriate amount of field blanking for the standard in use, 50 or 60Hz. The amplitude and duration of the field blanking signal are determined by the vertical blanking generator, whose output is mixed with the line blanking and burst gate pulses in the sandcastle pulse generator circuit.

Line blanking is most easily derived from the line flyback pulses, which are clipped and mixed in at pin 27. Correctly timed burst gate pulses are obtained from the rising edge of the line sync pulses, their duration being determined by accurate timing circuits within the chip..

Colour Decoder Chip

The TDA3301 is a newcomer to the range of colour decoder chips available. A block diagram is shown in Fig. 4. It incorporates automatic grey-scale correction which is now a standard feature, easing colour balance adjustment during manufacture and providing compensation as the tube ages. Three coils and one potentiometer comprise the only variable components for setting up. L13 forms part of a high-pass filter at the chroma input while L11, L12 and RV4 are associated with the chroma delay line. L11 is tuned to 4·43MHz. L12 and RV4 are adjusted for minimum Hanover bars. There's no subcarrier rejector adjustment: this is now incorporated in the luminance delay line.

Composite video is fed in at pin 37 while filtered chroma is fed in at pin 1. The luminance signal is first amplified by 10dB within the i.c., emerging at pin 35 to pass through the

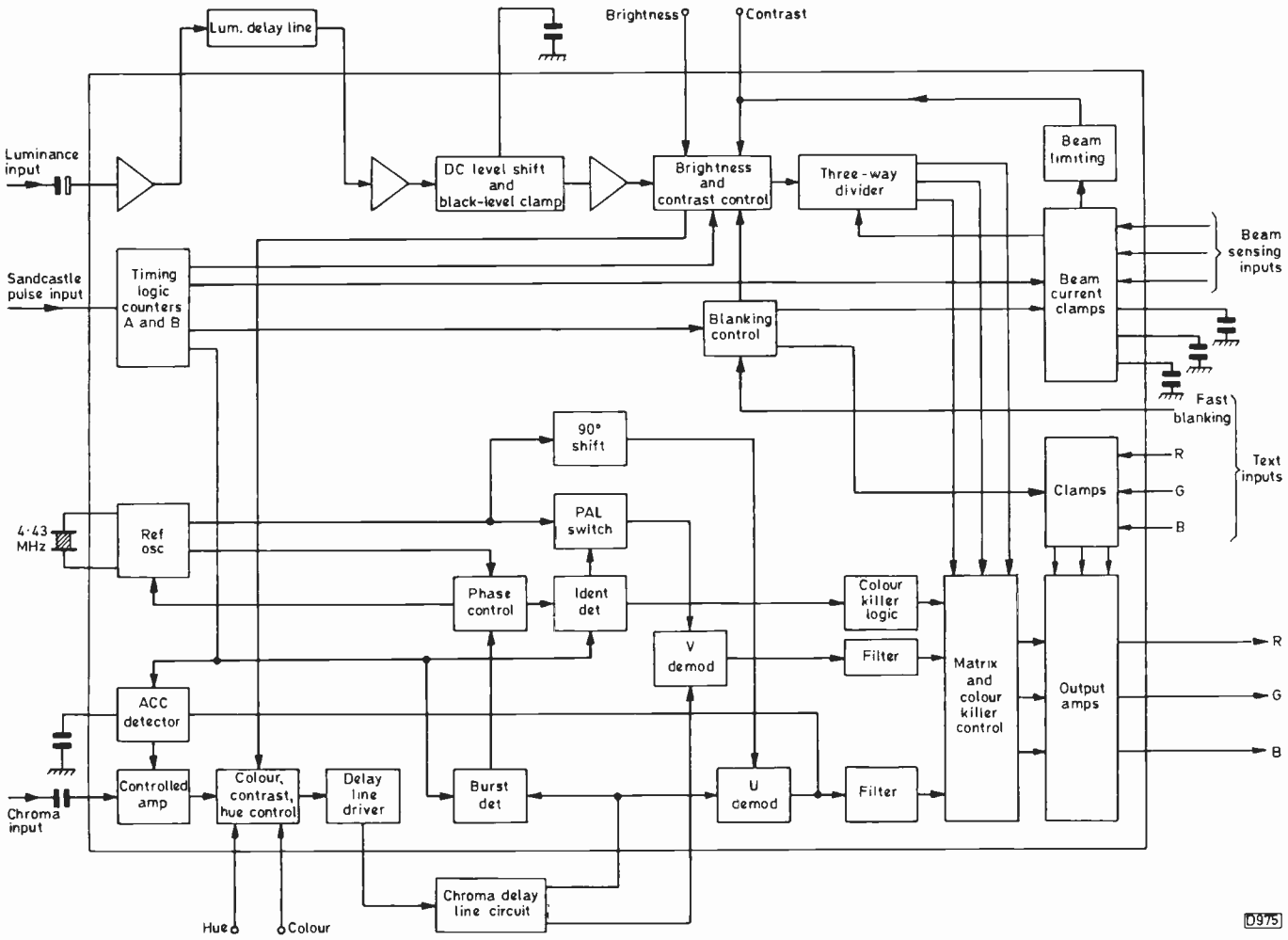

Fig. 4: Simplified block diagram of the TDA3301 colour decoder chip.

luminance delay line (and subcarrier trap). It re-enters the chip at pin 36. Internal systems operating on the luminance channel perform black-level clamping, contrast control and blanking. The contrast and saturation controls are interlinked. The effect of the brightness input at pin 30 is to shift the d.c. level on which the luminance signal sits. A preset brightness control is provided.

Beam limiting is carried out via the brightness and contrast systems. Fig. 5 shows the sensing circuit. Diode D27 is connected between the earthy end of the e.h.t. system and chassis and is forward biased from the 115V rail via R127 and R128, passing a forward current of approximately 600μA. The c.r.t. beam current flows via D27 in the opposite direction: when it reaches 600μA D27 switches off and the junction of D27/R128 goes negative. TR2 then provides beam limiting via emitter-follower action. For larger tubes the onset of beam current limiting can be raised to 1mA by closing link 56.

The chroma circuitry follows conventional practice. The reference oscillator operates at 4·43MHz, and the 90° phase shift required for U demodulation is achieved within the

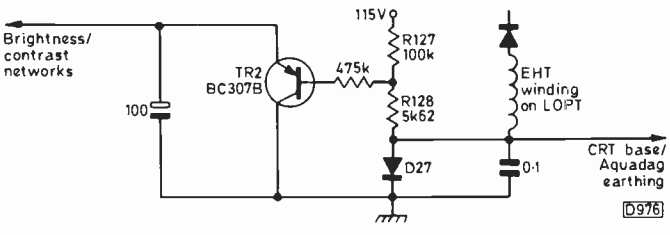

Fig. 5: The beam limiter circuit.

i.c. After filtering, the demodulated colour-difference signals are matrixed with the luminance signal and blanking signals are inserted. Blanking, burst gating and clamping are carried out by pulses produced by timing logic counters A and B.

Changeover to RGB teletext inputs (or from a peritel socket if fitted) is controlled by the "fast blanking" pin 23 which requires a steady d.c. input in excess of 700mV.

Automatic grey-scale correction is carried out by three clamps, one each for R, G and B. These are gated on to coincide with test signals which are added to the RGB outputs during the line blanking periods – this is done within IC3. Feedback is from resistors in the collector circuits of the emitter-followers TR22/24/26 incorporated between the RGB output transistors TR21/23/25 and the c.r.t.'s cathodes. The dark level beam current is set at 16μA by resistors R65/6/7. There is also dynamic beam limiting which is set by R57 and limits the peak current of any one gun to 3mA.

RGB Output Stages

Fig. 6 shows one of the RGB output circuits (green). TR23 is a class A amplifier whose output is buffered by the emitter-follower TR24. The resultant low-impedance c.r.t. drive allows fast charge and discharge of the c.r.t.'s cathode input capacitance, giving good bandwidth. The output circuits follow convention in being mounted on the c.r.t. base panel, removing the bandwidth limitations associated with long leads. The video gain is set by RV22 which allows peak-white colour adjustment during grey-scale alignment.

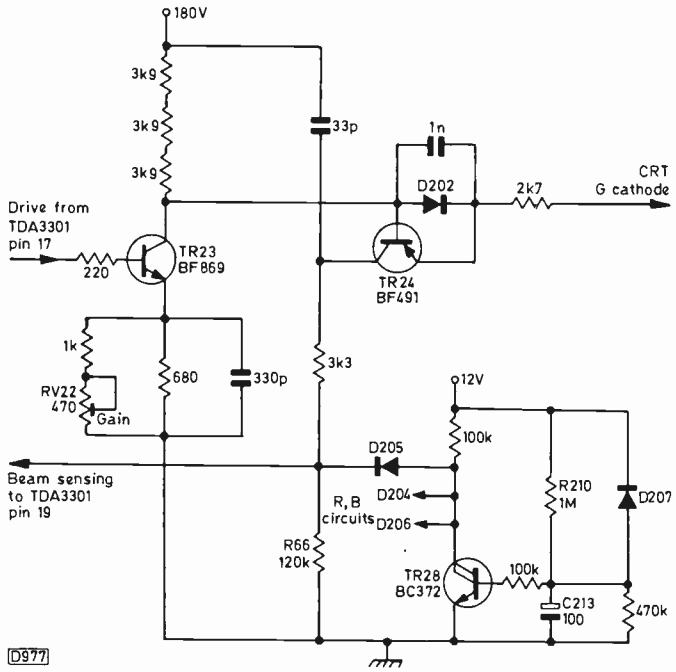

Fig. 6: The green output stage and the circuit for overriding the auto-grey-scale system at switch on.

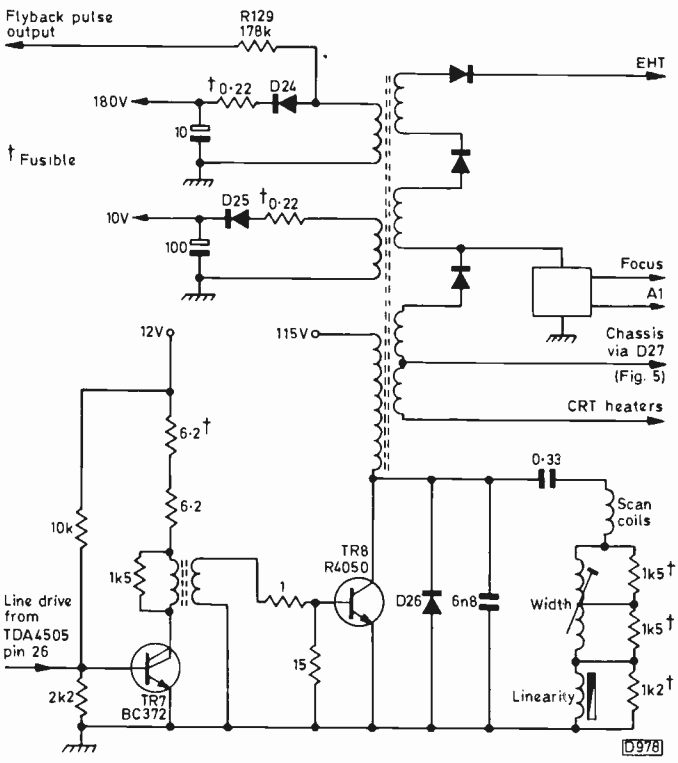

Fig. 7: The line driver and output stage circuits.

The circuitry associated with TR28 overrides the automatic grey-scale correction system at switch on to avoid a peak white raster. The operation of this circuit is controlled by the time-constant network R210/C213.

Line Driver and Output Stages

The line driver and output stages (see Fig. 7) are conventional. Because of the tube/yoke systems to be used with the chassis, no EW correction circuit is necessary. A low-voltage, transformer-coupled driver stage switches the

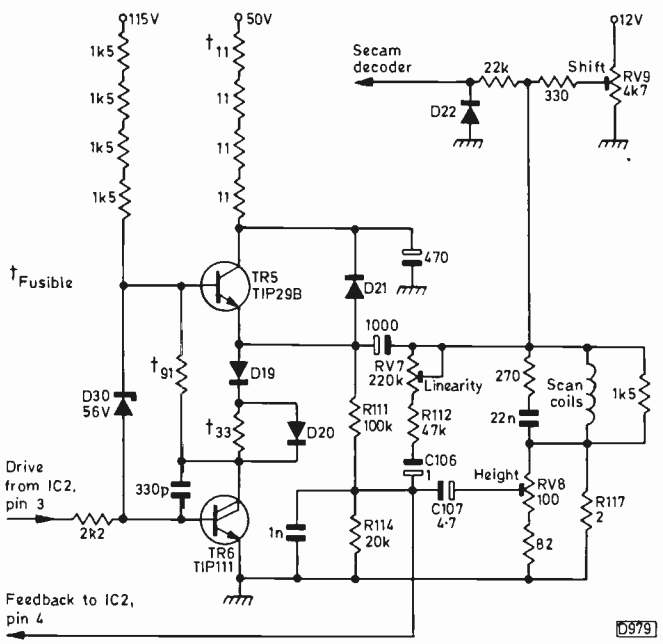

Fig. 8: the field output stage circuit. The resistors in TR5's collector circuit contribute to the fast flyback.

R4050 line output transistor. This is a Texas Instruments device with a quoted maximum operating collector voltage rating of 1,300V. The peak flyback voltage measured at the collector was 900V, so there appears to be a good safety margin.

The diode-split line output transformer provides various supplies – 180V for the RGB output stages and as a source for the tuning voltage, 10V for the TACS remote control system, 23kV e.h.t., adjustable focus and first anode voltages and the heater supply.

Because of the intention to use various different types of c.r.t. with the chassis, Ferguson has included what it refers to as a "c.r.t. personality" panel (PC1690). This carries the scan-correction capacitor and allows for different connections to the width control.

Field Output Stage

Fig. 8 shows the discrete component field output stage. The lower transistor of the output pair, TR6, is a Darlington device. This reduces the drive current requirement, enabling the output stage to be driven by the TDA4505 chip directly. A feature of the circuit is the four 11Ω resistors in the feed to TR5's collector. These reduce the collector voltage and the dissipation in the transistors during the first half of the scan, restoring the voltage to 50V during the second half of the scan in preparation for the flyback, giving a short flyback time. A.C. feedback from RV8 via C107 controls the height while RV7/R112/C106 provide linearity correction. D.C. feedback from the junction of R111/R114 stabilises the operating conditions in the output stage.

In Conclusion

The chassis does not incorporate stereo sound capability, either base band or off-air, presumably because it's not intended for use in up-market receivers. Teletext capability is built in however, reflecting the rising popularity of the broadcast text services. A plug on the chassis appears to cater for low-voltage operation via a d.c.-to-d.c. converter, a feature that will be welcome in many applications.

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FERGUSON 3V38

The head drum runs fast until the machine has been in operation for about half an hour, after which the drum slows and the servo locks. When the drum runs fast the voltage at pin 13 of IC404 is excessive. The supplies to the i.c.s are normal.

First confirm that the drum FG signal is present during the fault – check at TP421. If not, check the FG winding on the motor, IC404 etc. If the FG signal is present check the condition and setting of R463 before suspecting IC404 and IC403 in that order. Use of freezer and gentle heat from a hairdryer may help in tracing the source of this fault.

PHILIPS K35 CHASSIS WITH TELETEXT

A teletext fault has recently developed: occasionally single characters are missing from the text and on other occasions horizontal bands of several lines are missing – very often these are part of the page header. The problem started with BBC-2 and has now spread to BBC-1. ITV is all right.

While it's possible that the fault could be in the receiver circuitry, in which case very slight adjustment of the vision detector tank coil and/or the a.f.c. coil will probably clear it, much more likely is deterioration of the aerial system. Check the aerial, its downlead and the associated connections. A decoder fault is most unlikely.

HITACHI CBP260 (NP9A CHASSIS)

The problem is slight pulling on vertical bars. It's not affected by any of the controls.

If the disturbance travels slowly up or down the screen, check for ripple on the 18V remote control receiver power line and the main power line. IC980 and C983 are suspect in the former case, C907 in the latter. If the line distortion is stationary, check the earthing of the tube's outer conductive coating.

PHILIPS CTX-E CHASSIS

The picture is good but there's a low-intensity background warble on the sound. It appears to alter slightly in frequency and level depending on the picture content. The programme sound very often masks the warble, but it's plainly audible on quiet passages.

This may be difficult to track down. The most likely cause of the buzzing is radiation from the c.r.t. getting back to an unscreened audio lead. You will have to trace through the circuit and eliminate stages progressively.

JVC HR2200

The LED indicators on the front panel of this portable unit flash from left to right and the machine will not operate. This is the alarm mode of course and I've been told that a faulty cassette lamp is often the cause, but a check has shown that the lamp is working.

While failure of the cassette lamp is the most common cause of entry into the alarm mode another common cause is defective, i.e. metal fatigued, sensor switches under the deck. There are four of them. If they prove to be o.k. the solenoid switching transistors are suspect. These are on the audio/mechacon panel, X25-28 for the pinch solenoid and X21-24 for the brake solenoid. Replace all four in each group at one go.

ITT CVC32 CHASSIS

ITV, BBC-1 and BBC-2 are all right but on Channel 4 there's sometimes field rolling that cannot be stopped by field hold control adjustment. The fault is random: sometimes the picture is rock steady, sometimes the picture will flick then roll for a few minutes before settling down and at other times it just keeps rolling.

The fault is not unknown in this chassis and can often be cleared by replacing the electrolytic capacitors in the i.f. module – C303/7/9/12. If this doesn't provide a cure, try slight adjustment of the r.f. a.g.c. control R309. If necessary try the effect of adding an attenuator (say 6 or 10dB) at the aerial input.

HITACHI VT19

There's no clock or channel display and when play is selected the machine laces up, plays for about three seconds, then unlaces and stops. The same sequence applies with the other functions. The fault appears to be in the 10V supply to the clock/channel display board – the 2·5A fuse blows for no apparent reason.

The primary source of the 10V supply you mention is Q1795, which could well have failed with internal leakage. This would account for the fuse blowing. Use a BC171B if this transistor has to be replaced. If, due to tolerances in the mains transformer, the voltage at TP1792 exceeds 21V, increase R1768 to 150Ω. Check also diode D1769 (V06C) and zener diode ZD1769 (HZ-11C). Note that there's an error in the back-up circuit in the manual – Q1795's emitter voltage should be shown as 10V.

SONY KV2200

There's an intermittent whistle, but only with a picture present. With no signal input there's no whistle. When it's present the whistle is accompanied by Hanover bars. I've tried disturbance checks on all the chokes and the transformers but have been unable to pinpoint the source of the whistle.

This effect generally stems from instability in the power supply circuit, the cause being dried up electrolytic capacitors. We suggest you check C612 (3·3μF-4·7μF will do) and C622 (33μF).

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TELEVISION AUGUST 1988

ITT CVC1215 CHASSIS

The EW modulator driver transistor T563 and a couple of components (C511 and R503) in the line scan circuit had to be replaced, but now the set powers up at a reduced rate, all outputs from the line output stage being down to 25V. With the power supply isolated and a dummy load connected the maximum output that can be obtained is 125V instead of the correct 145V. The line output stage does not seem to be loading the power supply and the set doesn't show any signs of stress.

The 145V supply reservoir capacitor C733 (10μF) could be low in value and should be replaced. Also try C728 (22μF) which provides the 13V supply in the chopper circuit. We've known C614 (100μF) which decouples the supply to the TDA1940F sync/line oscillator chip cause problems of this sort.

TEST CASE

308

Each month we provide an interesting case of TV/video servicing to exercise your ingenuity. These are not trick questions but are based on actual practical faults.

We've still got some Decca series 80 and 100 TV sets about. They've served us well on rental, and still produce the odd surprise for our engineers despite our many years' acquaintance with them. Take the one we had in the other day . . .

The job card said "funny colours". What does that mean? What in fact it meant was that the picture was fine at switch on, but within five or so minutes the colours changed to give a bizarre display – similar to what you'd get by swapping the tube drives around. Exactly what the unusual colours were is not really relevant to the diagnosis. A squirt of freezer here and there on the decoder panel established that the MC1327 colour demodulator/matrixing chip seemed to be responsible for the trouble, so it was replaced.

The set was then left to run while waiting collection. Within a few minutes the colours were once again wrong, and a squirt of freezer on the new MC1327 chip brought them back to normal. It seemed unlikely that the original and the new chips had identical faults. In fact we found that after a few minutes in operation the i.c. was finger-sizzlingly hot. This was an unusual one indeed!

Study of the circuit diagram (see Fig. 1) suggested a very obvious cause for all this. The chip receives it's 25V supply at pin 14, the supply being stabilised by zener diode D202 which is fed from the 37V rail via R246. It seemed likely that D202 had gone open-circuit and that the chip's supply voltage had risen. But no, this wasn't so! In fact there was only 21V at pin 14, and zener diode D202 was cold. The series resistor R246 was very warm indeed, and so by now

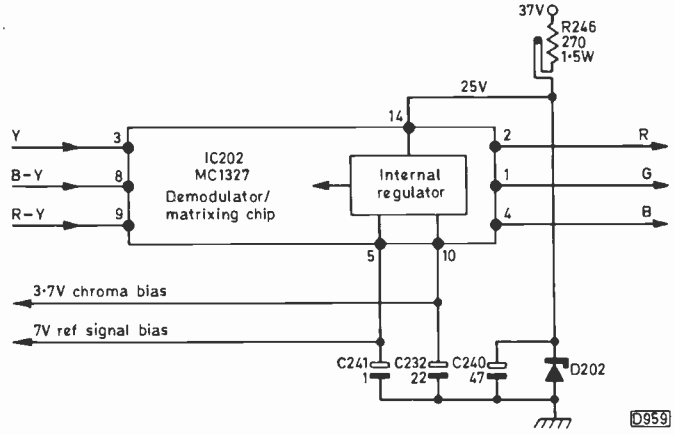

Fig. 1: Power supply arrangements associated with the MC1327 colour demodulator/matrixing chip in the Decca 80 and 100 series chassis.

was the chip. Disconnecting D202 made no difference to the voltage reading at pin 14.

A check was made on the other voltages around the chip. All were found to be low, but not so low as to upset the operation of the RGB output stages – until the chip overheated – or the overall functioning of the device. The voltages at pins 5, 12 and 13 were markedly low at around 2V. What do you think was the cause of the trouble? When the faulty component was replaced the MC1327's dissipation returned to normal – as did the voltage at pin 14. For the answer, see next month.

ANSWER TO TEST CASE 307
— page 686 last month —

A hot and sultry workshop was the setting for last month's puzzle, in which a GEC Model C2026 (PIL tube chassis) would pump half a dozen times at switch on then lapse into rest. The technician dealing with it was also rather languid if his random, shot-in-the-dark approach to diagnosis was anything to go by – maybe it had something to do with the ventilation system, or lack of one, in the workshop. His more alert colleague soon got to the bottom of the trouble.

Their first joint action, removal of the line shift choke, could well have cured the fault. Chokes of this type often develop short-circuit turns in sets of this vintage, triggering the excess-current trip. In fact the excess-current trip in the set was operating, though not because of excessive current. What had happened was that the current sampling resistor R530 (1Ω) had gone high in value. The reading obtained on the ohmmeter varied around the 3Ω mark. The equivalent resistor in the ITT CVC20 chassis is R89; in the CVC30/32 it's R86.

A quick way of proving the point would have been to short out the sampling resistor, which is connected in series with the chopper transistor. If there had been a real overload fault present however this would have invited disaster! Better to connect the scope across C513 (4·7nF), which decouples the TDA2640 chip's current sampling input pin, to see whether the excess-current pulses are well in excess of the normal 50mV level.

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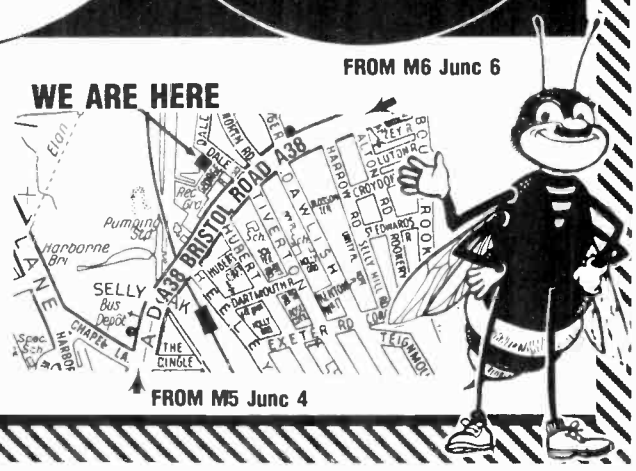

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BD267	45p
BD269	45p
BD278	50p
BD311	100p
BD312	100p
BD313	100p
BD314	100p
BD315	150p
BD316	150p
BD317	150p
BD318	150p
BD331	40p
BD332	40p
BD361	60p
BD362	60p
BD370	30p
BD371	30p
BD410	50p
BD433	28p
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BD436	30p
BD437	28p
BD438	36p
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BD440	40p
BD441	40p
BD442	40p
BD520	60p
BD533	50p
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BD537	40p
BD538	40p
BD643	50p
BD645	50p
BD647	50p
BD649	50p
BD651	50p
BD675	40p
BD676	40p
BD677	38p
BD678	40p
BD679	40p
BD680	40p
BD681	45p
BD682	45p
BD705	50p
BD707	50p
BD709	50p
BD711	50p
BD736	50p
BD826	50p
BD828	50p
BD875	50p
BD897	50p
BD899	50p
BD901	50p
BD977	50p
BDX32	100p
BDX33	60p
BDX53	60p
BDX65	80p
BDW23	55p
BDW24	55p
BDW93	50p
BDW94	50p
BDY20	100p
BDY92	100p
BF137	35p
BF154	25p
BF167	30p
BF173	40p
BF178	30p
BF180	16p
BF181	18p
BF183	20p
BF184	20p
BF185	20p
BF194	7p
BF195	7p
BF196	8p
BF197	10p
BF198	10p
BF199	8p
BF200	16p
BF225	30p
BF240	16p
BF241	10p
BF245	25p
BF247	25p
BF254	15p
BF255	12p
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BF258	18p
BF259	18p
BF262	25p
BF263	25p
BF270	18p
BF273	15p
BF311	21p
BF324	25p
BF336	20p
BF337	20p
BF338	20p
BF355	28p
BF362	30p
BF367	13p
BF371	17p
BF391	18p
BF392	18p
BF393	20p
BF414	18p
BF420	16p
BF421	18p
BF422	21p
BF423	25p
BF440	16p
BF450	20p
BF451	17p
BF455	14p
BF458	19p
BF459	19p
BF461	60p
BF462	62p
BF469	30p
BF470	28p
BF471	28p
BF472	28p

BF479	30p
BF493	18p
BF494	16p
BF495	16p
BF506	25p
BF595	16p
BF596	16p
BF597	10p
BF615	30p
BF617	30p
BF680	30p
BF757	40p
BF758	41p
BF759	40p
BF760	40p
BF763	40p
BF869	22p
BF870	22p
BF871	22p
BF872	23p
BF960	38p
BF961	35p
BF963	40p
BF964	38p
BF966	40p
BFR34	110p
BFR36	110p
BFR40	25p
BFR51	21p
BFR62	21p
BFR79	25p
BFR90	52p
BFR91	99p
BFR94	500p
BFS22	110p
BFT37	130p
BFT42	30p
BFT43	30p
BFW84	30p
BFW92	35p
BFX29	20p
BFX84	20p
BFX85	20p
BFX87	15p
BFX88	15p
BFX89	60p
BFY17	30p
BFY18	40p
BFY41	28p
BFY50	14p
BFY51	14p
BFY52	14p
BFY56	25p
BFY57	25p
BFY64	25p
BFY90	45p
BLY48	85p
BLY49	85p
BR100	14p
BR101	43p
BR103	37p
BR303	85p
BRY39	55p
BRY49	38p
BRY56	33p
BSS74	33p
BSX20	15p
BSX26	18p
BSX29	19p
BT100A	70p
BT106	120p
BT109	90p
BT116	80p
BT119	100p
BT120	100p
BT138	60p
BT146	99p
BT151	58p
BTY79	140p
BU100A	110p
BU104	100p
BU105	80p
BU108	100p
BU109	100p
BU110	110p
BU111	140p
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BU126	70p
BU180	150p
BU184	100p
BU204	75p
BU205	70p
BU206	100p
BU208	75p
BU208A	80p
BU208D	100p
BU209	140p
BU225	190p
BU226	190p
BU312	120p
BU325	55p
BU326	85p
BU406	85p
BU406D	95p
BU407	75p
BU407D	95p
BU408	85p
BU408D	95p
BU409	95p
BU426	120p
BU500	110p
BU508A	120p
BU508D	100p
BY536	150p
BU526	80p
BU546	140p
BU608	150p
BU626	150p
BU636	150p
BU801	95p
BU806	120p
BU807	95p
BU902	130p
BU903	130p
BU920	130p
BU921	130p
BU922	130p
BU930	130p
BUX80	180p
BUX82	180p
BUX84	65p
BUX85	65p
BUY69A	200p
BUY70C	160p
C106D	28p
J174	38p
J300	50p
MCR220	120p
MEO411	38p
MEO414	125p
ME3001	12p
ME4103	12p
ME6001	12p
ME6002	15p
ME8001	15p
ME9021	12p
MJ802	350p
MJ900	200p
MJ901	200p
MJ1000	200p
MJ1001	200p
MJ10012	300p
MJ15001	325p
MJ15002	300p
MJ15003	325p
MJ15004	370p
MJ15022	400p
MJ2500	100p

MJ2501	110p
MJ2955	55p
MJ3000	115p
MJ3001	115p
MJE29A	30p
MJE30A	30p
MJE340	25p
MJE350	80p
MJE520	30p
MJE2955K	90p
MP8111	40p
MP8112	45p
MP8113	55p
MP8512	50p
MPN3404	30p
MPS6571	20p
MPS9012	20p
MPS9013	20p
MPS9014	20p
MPS9015	20p
MPSA05	15p
MPSA06	15p
MPSA13	15p
MPSA20	15p
MPSA42	15p
MPSA43	15p
MPSA65	25p
MPSA66	25p
MPSA70	15p
MPSA92	20p
MPSA93	20p
MR510	35p
MR856	36p
MRF479	350p
MV1622	80p
MV209	48p
MV2209	48p
OC28	250p
OC29	250p
OC35	250p
OC36	250p
OC45	50p
OC71	30p
OC72	50p
OC200	180p
OT121	120p
R2008B	100p
R2010B	100p
R2030	100p
R2306	55p
S2800D	52p
S2800M	72p
T2800D	52p
T2800M	72p
TAG4442	76p
TAG4443	76p
TAG4444	76p
TIP29	15p
TIP29A	22p
TIP29C	25p
TIP30	25p
TIP30C	30p
TIP31A	24p
TIP31C	30p
TIP32	24p
TIP32A	24p
TIP32C	28p
TIP33	50p
TIP33C	60p
TIP34	50p
TIP34C	60p
TIP35C	65p
TIP36C	65p
TIP41A	22p
TIP41C	25p
TIP42A	22p
TIP42C	25p
TIP47	40p
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TIP54	140p
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TIP107	65p
TIP110	47p
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TIP112	40p
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TIP117	50p
TIP120	43p
TIP121	46p
TIP122	47p
TIP125	47p
TIP126	56p
TIP127	56p
TIP130	30p
TIP131	30p
TIP130	30p
TIP141	90p
TIP142	90p
TIP145	65p
TIP146	90p
TIP147	100p
TIP150	90p
TIP151	90p
TIP2955	42p
TIP3054	45p
TIP3055	42p
TIS43	45p
TIS44	40p
TIS61	15p
TIS88A	45p
TIS90	15p
TIS91	18p
TIS93	20p
VK1010	88p
VN.10KM	60p
VN 46AF	88p
VN.66AF	100p
VN.88AF	115p
VN.89AF	110p
Y723	75p
Y827	75p
Y860	22p
Y969	65p
ZTX107	11p
ZTX108	11p
ZTX109	12p
ZTX212	27p
ZTX300	13p
ZTX301	16p
ZTX302	16p
ZTX303	24p
ZTX304	17p
ZTX320	29p
ZTX326	29p
ZTX500	13p
ZTX501	13p
ZTX502	18p
ZTX503	18p
ZTX504	25p
ZTX550	24p
2N.696	26p
2N.697	22p
2N.698	40p
2N.699	45p
2N 706	22p
2N.708	22p
2N.914	28p
2N.918	36p
2N.930	18p
2N.1131	28p

2N.1132	28p
2N.1613	24p
2N.1711	24p
2N.1893	30p
2N.2102	50p
2N.2160	300p
2N.2218A	24p
2N.2219	24p
2N.2221	23p
2N.2222	23p
2N.2369	15p
2N.2484	20p
2N.2646	40p
2N.2904	20p
2N.2905	20p
2N.2906	18p
2N.2907	18p
2N.2926	8p
2N.3019	28p
2N.3053	18p
2N.3054	40p
2N.3055	38p
2N.3055H	50p
2N.3440	58p
2N.3442	85p
2N.3525	150p
2N.3583	90p
2N.3585	120p
2N.3702	9p
2N.3703	9p
2N.3704	9p
2N.3705	9p
2N.3706	9p
2N.3707	9p
2N.3708	9p
2N.3710	12p
2N.3711	12p
2N.3771	85p
2N.3772	90p
2N.3773	110p
2N.3799	18p
2N.3819	29p
2N.3866	68p
2N.3903	11p
2N.3904	11p
2N.3905	11p
2N.3906	11p
2N.4031	25p
2N.4036	25p
2N.4037	25p
2N.4058	13p
2N.4062	12p
2N.4064	100p
2N.4240	150p
2N.4248	130p
2N.4401	12p
2N.4403	12p
2N.4443	76p
2N.4444	76p
2N.4904	75p
2N.5061	20p
2N.5062	28p
2N.5088	20p
2N.5163	45p
2N.5192	50p
2N.5241	500p
2N.5245	45p
2N.5294	30p
2N.5296	30p
2N 5303	200p
2N.5320	90p
2N.5321	60p
2N.5366	25p
2N.5401	12p
2N 5448	12p
2N.5496	80p
2N.5777	40p
2N.6106	40p
2N.6107	40p
2N.6109	40p
2N 6254	110p
2N.6292	40p
2N.6384	120p
2N.6385	120p
2N.6403	160p
2N.6649	140p
3N.128	55p
3N.143	65p
DIODES	
AA119	9p
BY100	40p
BY103	32p
BY126	6p
BY127	8p
BY133	8p
BY164	40p
BY176	85p
BY179	35p
BY182	32p
BY184	32p
BY187	32p
BY196	20p
BY206	11p
BY207	11p
BY208	18p
BY210	22p
BY223	72p
BY225	120p
BY226	18p
BY227	19p
BY228	32p
BY296	20p
BY298	26p
BY299	28p
BY476	90p
BYX10	15p
BYX55/350	30p
BYX55/600	30p
BYX55/800	32p
BYX70/300	29p
BYX70/500	32p
BYX70/800	36p
BYX71/600	80p
OA47	6p
OA90	6p
OA91	8p
OA200	7p
OA202	7p
IN.914	2p
IN.4001	4p
IN.4002	4p
IN.4003	4p
IN.4004	4p
IN.4005	4p
IN.4006	4p
IN.4007	5p
IN 4148	2p
IN.5400	9p
IN.5401	10p
IN.5402	10p
IN.5403	11p
IN.5404	11p
IN.5405	12p
IN 5406	13p
IN.5407	13p
IN.5408	13p
SKE4F2/06	50p
SKE4F2/08	70p
SKE4F2/10	90p
I.C. SOCKETS	
8pin	6p
14pin	8p
16pin	9p
18pin	12p
20pin	14p
22pin	16p
24pin	18p
28pin	20p
40pin	25p

ZENER	
400MV	
BYZ88 RANGE	
2V7 to 39V	6p
1.3W	
BZX61 RANGE	
2V7 to 39V	12p
VOLTAGE REGULATORS	
7805	35p
7806	35p
7808	35p
7812	35p
7815	35p
7818	35p
7824	35p
7905	35p
7906	40p
7908	40p
7912	40p
7915	40p
7918	40p
7924	40p
78L05	28p
78L08	28p
78L12	28p
78L15	28p
78L18	28p
78L24	28p
79L05	40p
79L08	40p
79L12	40p
79L15	40p
7818KC	100p
7824KC	100p
LM309K	100p
LM317K	220p
LM317T	180p
LM323K	420p
LM723	40p
78HGKC	570p
78H05KC	800p
78H12KC	700p
78GU1C	190p
79GU1C	215p
79HGKC	800p
VALVES	
DAF96	60p
DF96	50p
DL92	60p
DY86	50p
DY87	60p
DY802	75p
EABC80	60p
E891	44p
EBF80	45p
EBF89	50p
ECC82	80p
ECC83	80p
ECC84	70p
ECC85	80p
ECH81	100p
ECH84	70p
ECL80	65p
ECL82	80p
ECL84	70p
ECL85	70p
ECL86	90p
EF80	65p
EF85	65p
EF89	85p
EF183	75p
EF184	85p
EL34	250p
EL36	90p
EL84	75p
EL95	85p
EL500	100p
EL504	130p
EY86	45p
EY87	45p
EY88	65p
EZ35	65p
EZ80	70p
EZ81	55p
GZ34	200p
PC97	100p
PCC85	60p
PCF80	80p
PCF200	135p
PCF801	110p
PCF802	80p
PCF806	115p
PCH200	100p
PCL81	62p
PCL82	80p
PCL84	50p
PCL85	80p
PCL86	80p
PCL805	80p
PFL200	110p
PL36	120p
PL82	60p
PL83	60p
PL84	80p
PL95	180p
PL500	110p
PL504	120p
PL508	200p
PL519	450p
PY81	90p
PY88	70p
PY500A	190p
L.E.D.'S	
LED 3MM RED	5p
LED	3MM
YEL	10p
LED	3MM
GRN	10p
LED 5MM RED	5p
LED	5MM
YEL	10p
LED	5MM
GRN	10p
LINEAR IC'S	
AN-124	230p
AN-127	250p
AN-136	250p
AN-203	210p
AN-210	165p
AN-214Q	170p
AN-228	280p
AN-234	450p
AN-235	450p
AN-236	235p
AN-238	400p
AN-239O	400p
AN-240P	150p
AN-241	135p
AN-245	290p
AN-247	230p
AN-252	150p
AN-259	250p
AN-262	140p
AN-270	200p
AN-271	230p
AN-272	480p
AN-274	250p
AN-294	380p
AN-295	340p
AN-301	330p
AN-303	250p
AN-304	360p
AN-305	320p
AN-306	800p
AN-313	270p
AN-315	210p

AN-316	350p
AN-318	460p
AN-331	295p
AN-360	100p
AN-362	140p
AN-366	150p
AN-610	160p
AN-612	160p
AN-3320K	900p
AN-5151	600p
AN-5430	280p
AN-5612	400p
AN-5620	330p
AN-5712	350p
AN-5722	140p
AN-5730	160p
AN-5732	160p
AN-5753	170p
AN-6100	425p
AN-6120	400p
AN-6135	150p
AN-6300	600p
AN 6320	300p
AN-6330	380p
AN-6340	830p
AN-6341	350p
AN-6344	440p
AN 6350	610p
AN-6359	810p
AN-6360	400p
AN-6362	480p
AN-6371	510p
AN 6387	560p
AN-6430	390p
AN-6431	400p
AN 6677	550p
AN-6811	130p
AN 6876	270p
AN-6884	240p
AN-7105	210p
AN-7110	130p
AN-7114	150p
AN-7115	150p
AN-7116	130p
AN-7120	130p
AN-7130	110p
AN-7222	300p
AN-7310	90p
AN-7311	90p
AN-7410	250p
AN-7420	250p
AN-7140	450p
AN-7145	195p
AN-7146	210p
AN-7154	180p
AN-7156	240p
AN 7158	310p
AN 7168	260p
AN-7178	270p
AY3-1015	290p
AY3-1270	800p
AY3-1350	450p
AY3-8910	360p
AY3-8912	400p
AY5-3600	570p
BA-301	65p
BA-302	90p
BA-308	100p
BA-311	80p
BA-313	60p
BA-314	100p
BA-318	120p
BA-333	100p
BA-340	150p
BA-401	60p
BA-402	60p
BA-403	100p
BA-501	450p
BA-511	160p
BA-514	160p
BA-516	150p
BA-521	160p
BA-524	240p
BA-526	220p
BA-527	95p
BA-532	140p
BA-534	290p
BA-535	600p
BA-536	180p
BA-546	180p
BA 612	160p
BA 656	150p
BA 658	380p
BA-684	400p
BA-664	300p
BA 684	400p
BA-685	400p
BA-1310	160p
BA-1320	110p
BA-1330	160p
BA-1360	160p
BA-4403	220p
BA-5101	500p
BA-5102	250p
BA-5204	200p
BA-5402	250p
BA-5406	230p
BA-5408	220p
BA 6104	250p
BA-6135	250p
BA 6208	250p
BA-6209	320p
BA-6304	190p
CA-3011	110p
CA-3012	150p
CA-3014	250p
CA-3018	75p
CA-3019	75p
CA-3020	190p
CA-3023	190p
CA-3028A	95p
CA-3035	230p
CA-3036	240p
CA-3043	240p
CA 3045	360p
CA-3046	60p
CA-3048	190p
CA-3052	190p
CA-3054	95p
CA-3059	300p
CA-3060	280p
CA-3065	210p
CA 3080E	60p
CA-3085	135p
CA-3086	55p
CA-3088E	200p
CA-3089E	150p
CA-3089O	250p
CA-3130E	80p
CA-3130S	100p
CA-3134E	280p
CA-3140E	38p
CA-3160	85p
CA-3161E	140p
CA-3162E	450p
CA 3189E	230p
CA-3193E	230p
CA-3240E	90p
CA-3260E	170p
CA-3290E	150p
CX-108	750p
CX-130	450p
CX-136	610p
CX-139A	1150p
CX-143A	580p
ER-1400	200p

HA-1125	150p
HA-1137W	135p
HA-1144	380p
HA-1156	110p
HA-1197	150p
HA-1199	145p
HA-1306W	170p
HA-1319	240p
HA-1338	300p
HA-1339A	350p
HA-1342	350p
HA-1366WR	160p
HA 1367	300p
HA 1368	160p
HA-1371	300p
HA-1372	300p
HA-1374	230p
HA-1377	200p
HA-1388	320p
HA-1389	210p
HA-1392	230p
HA-1394	280p
HA-1397	250p
HA-1398	240p
HA-1452	120p
HA-1457	120p
HA-11219	280p
HA-11221	210p
HA-11223	340p
HA-11225	170p
HA-11226	410p
HA-11235	170p
HA-11251	240p
HA-11423	210p
HA-11701	310p
HA-11703	390p
HA-11705	620p
HA 11710	340p
HA 11714	400p
HA-11715	560p
HA-11724	800p
HA-12005	450p
HA-12017	130p
HA-13001	260p
HA-13007	400p
HA-13008	800p
HA-13432	400p
ICL-7016	650p
ICL-7017	950p
ICL-7611	90p
ICL-7660	240p
ICM-7555	60p
ICM-7556	130p
LA-1111	80p
LA-1130	240p
LA-1150	150p
LA-1185	150p
LA-1201	75p
LA-1210	140p
LA-1222	80p
LA-1230	130p
LA-1231	210p
LA-1352	120p
LA-1364	200p
LA-1365	120p
LA-1368	220p
LA-1369	260p
LA-1385	170p
LA-1460	220p
LA-2000	150p
LA-2100	260p
LA-2101	270p
LA-2200	190p
LA-3100	125p
LA-3101	160p
LA-3120	125p
LA-3155	100p
LA-3160	120p
LA-3201	80p
LA-3210	65p
LA-3220	100p
LA-3300	140p
LA-3301	110p
LA-3350	110p
LA-3361	100p
LA-3375	300p
LA-4030	180p
LA-4031	140p
LA-4032	140p
LA-4050	130p
LA-4051	160p
LA-4100	85p
LA-4101	80p
LA-4102	120p
LA-4110	120p
LA-4112	120p
LA 4120	270p
LA-4125	200p
LA-4126	240p
LA-4135	250p
LA-4137	180p
LA-4140	70p
LA-4160	220p
LA-4180	300p
LA 4182	190p
LA-4190	300p
LA-4192	180p
LA-4200	130p
LA-4201	120p
LA-4210	150p
LA 4220	120p
LA 4230	175p
LA-4250	260p
LA-4260	230p
LA 4261	300p
LA-4270	300p
LA-4400	190p
LA 4420	140p
LA-4422	130p
LA-4430	130p
LA-4440	230p
LA-4445	260p
LA 4450	150p
LA-4460	170p
LA-4461	180p
LA-4500	230p
LA 4505	260p
LA-4507	360p
LA-4508	260p
LA-4510	160p
LA-4520	230p
LA-4530	250p
LA-4540	300p
LA-4550	200p
LA-4555	220p
LA-4560	300p
LA-4570	300p
LA-5112	120p
LA-5523	150p
LA-5527	150p
LA-5700	300p
LA-6324	200p
LA-6358	100p
LA 6458	100p
LA-7000	100p
LA-7003	400p
LA-7005	350p
LA-7007	400p
LA-7009	500p
LA-7011	220p
LA-7013	300p
LA-7015	300p
LA-7017	320p
LA-7018	160p
LA-7019	160p
LA-7020	400p
LA-7025	380p

LA-7027	400p
LA-7031	250p
LA-7032	700p
LA-7033	400p
LA-7040	250p
LA-7042	280p
LA-7043	300p
LA 7045	300p
LA 7046	300p
LA-7048	300p
LA 7050	250p
LA-7051	300p
LA-7060	250p
LA-7061	250p
LA-7070	500p
LA-7071	500p
LA-7072	350p
LA-7090	300p
LA-7110	400p
LA-7112	300p
LA-7205	250p
LA-7210	300p
LA-7212	300p
LA-7215	300p
LA-7220	300p
LA-7224	150p
LA-7225	180p
LA-7230	500p
LA-7505	250p
LA-7506	250p
LA-7507	250p
LA-7508	250p
LA-7520	500p
LA-7590	250p
LA-7620	500p
LA-7621	500p
LA-7751	450p
LA-7755	300p
LA-7770	300p
LA-7800	180p
LA-7801	280p
LA-7802	300p
LA-7803	400p
LA-7805	400p
LA-7806	260p
LA-7808	250p
LA-7810	300p
LA-7811	300p
LA-7820	250p
LA-7822	280p
LA-7823	280p
LA-7910	150p
LA-7920	150p
LAP-512	310p
LAG-552	200p
LAG-600	200p
LAG 634D	300p
LAM-508	200p
LC-7120	280p
LC-7130	280p
LC-7131	260p
LC-7132	400p
LC-7137	450p
LF-347	110p
LF-351	45p
LF-353	48p
LF-355	60p
LF-356	60p
LF-357	70p
LF-398	300p
LM-301	26p
LM-307	42p
LM-308CN	70p
LM-310	220p
LM-311	35p
LM-318	120p
LM-319	165p
LM-324	35p
LM-325	45p
LM-334Z	115p
LM-335Z	120p
LM-336	140p
LM-337	250p
LM-339	37p
LM-348	55p
LM-358	45p
LM-377	220p
LM-380	100p
LM-381	150p
LM-382	130p
LM-383	300p
LM-384	130p
LM-386	85p
LM-387	100p
LM-389	150p
LM-391	160p
LM-392	100p
LM-393	55p
LM-394CH	370p
LM-558	160p
LM-709DIL	30p
LM-710	45p
LM-711	85p
LM-723	40p
LM-725CN	380p
LM-733	60p
LM-741DIL	18p
LM-741MET	45p
LM-747	58p
LM-748	35p
LM-1458	33p
LM-1889	400p
LM-3900	40p
LM-3909	80p
LM-3911	160p
LM-3914	250p
LM-3915	255p
LM-3916	290p
LM-8560	300p
LM-016H	3200p
M-5155	150p
M-50120	600p
M-51102	290p
M-51316B	540p
M-51513L	160p
M 51514	160p
M-51515BL	220p
M-51516	260p
M-51517L	260p
M-51518	200p
M-54836	600p
MB-3705	150p
MB-3712	140p
MB-3722	310p
MB-3730	240p
MB 3731	300p
MB-3756	230p
MB 3759	200p
MB-8719	360p
MC-1310P	130p
MC-1327	70p
MC-1413	65p
MC-1455	45p
MC-1458	33p
MC-1459	290p
MC-1488	65p
MC-1489	65p
MC-1494	670p
MC-1495	285p
MC-1496	65p
MC-1569	210p
MC-3302	70p
MC-3401	45p
MC-3403	60p
MC-3423	75p
MF-10	295p
ML-920	480p
ML-922	380p

NE-531	115p
NE-544	170p
NE-555	20p
NE-556	40p
NE-564	380p
NE-565	110p
NE-566	130p
NE-567	115p
NE-570	360p
NE-571	290p
NE-592	85p
NE-5532P	140p
NE-5533P	150p
NE-5534P	110p
SAS-560	110p
SAS-570	110p
SAA-1006	300p
SAA-1008	450p
SAA-1009B	350p
SAA-1024	250p
SAA-1016T	400p
SAA-1220	400p
SAA-1251	380p
SAA-1272C	280p
SAA-1274	280p
SAA-3004	400p
SAA-5040A	280p
SAA-5040B	400p
SI-3242P	360p
SI-7300A	1400p
SNR-20A130K	200p
STA-301A	380p
STA-312	280p
STA-401A	380p
STK-0025	420p
STK-0029	430p
STK-0030	400p
STK 0039	410p
STK 0040	560p
STK 0049	570p
STK-0050	570p
STK-0059	620p
STK-0060	900p
STK-0070	1100p
STK-0080	690p
STK-011	370p
STK-013	700p
STK-014	700p
STK-015	490p
STK-016	800p
STK-020	540p
STK-022	700p
STK-025	700p
STK-041	700p
STK-043	980p
STK-050	1450p
STK-077	600p
STK-078	620p
STK-080	710p
STK-082	720p
STK-086	910p
STK-430	500p
STK-433	490p
STK-435	510p
STK-436	490p
STK-437	600p
STK-439	550p
STK 441	740p
STK 443	740p
STK-457	580p
STK-459	610p
STK-460	720p
STK-461	720p
STK-463	780p
STK-465	800p
STK-501	580p
STK-563	480p
STK-732	850p
STK-1039	550p
STK-1040	700p
STK-1049	800p
STK-1050	750p
STK-1060	760p
STK-1070	1200p
STK-1080	1000p
STK-2025	800p
STK-2028	650p
STK-2029	500p
STK-2110	680p
STK-2129	610p
STK-2139	800p
STK-2230	580p
STK-2240	920p
STK-2250	920p
STK-3041	600p
STK-3042	580p
STK-3044	575p
STK-3062	600p
STK-3082	700p
STK-4026	800p
STK-4060	580p
STK-4111	650p
STK-4121	800p
STK-4131	650p
STK-4141	700p
STK 4151	720p
STK-4171	1000p
STK-4191	1100p
STK-4332	500p
STK-4352	700p
STK-4362	625p
STK-4392	720p
STK 4773	1000p
STK-4803	820p
STK-4813	950p
STK-4833	920p
STK-4843	865p
STK-4853	950p
STK 4893	1400p
STK 5314	625p
STK-5315	650p
STK-5324	550p
STK-5325	650p
STK-5421	625p
STK-5422	600p
STK-5476	600p
STK 6972	630p
STK-7216	610p
STK-7308	800p
STK-7404	680p
STK-7563	1000p
STK-8250	700p
STK-4833	1200p
STR-370	650p
STR-380	580p
STR-440	520p
STR 441	480p
STR-451	500p
STR-453	700p
STR-2012	650p
STR-3115	580p
STR-3125	580p
STR-4090	650p
STR-6020	600p
T2800D	52p
TA-7054	190p
TA-7061	115p
TA-7063	70p
TA 7066	120p
TA-7072	300p
TA-7073	200p
TA-7089	300p
TA-7108	130p
TA-7109	220p
TA-7119	150p
TA-7120	55p
TA-7130	80p

TA-7137	83p
TA-7140	130p
TA-7142	220p
TA-7145	220p
TA-7146	400p
TA-7148	350p
TA-7157	140p
TA-7162	300p
TA-7169	420p
TA-7176	240p
TA-7193	400p
TA-7200	200p
TA-7201	200p
TA-7203	180p
TA-7204	140p
TA-7205	80p
TA-7207	150p
TA-7208	145p
TA-7210	200p
TA-7212	300p
TA-7213	200p
TA-7214	260p
TA-7215	215p
TA-7217	145p
TA-7220	220p
TA-7222	120p
TA-7223	210p
TA-7224	270p
TA-7225	300p
TA-7226	290p
TA-7227	190p
TA-7229	300p
TA-7230	170p
TA-7232	250p
TA-7233	250p
TA-7237	400p
TA-7238	400p
TA-7240	260p
TA-7241	260p
TA-7242	290p
TA-7243	350p
TA-7245	450p
TA-7247	800p
TA-7267	290p
TA-7269	850p
TA-7270	250p
TA-7271	400p
TA-7272	260p
TA-7273	350p
TA-7274	260p
TA-7280	330p
TA-7281	270p
TA-7282	260p
TA 7283	260p
TA-7288	260p
TA-7299	400p
TA-7310	100p
TA-7312	120p
TA-7313	110p
TA-7314	210p
TA-7315	200p
TA-7317P	240p
TA-7320	300p
TA-7324	200p
TA-7325	90p
TA-7328	200p
TA-7335	200p
TA-7336	250p
TA-7341	250p
TA-7343	250p
TA-7357	400p
TA-7358	200p
TA-7401	400p
TA-7607	270p
TA-7608	360p
TA-7609	270p
TA-7611	280p
TA-7612	360p
TA-7614	230p
TA-7616	400p
TA-7621	520p
TA-7622	420p
TA-7625	420p
TA-7628	240p
TA-7629	420p
TA-7630	300p
TA-7632	400p
TA-7640	150p
TA-7641	170p
TA-7658	130p
TA-7668	160p
TA-7680	480p
TA-7688	250p
TA-7698	720p
TA-7699	1200p
TA-7769	300p
TAA-550	20p
TAA-	p
611B12	100p
TAA-661	100p
TBA-120S	50p
TBA-395	60p
TBA-396	70p
TBA-520	120p
TBA-530	120p
TBA-540	120p
TBA-560	120p
TBA-	p
641B11	400p
TBA-750	120p
TBA-800	40p
TBA-810AS	60p
TBA-820	65p
TBA-820M	50p
TBA-920	120p
TBA-950	120p
TBA-990	120p
TBA-1440G	120p
TC-5020	285p
TC-9109	500p
TC-9106	470p
TCA-240	200p
TCA-610	100p
TCA-740	130p
TCA-830	90p
TCA-940	100p
TCEP-100	200p
TDA-1001	200p
TDA-1003	150p
TDA-1029	300p
TDA-1035	120p
TDA-1044	300p
TDA-1054	200p
TDA-1083	200p
TDA 1170	100p
TDA-1180	190p
TDA-1190	100p
TDA-1200B	80p
TDA-1270	200p
TDA-1410	210p
TDA-1412	100p
TDA-1420	200p
TDA-1470	140p
TDA 1670A	300p
TDA-1770A	300p
TDA-1870A	300p
TDA-1908A	100p
TDA-1940	280p
TDA-1950	280p
TDA-2002	80p
TDA-2003	150p
TDA-2004	170p
TDA-2005	170p
TDA-2006	150p
TDA-2008	175p
TDA-2009	200p
TDA-2010	100p
TDA-2020	140p
TDA-2030	140p

TDA-2532	120p
TDA-2540	100p
TDA 2560	120p
TDA 2575A	100p
TDA-2581	180p
TDA 2590	200p
TDA 2593	150p
TDA 2600	580p
TDA-2611A	120p
TDA 2653	380p
TDA-2670	150p
TDA-2690	100p
TDA-2760	400p
TDA-3190	100p
TDA-3300B	480p
TDA-3301B	380p
TDA-3560	350p
TDA-3561	280p
TDA-3651A	290p
TDA 3652	300p
TDA 3710	320p
TDA-3800	350p
TDA-4420	180p
TDA 4600	260p
TDA-4601	250p
TDA-4950	200p
TDA-5700	200p
TDA-7040	250p
TDA-7050	200p
TDA-7211	150p
TDA-7220	150p
TDA-7270	150p
TEA-1002	650p
TLO-61	40p
TLO-64	80p
TLO-71	38p
TLO-72	55p
TLO-74	92p
TLO-81	40p
TLO-82	46p
TLO-83	67p
TLO-84	80p
UCN-5801A	560p
ULN-2002	70p
ULN-2003	69p
ULN-2004	69p
ULN-2068	270p
ULN-2802	170p
ULN-2803	130p
ULN-2804	170p
UPC-16C	160p
UPC-20C	220p
UPC-30C	190p
UPC-358	150p
UPC-554	130p
UPC-555	60p
UPC-556H	80p
UPC-558	200p
UPC-566	60p
UPC-571	220p
UPC-572	200p
UPC-574	60p
UPC-575C2	90p
UPC-576	200p
UPC-577	64p
UPC-578	400p
UPC-580	300p
UPC-592	95p
UPC-595	190p
UPC-596	190p
UPC-1001	220p
UPC-1018	170p
UPC-1020	200p
UPC-1021	200p
UPC-1023	60p
UPC-1025	230p
UPC-1026	95p
UPC-1028	90p
UPC-	p
1031H2	180p
UPC-1032	60p
UPC-1155	200p
UPC-1156	250p
UPC-1158H2	70p
UPC-	p
1167C2	170p
UPC-1168	105p
UPC-1181	110p
UPC-1182	110p
UPC-1183	200p
UPC-	p
1185H2	2350p
UPC-1186	80p
UPC-1187	150p
UPC-1191	100p
UPC-1197	140p
UPC-1216	120p
UPC-1222	130p
UPC-1230	210p
UPC-1238	120p
UPC-1263	230p
UPC-1277	240p
UPC-1278	240p
UPC-1350	115p
UPC-1353	160p
UPC-1363	190p
UPC-1365	320p
UPC-1373	85p
UPC-1378	210p
UPC-1380	450p
UPC-1382	110p
UPC-1383	250p
UPC-1384	260p
UPC-1394	170p
UPC-1397	450p
UPC-1470	200p
ZN-423	100p
ZN-424	100p
ZN-425	320p
ZN-426	260p
ZN-427	560p
ZN-428	425p
ZN 429	215p
ZN-435	340p
ZN-448	510p
ZN-459	190p
ZN-1034	170p
ZN-1040	640p
ZNA-134H	2150p
ZNA-234E	920p
2SJ-48	480p
2SJ-49	425p
2SJ-50	425p
2SJ-77	350p
2SJ-122	580p
2SK-15	350p
2SK-19	45p
2SK-49	50p
2SK-55	100p
2SK 68	100p
2SK-133	480p
2SK-134	415p
2SK-135	415p
2SK-147	160p
2SK-176	800p
2SK-191	160p
2SK-192	45p
2SK-195	150p
2SK-197	140p
2SK-210	130p
2SK-211	130p
2SK-217	130p
2SK-291	300p
2SK-294	400p
2SK-312	750p
2SK-322	300p
2SK-323	130p
2SK-555	480p
2SK-557	650p
2SK-[illegible]	70p

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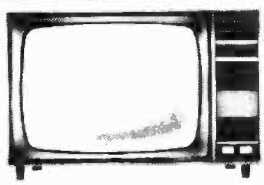

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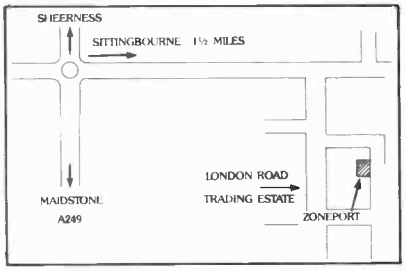

VIDEO AND TV SPARES

Stock items despatched by return — ***Access & Visa Accepted***

VIDEO HEADS

3HSSV – JVC/Ferguson most models £18.00
3HSSVA – Ferguson 3V42/44/45/46 etc. £38.00
3HSS4VB – Ferguson 3V32 JVCHR7655 ..... £45.00
3HSS4VC – Ferguson 3V48 JVCHRD565 ..... £46.00
3HSSN – Panasonic most models £18.00
3HSSU1N – Panasonic NV370/380/100 Phillips VR6460 ..... £24.95
3HSSU2N – Panasonic NV230/470/480/G9/G10/G11/G15PX £36.20
3HSSU3N – Panasonic NV430/460 ..... £28.60
3HSS3N – Panasonic NV777/330 ..... £34.35
3HSS4NB – Panasonic NV730 ..... £46.00
3HSS4NA – Panasoinc NV366 ..... £45.00
3HSSHA – Hitachi VT8000/9500 etc £22.00
3HSSHB – Hitachi VT11/33/63 etc £22.00
3HSSSP – Sharp VC9300/9500 etc £22.00
PS3B – Sony C7/5/6 SL8000 etc £22.75
3HSSSF – Fisher FVH710/510 etc £28.50
3HSSR – Amstrad, Saisho, Orion etc. £28.50
PSF1 – Amstrad 4500/5200 ..... £26.30
PS3BT – Toshiba V9600/31/33 ..... £28.00
3HSSSY – Sanyo VHR1100/1110/1300 ..... £39.50
3HSS3SY – Sanyo VHR1500 ..... £52.00

The above equivalent video heads are new. For reprocessed heads send old head. Sharp (brass) and Mitsubishi models @ £37.50 and most 4 head VHS types @ £45.00.

VIDEO MOTORS

Drum Motors

Ferguson/JVC (Mechanical models) £21.45
Sharp VC7300/7700/7750/8300 ..... £21.00

Reel Motors

Sanyo VTC5000/5150/5300/5400 ..... £7.90
Sharp VC9300/9500 etc. (most models) £15.90

Capstan Motors

Ferguson/JVC (mechanical models) £21.45
Ferguson 3V35 ..... £22.50
Sony SLC7/C5 (BHF 1100D) £28.20
Sharp VC7300/7700/7750 ..... £26.90

REMOTE CONTROLS

Ferguson, Grundig, ITT, Phillips, Pye, Sony various models £13.50

CAR RADIO/CASSETTE MOTORS

6V, 9V, 12V and 13.2V clockwise or anticlockwise. Three sizes available

(1) Shaft 10mm, Height 34mm, Width 38mm £3.50
(2) Shaft 7mm, Height 21.5mm, Width 34mm £3.50
(3) Shaft 8mm, Height 25mm, Width 36mm £3.50

LINE OUTPUT TRANSFORMERS

Decca 100 ..... £8.50
ITT CVC 25/30/32 ..... £8.50
Rank Bush T20A £9.25

OTHER SPARES

IC STR6020 Modification kit for Hitachi CPT1471/1473 ..... £6.95
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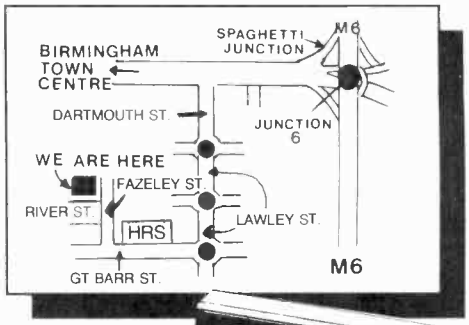

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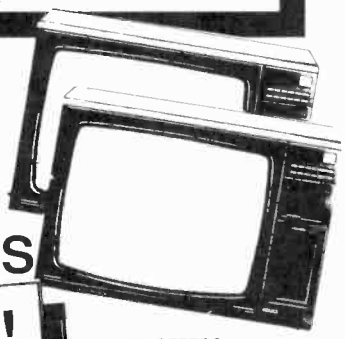

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THORN	TX9/TX10 REMOTE & TEXT
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ITT	TRIMLINE BASIC/REMOTE/TEXT
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TOSHIBA	BASIC/REMOTE/TEXT
PORTABLES	

VIDEO RANGE	
FERGUSON	3V29/30
FERGUSON	3V23
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Text Portable	£100.00	£85.00
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Grundig	£20
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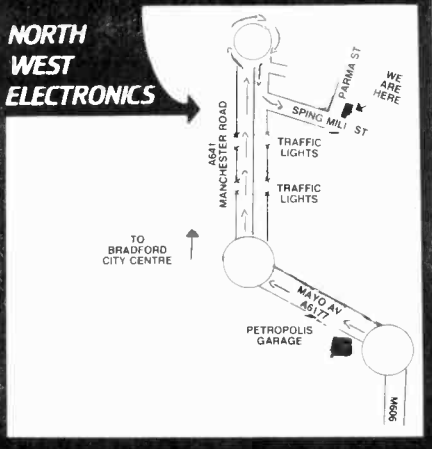

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718	7.50	5	14	20	3	14.00
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Pye KT3	£30
Pye K30	£35
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Grundig	£10
Hitachi	£10
Thorn 9000	£10

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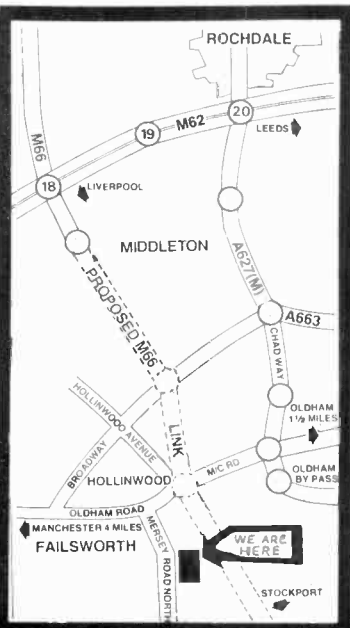

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G.E.C.	**£20.00**	**£10.00**
I.T.T. R/C	**£30.00**	**£20.00**
Philips G11 & Pye G11	**£28.00**	**£18.00**
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KT3	**£50.00**	**£40.00**
KT3 Text with Handset	**£70.00**	**£45.00**
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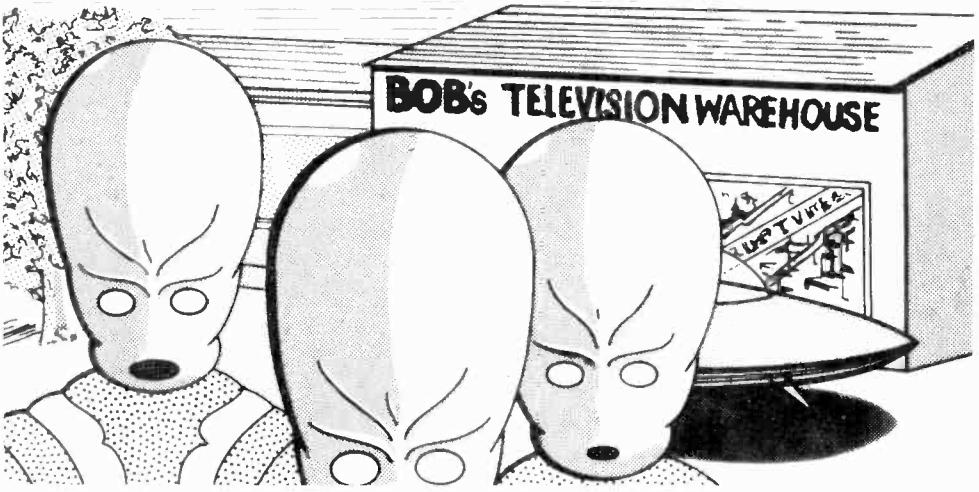
WORLD EXCLUSIVE

ALIENS SEEN IN BASILDON

A space ship was seen today outside a local television warehouse in Basildon.

Passers by were held spellbound by the sight of three space aliens appearing from within the store, carrying what appeared to be Television sets and video recorders.



In an exclusive interview with one of the aliens, our reporter was told that they had travelled a great distance across our galaxy to this particular T.V. store, because as they said "Bobs T.V. & Video deals cannot be beaten". They were also particularly impressed by the large selection of reconditioned sets

The Alien went on to say that as a main dealer for T.V. equipment on his own planet Trinitron, he found that the trip to earth was justified and rewarding due to the amazing deals he found at Bobs.

Two of the aliens were also impressed by the variety of makes including Ferguson, Philips, National Panasonic, Hitachi, Sharp, Grundig etc. plus B grade Philips machines.

SUPERVISION

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9600 Basic 2 function remote	£15
9900 2 function remote	£25
9900 Full infra red remote	£30
Text TV's	£50
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VIDEOS

3V22	£35
3V23 Full infra red remote	£60
3V29/30	£60
JVC, SHARP, AKAI, HITACHI	£65

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Ferguson/JVC Universal Heads	£17

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ITT SEL IIF Modul 2 UK IF Tuner £8

4 types of front panels Fidelity 2000/3000 types £5

CVC20, CVC32 I.F. CVC40 Cans £5

20AX Line lin coil 50p

GEC switch mode trans 20AX
ITT mains CVC9 to CVC33 print type 60p

ITT 2,800 mains remote switch 50p

NEW

2110 GEC Sound O/P Panel £1

2110 GEC L.O.P.T. Panel £6

2110 GEC Power Panel £5

Line o/p frame panels GEC 20AX £10.00

ITT CVC40 Push Button Unit & Mains Switch £12

▽ **25% OFF** ▽

Rank Panels

Z736 Tuner I.F. £10

A805 Conv. 7/8 £2

Z780 Line O/P £10

Z968 £10

Z582 I.F. Panel £5

KT3 Teletext Power Supply £10

BA 301	£1
TA 4127	£1
HD 3884 2A23	£3
TA 4184	£1
TA 2125	£1
TA 4190	£1
TA 4138	£1
TA 4196	£1
TA 4174	£1
TA 4139	£1
TA 4198	£1
TA 4167	£1
TA 4199	£1
BA 546	£1
BA 328	£1
TA 4176	£1
TA 4145	£1
TA 4191	£1
HA 11710	£1
TA 4188	£1
TA 4197	£1
TA 4183	£1
TA 4197	£1
TA 4183	£1
TA 4195	£1
TA 4175	£1
TA 4177	£1
TA 4192	£1
TA 4146	£1
TA 7265	£3
TA 7699P	£3

The Service Engineers Guide to Teletex £2

4 Types Fedility front panels with t.c. & pats £2 each

BB 103	10p
BB 105A×12	£1
BB 105B×12	£1
BB 105G×12	£1
BB 121a	10p
47	10p each

1A/1600V 10p

DG3P EQV-BY228 10 for £1

2 amp bridge rec. wire end 15p

CV 8617	10p
Y 716	10p
Y 729	30p
Y 730	10p
Y 827; 6A/1KV	20p
Y 860	30p
Y 933	5p
Y 969	50p
Y 997	30p
Min 12 volt Relays	75p
R 1038	40p
R 1039	40p
R 2009	80p
R 2010b	£1
R 2029	50p
R 2210	60p
R 2257	60p
R 2265	50p
R 2305	50p
R 2306	30p
R 2322/2323	pair 80p
R 2323	15p
R 2396	50p
R 2461	80p
R 2030	50p
R 2443=BD124	30p
R 2540	£2
R 2737	40p
R 2738=TIP41	30p
R 2775=TIP41c	40p
R 3129=TIP47	40p
R 4050	£1.00
S 2008b	80p
2SD898B	£1
2SC1942	£1
Hitachi sets etc.	
STR441	£2.50
STR454	£2
STR6020	£2
S 2000AF line o.p.	£1
2SC940	£1
BU 105/04	80p
BU 108	£1
BU 124	50p
BU 126	80p
BU 180a	65p
BU 204	60p
BU 205	75p
BU 206	£1
BU 207	£1
BU 208	80p
BU 208A	75p
BU 208D	90p
BU 222	£1
BU 326	£1
BU 407	60p
BU 426A	45p
BU 426V	60p
BU 500	£1.10
BU 500D	£1
BU 508A	90p
BU 508V	£1
BU 705	£1
BU 807	£1
BU 824	50p
BUT 11	50p
BUW 11	50p
BUW 84	60p
BYW 20-08-9	£1
BYW 95	10p
BUX39	£1
BUX84	50p
BUX85	50p
TIC 106a	30p
TIC 116m	30p
TIC 116n/Y 1003	30p
TIC 126N	30p
TIC 225S	30p
TIC 226E	30p
TIC 226m	30p
TIC 236m	30p
TAG 226/600	30p
TICV 106D (TO92 case 2A/400V)	10p
TIP 29	25p
TIP 30	25p
TIP 30A	25p
TIP 30B	25p
TIP 30C	25p
TIP 31	25p
TIP 32	25p
TIP 33B	50p
TIP 33C	70p
TIP 34A	50p
TIP 34B	60p
TIP 34C	70p
TIP 35B	50p
TIP 35C	70p
TIP 35D	80p
TIP 36	50p
TIP 36C	70p
TIP 41	15p
TIP 41B	40p
TIP 41D	70p
TIP 42	10p
TIP 42/BRC 6109	10p
TIP 48	40p
TIP 49	30p
TIP 57	30p
TIP 110	20p
TIP 100	30p
TIP 102	30p
TIP 115	50p
TIP 117	50p
TIP 125	35p
TIP 126	40p
TIP 127	40p
TIP 130	30p
TIP 131	6p
TIP 136	30p
TIP 140	50p
TIP 142	80p
TIP 640	50p
TIP 2955	35p
TIP L761A-1000V/4Amp	75p
T 6032	30p
T 6036	40p
T 6040	40p
T 6047	40p
T 6049	40p
T 6051	40p
T 6052	40p
T 9004	40p
T 9005	40p

ZTX 107	10p
ZTX 108c	10p
ZTX 109k	5p
ZTX 213	5p
ZTX 341	10p
ZTX 342	10p
ZTX 384	10p
ZTX 451	10p
ZTX 550	10p
MJ 2253	60p
MJE 3040	60p
MJE 2209	10p
SP 8385	50p
SAB 3205	£1.00
SAB 4209	£1.00
300M + 700 320V	£1.80
200 + 100 + 100 + 50 300V	50p
150 + 200 + 250M 300V	50p

Computer Transformer 20v/2.25A; 20v/1.5A; 17/.5A; 19/.5A; 28/.05A £3

OLD TYPE TEX. I.C.

TX004F	£3.50
TX005GN	£3.00
TX904	£3.00
X908	£4.00
MM2102AN	£2.00

Voltage Regulators

+5V/UA78PO5SC	30p
−8V/79M08c	30p
+6V/78M06c	30p
+10v/78LA10	20p
LM 337	30p
LM 342/18	30p
LM 340T 5.0	50p
+12V/LM 340T12	50p
+18V/MC78M18	20p
+24V/78M24	30p
MC 7724cp	40p
MC 7824	40p
TIS 90	10p
TIS 92	20p
TIS 93	20p
U 19885	40p
U 3832	15p
U 3845	15p
MR 508	10p
MR 501	10p
MR 502	10p
BCW 71R	30p
BYF 1202	10p
BYF 1204	10p
BYF 3126	40p
BYF 3214	40p
BYX 10	10p
BYX 36/600	35p
BYX 38/300	25p
BYX49/600R	75p
BYX 55/350	10p
BYX 55/600 (Bead)	10p
BYX 71/350	20p
BYX 71/600	50p
BYX 72/300	20p
BYX 36/600	50p
BYV 95B	10p
BVY 95C	12p
BYV 96D	10p
BYZ 106	10p
BPW 41	15p
BYW 56 2A/1000v G11	8p
BYW 29/50	15p
BZU 15/24	54p
BZY 93c75	50p
BZV 15/18	30p
BZV 15/30	30p
BZW 70c6v2	10p
BZX 79.3v	10p

Bush thyristor RCA 76122 £1
Transformer 240v/20v-500Ma 75p
Chassis type Transformer 240v/12 Volts 500m/a 75p
CVC 20 tube base £2
Tube Base Rank & G11 £1.20

Infra red led LD57CA 15p
15K-20 turn pots 20p
Thorn 3500 2A cut out 50p

BBH/SAFETY MAINS ISOLATING TRANSFORMER
250V-250V/A £10

BRIDGES

KBL 005	30p
KBL 02	30p
KBP 04	30p
W02	15p
W004	15p
W005	20p
800V Bridges 2½ Amp	30p

MAINS MICRO SWITCH
GEC & Double etc. £1

12V Video Battery Packs 4Amp Ul2 Cells £10

24V 4Amp (100VA) Trans £4.00

Mains 240V (100VA) to 240V out fully shrouded £5.00

ITT CVC45 8 way resistor unit for v/cap £3

CVC40 8 button unit with mains lead & slider pots with sockets £10.00

470/40v × 10	£1
22/100v × 10	£1
100/350v	70p
400/350v	70p
.47/500v	25p
1/600v	25p
.022/1kv	10p

Hills £4.50
NI.CD 5 Hours Battery Charger with battery test £6

Hill Deluxe Universal Ni-Cad Charger £6

Nickel Cadmium Battery Charger AA-C-D-PP9 £4.50

12 Volt Aerial Changer over Relays 144 Mc/s 45 watts 50p

6 Push Button Unit for GEC 2100 Series Replacement for Touch Button Unit £8

8 SEG LED Display with driver I.C. LM1017 50p

PHILIPS' MIN. HEAD PHONES £1.50

Electronic Buzzer 6 volt, 12 volt 40p

15V, 015V, 1A £1
Print Type Trans

Regulated Power Supply 3-12 volts 1 amp in box with switch and mains lead £4

Philips' Video Cleaning Cassette SBC461 £6

Philips' Headphones Compact Disc Stereo Type £10

ITT Display Tube 58705 50p

8 Seg Display FND500 20p

Model 3000 Pocket Personal D.M.M Volts range AC, DC 200M/V to 400V Res. 2000Km £20

Export PYL731 6 Push Button unit with (UHF-VHF) band switch £4

ITT Micro Phone M5 50p with switch

1½ Volt Sub Min Relays 25p

Philips Solar Scientific SBC1730 Calculator £12

15v-0-15v 1 Amp Transformers £1

RGP30K	10p
RGP30G	8p
RGP10B	5p
RGP15G	6p
T6024WGI	10p
GP10	5p
GP15Q	5p

THORN RGP80G 30p

Multi Core £4.50
60-40 Soldar 500G 20 SWG £5.00
15 Watt Stereo Amp Sanyo Module with Data 50p
PHILIPS
25 Watt Solder Iron £4.00

Various Tools and Accessories

10 mixed tube bars	£4.00
5000 Diodes-Resistors	£3 pack
T/V V/Aerial 300Ω or 75Ω	£1.50
* D/P push mains switch	20p each
Mains lead & two pin socket for radio cassette	35p
T/V loop aerial	75p
Radio Telescopic Aerial	£1.00
Philips Neon Lamps for TV sets	5p
Freeze Philips	£1.20
Foam Cleaner Philips	£1.20
Contact Cleaner Philips	£1.20
Cans of Anti Static, Degrease Cleaner and Anti Corona	All at £1.40
Lorlin Full Remote Relay Switch fit most T/V sets, mains 4 tag, 2 tag 12 volt	£1.00
Mains timer, 13 amp — up to 2 hours; easy to use, plugs into socket	£3.00
Screen locking agent, large can	£1.50
Red E.H.T. LAED and Anode Cap	£1.00
Weller solder iron 25 watt	£4.00
Hitachi Silver Oxide Battery G13 UCC357 IEC SR44 1.5V	60p
100 Coax Plugs	£12.00
De-solder pump + 2 nozzels Philips	£4.00
Flat Red LED and Green	5p
500gm 60/40 solder reel	£6
Solder 1 kilo reel	£5.50
Dual v/u meter -20 – +10db	£1
K30 thermistor 232266298009	75p
De-solder Pump	£2.50
Portasol Flameless Gas Soldering Iron	£16.00
Green & Red, LED pack mixed	100 for £1.00

HILLS
Miniature Linesman Pliers £2.20 Miniature Pliers £2.20
Miniature Side Cutters £2.20 Miniature End Cutters £2.20

KT3 PANELS
Sound Output RGB Output Chroma Panel, I.F. Panel and Line OSC £7.00 each

SONY 1400KV Chroma Panel £6
SONY 1400KV Touch button unit £3.50

GEC Decoder Panel PC772A3 PC446A5 £6

12 Volt Mains Trans 500M/A £1.00

Double 1.5 Digital Display. High brightness 20p

Quantity Reductions

BY204/4	25 for £1.00
BY206	25 for £1.00
KT3 touch button black	6 for £1
G11 touch button red	6 for £1
K30 full remote Dawer Ass with 3 I.C.	£7.00
K30 VHF, UHF Dawer Ass	£6.00
BY298 3 amp/fast/R	20 for £1.50
BU126	10 for £6.00
BU205	10 for £8.00
BU105	10 for £6.00
BF458	10 for £1.00
BF224	20 for £1.40
OA90	40 for £1.00
50 Ceramic Condensers	£1.50
Mixed Mounting Kit for Power Transistors	50p
300 Condensers	£1.50
300 Resistors	£1.50
150 Electrolytics	£2.00
15 Bulbs Philips	40p
GEC-Hitachi Thick Film Frame	£5

Plastic Boxes 4¾ × 4 × 1 × ¾ 50p
100 Fuses £2.00
100 W/W Res. £1.50
BF 199 20 for £1
10 × 20 Turn 100k pots. Rank £2
BF 470 20 for £2

6 Mixed UHF Aerial Isolating Sockets, some with long leads. Fit ITT, GEC, Philips, Pye £1.00

Mixed Packs

TO66 12 Power Trans RCA 16182 NPN Replacement for BD124 and Mounting Kits	£1.00
25 Panel Mount Bulbs & Neons	£1.50
10A	£1.50
25 LED red/yellow/green	£1.50
20I/C Holders	£1.20
20 Large LED Red	£1.00
20 Small LED Red	£1.00
10×20 Turn 100K Pots	£1.00

Red & Green LED on Panel 1p each

Mixed 100 Transistor B.F. and B.C. and PET £1.50 1000 for £10.00

12 Volt 4 Amp Video Battery Pack 10 of Type D Cells £8.50

40 glass reed switch £1
10 press to make switch 70p
40 Pots £1.50
With Focus Pin, 10 Tube Bases, mixed £2.00
1,000 Diodes, Condensers, Resistors on Bandolier £1.00
20mm Fuse Holders
Chassis Mount 20 for £1
EHT Diodes, small 20 for £1

300 Mixed Diodes £2

100 500M/A Fuse £1
Mixed V/Cap Pots ITT-GEC-Hitachi-Philips etc. 20 for £1
ITT Mains Switch with Remont CMC113 £1

SENDZ COMPONENTS
TO ORDER SEE BACK PAGE

SENDZ COMPONENTS
TO ORDER SEE BACK PAGE

Matsushita PY34220 Tuner	£7
C Cam Decoder with TDA3591	£5
Toshiba VHF/UHF EG522F	£6
Mitsumi MF-C1-F51	£5

Thorn Spares

New 9000 Decoder	£8.50
9000 Frame panel	£8
9000 Cyclops panel	£1.50
8800 convergence panel	£6
8500 convergence panel	£6
4000 Power supply	£3
1600 Mains lead, switch	
T605 1xNPN T066 80v/6A	10p
9000 Sound output panel	£1
3500 Focus unit	£1.50
3500 Mains Trans	£4
3500 cut outs	10 for £4
3500 IF panel	£2
3500 Frame panel	£3
3500 Line panel	£3
3500 A1 Diode	20p
Export 3500 IF panel	£2
IC board with set of SN74LS	£1
4000 Tube base	£4
3500 A1 pots	50p
Beam limiter panel	£1.50
3500 Power panel with Y969	£1
3 Way regulated adaptor 240V 6V 7.5 9V/300mA	£3.50
Rank/Toshiba preh unit 0354	£9.50
4 Push button unit preh	£1.00
6 Push button VHF/UHF for v/cap GEC/Decca type	£7.00
7 Push button for CVC5 ITT KT3 12 Push button unit	£8.00
KT3 (Export) 12 P B u	£2.00
6 Push button Unit Thorn	£2
6 Push button GRC	£1.00
6 Push button PYE 731	£6.00
Hearing aid unit	£6.00
Rank Z718 4 P/B/Unit MECH	£3
7 Button Unit GEC with Lamps	£4
697 Push Button Unit	£7
Z916B panel	£6.00
T513AP panel	£5.00

Mains Droppers

Pye 731 3+56+27R	50p
Thorn 50/17/1K5	£1.00
120/20/20/48/117	£1.00
270/1006 for Thorn 4000	50p
18 320/70/39	£1.10
Thorn 50-40R-1K5	50p
Ac Socket & Lead GEC, ITT, Philips, Pye	25p
7×33+4 Thorn	£1
Thorn 1600-1700	£1.50
Rank Toshiba Tube Bases	30p

Speakers

6×4 G11	25 ohm	£1.00
5½×2½	3 ohm	£1.00
5×3	80 ohm	70p
5×3	50 ohm	50p
5×3	35 ohm	70p
4×4	8 ohm 15 watt	£1
6×4	15 ohm	£1.00
6×4 speaker	16 ohm	
7×3	70 ohm	£1.00
8×5	8 ohm 15 watt	£2
8×5	8 ohm	£1
5×3	8 ohm	70p
7×3	16 ohm	£1.00
5" dia	16 ohm	£1.00
5" dia	8 ohm	£1.50
6½" dia	4 ohm	£1.50
6½" dia	3 ohm	£1.50
2¾" dia	8 ohm	75p
3" dia	8 ohm	75p
4½" sq	15 ohm	75p
KT3 speaker	K30	75p
3" dia	15 ohm	60p
1690 5×3	12 ohm	£1
K45 Philp	15 ohm	75p
K30 15 watt		£1

KT3-K30

OE-425		
OE-550	F W	10p
OE-513	correction	10p
OE-557		50p

DIODES

BY 126	10p
BY 127	10p
BY 133	10p
BY 134	10p
BY 164	50p
BY 176	25p
BY 179	40p
BY 184	25p
BY 187	10p
BY 190	40p
BY 196	30p
BY 198	10p
BY 204 4	8p
BY 206	8p
BY 208/800	8p
BY 210/400	5p
BY 210/800	10p
BY 223	60p
BY 224/600 4 8A/600R bridge	50p
BY 226	15p
BY 227	15p
BY 228 1500v	20p
Flat BY 229 black	15p
BY 299 Red	20p
BY 229/400	30p
BY 299/600p Tag	30p
BY 237	5p
BY 254	10p
BY 255	30p
BY 298	10p
BY 299	10p
BY 406	8p
BY 527	20p
BY 407a	10p
BY 527	10p
BY 602	10p
E 247	10p
GP20G	5p
GRP80G (TX10)	60p
XK 3102	50p
BYV 28/200	20p
Bridge TX10 800/3 amps	30p
KBPC35-02 Bridge	£1.50
Bridge Rec D35B10	40p
International Rectifier EHT Diodes G770/HV34 6KV	3 for 8p
6A/600V Stud Diodes	20p
6A/1000V Stud Diodes	20p

K35 Decoder	£8.00
K35 Sound OP	£4.00
Thick Film Daughter KT3 3122-127-43891	£3
12A IF K30 Tex Rec Front Panel with IC	£5
K35 II	£5.00

Plug In

K4 Focus Pot	£1.00

Fidelity Tube Base with transistor & focus pot	£1.50
Bush Tube Base on panel	£1.00
TX10 Tube Base on Panel	£3.00

Line Transformers

Line O/P Trans Mono TX 12"-14" Philips	
27482	£10
4822	£10
10273	£10
Thorn 1690 LOPT	£7.50
2 I Pots 3,500 I off each type	£3.00
G8 Trans Philips	£7.00
G11 Split Diode	£12.00
CVC 820 Split Diode ITT	£10.00
Thorn B W AD5308E + Stik + Lead	£1.50
GEC 2040	£3.00
GEC 2110	£7.00
Mullard AT 2036	£1.50
Pye 169 Line Trans	£3.00
Pye mono	£3.00
Rank mono 1704A	£3.50
Split Diode Trans	£7.00
GEC 20 AX Rank Z522	£3.00
Rank L O P T. Z970	£3.00
CVC 32	£6.00
XT2080 15	£5.00
CVC30 ITT	£5.00
CVC 32 Line Tran	£7.00
CVC 800 Line Trans	£6.00
CVC 40 Slip Diode	£12.00
CVC 45	£5.00
GEC Portable G1OT2041	£3.00
GEC Portable G1OT2046	£3.00
ITT Split Diode Leads ITT	£1.00
3500 L O P T. & ITT Trans	each £2.00
I OPT Rank Z763	£5.00
K35 Split Diode 3122 13839301	£10.00

Universal Tripler

with small focus pot Green type	£7.00

Black Triplers

KT3 Triplers	£6.00
S I C Universal Tripler	£6.00
11 13H	£2.50
11 1GA	£2.00
ITT CVC 5-8-9	£3.50
Rank 1251 Tripler	£2.00
Rank 1110P A823	£3.50
TC 25 30K Rank	£3.00
11 1E2Z Rank	£3.00
G9 Philips	£4.00
GEC 2110	£4.00
3500 Thorn	£3.00
8500 Thorn	£4.00
9000 Thorn	£7.00
9500 Thorn	£4.50
9600 Thorn	£4.00
2040 GEC	£3.50
GEC TVM25 Tripler	£2.00
Universal Tripler	£5.00
G8 Tripler	£5.00
CVC20-32	£5.00
Decca 80 100	£4.50
Grundig TVK 52	£2.50
11 13BQ Pye 731	£3.00
11 TTY	£4.00
D22 for Pye 18" colour portable	£4.00
LP 1193/93	£4.00
BG 100/41	£3.25
FRO Tripler print type with loops PO7	
BG2087	£5
Telext ultrasonic rec't panel	£14.00
12-14V 20 for £5.00 200 for £25.00	
GEC S touch unit assy complete with all I C's + pots	£4.00
G11 E W Transformer	50p
G11 E W coils	£1.00
G11 Transient Suppressors 245V	20p
G11 Scan Coils	£5.00
G11 100K tuner pots	12 for £1
KT3 IF panel	£6.00
KT3 line OSC Transformer	£1
KT3 K30 infra-red receiver head	£1
K30 drawer unit with IC's (home)	£10
K30 drawer unit with IC's (export)	£10
KT3 AE Sockets	50p
KT3 receiver panel	£8
KT3 line driver transformer	50p
Pye, K30, GEC, etc Pre mains stand-by switch	£1
Decca 80/100 IF panel	£5
NPN PNP 80V 6 Amp TO66 O P Trans	pair 25p
5 button touch tuner BBC1/2 ITV1/2 video with ic SAS 5601 5701	£7.00
Control panel 5 sliders + mains lead	£1.50
G11 8 touch button unit replaces old 6 P B U	£24
Tube base + base unit for 820 Euro chassis	£4.00
GEC Line O/P Trans & Rec Stick for Portable	£3.00
CVC 20/25/30/35/40 decoder panel	£10
CVC 20/25 30/35/40 decoder panel (untested)	£5
CVC 40/45 IF panel	£5
40K Transducer	50p
PHILIPS NL51IN	£1.20
LM337M Reg.	30p
20 GEC Black Spark Gaps	£1.00
KT3 Front Panel Control Assy	£2.50
BTW 30/50	50p
BTW 92/800R	£3
25A473 PNP C/P	10p

Rank T20 Z136 Panel	£6.00
NEW GEC 20AX Power Supply Switch Mode	£12.00
Field + Jungle panel for GEC 3133/3135	£1.50
GEC 2110 line panel with transformer	£7.00
GEC 2110 tuner unit + IF Panel	£12.00
Pye/Chelsea Line op panel	£12.00
Pye 205 Tunit	£3.90
Pye 713 IF panel and tuner	£7.00
Pye 713 Chroma	£10.00
Pye/Chelsea Timebase panel with LOPT1	£10.00
Pye 731 Frame Panel	£5.00
Pye 731 Convergence Panel	£5.00
Pye 731 Chroma	£10.00
Pye 731 IF panel + tuner	£10.00
GEC portable chassis + LOPT1 2114 New	£4.00
G9 Power Panel	£6.00
Mono RANK Chassis 127A NEW	£10.00
NEW G9 Frame Panel	£4.00
NEW G11 IF Panel	£10.00

25% OFF ALL PANELS

G8 Tuner Unit + Panel	£4.00
G8 IF & Chroma	£6.00
G8 Chroma	£3.00
G11 IF Detector	£3.00
G11 Selector gain module	£3
Complete CVC 825 Chassis (both panels)	£40.00
AEC V/Cap Resistor Unit UHF with IC SAS660 SAS670	£3.00
Z714 RANK IF Panels 6MHz I.F.C.	
SL431F	£3.00
Z909B RANK IF Panels Export 5.5MHz 2 I.C's	
TBA1205B TCA2705Q	£2.50
K35 IF	£6.00
Z743 RANK IF Panel Export 5.5MHz 3 I.C's	
TBA750+SC9504P+ SC9503P	£1.50
Pye G11 Front panel with transducer, pots, tuner pots, 6 ph switch+lead	£5.00
Pye 6 button switch portable	£1.00
GEC V/cap VHF/UHF tuner and IF+ sound O/P PC 706B3 (Export)	£12.00
GEC Line O/P PC 659B3	£6.00
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CVC 20 Front panel with sliders + mains input panel	£4
CVC 40 PUSH BUTTON ASSY with sliders; complete with lamp assy + pots 8 button units	£9.00
CVC9 slider pots panel	50p
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T147 Rank tube base on panel	£1.00
Z718 Focus Unit	£1.50
T20 Focus Unit	£1.00
Large Type	75p
Decca Small	75p
KT3 Focus Unit	75p
K30 Focus Pot	75p
K30 Tube base on panel	£1.00
TX10 Focus Units	£8.50
CVC 32 Focus Unit	75p
Fedility Focus Unit 14R-14S	30p
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ITT Small for use with Split Z718 Bush Focus	£2.00
Diode	50p
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TV14	50p
TV20	£1.00
TV45	50p
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TX10/TX100 16 Button	£10.00
G11 drawer ASS 3 pots Mains switch and lead	£2.00
K30 Drawer Ass with pots cable forme	£1.00
TX10 Drawer with 8 way pots. ass.	£2.50
TX10 Ex. port with band switch (drawer)	£2.50
Line O/P panel GEC 2217/2218/2213/ 2214/2226/2227/2228	£10

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SR54	25p
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M491B81	£1.00
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M58658P	£1.00

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.33/250V	20p
.39/250V	15p
4n7/250 tested 5KV	25p
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GEC600/250	60p
700/250	£1
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800/250	40p
32/300	20p
4/350	5p
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4.7M/350v	10p
33/350	20p
220/350	30p
300/350	40p
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22/375	15p
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4700pf/400	10p
.22/400	10p
8/400	15p
33/400	20p
4000/400	40p
394K 400V	20p
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.47/500	25p
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0.1/1200V wire end	15p
0.1/450 A/C wire end	20p
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.047/600	15p
0.0047/1000	10p
0.01/1000	10p
0.1/1000	10p
.47/1000v	65p
.47/250V A.C.	10p
.001K 1250	10p
0.0047/1500	10p
.005/1500	10p
.0105/1500	10p
1n8/1500	15p
2n0/1500	15p
2n2/1500	15p
.01/1600	15p
G11 8200/2KV	15p
0.1/2KV	20p
3n9/2KV	10p
0.0015/2KV	10p
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2n0/2KV	15p
2n2/2KV	15p
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350V 400M	60p
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K35	
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ITT

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BFT84	8p
BFW11	20p
BFX29	30p
BFX84	25p
BFY50	15p
BFY52	20p
BFY90	25p
BLY49	25p
BPW41	25p
BRC116	25p
BRX43	15p
BRX48X	10p
BRY56	30p
BSS68	10p
BSY79	10p
BSY95a	10p
BTY80	20p
BSX19	17p
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BC109	5p
BC113	10p
BC114	10p
BC115	10p
BC116	10p
BC117	20p
BC119	20p
BC125	10p
BC126	10p
BC139	10p
BC140	30p
BC141	25p
BC143	25p
BC147	10p
BC148	10p
BC149	10p
BC153	10p
BC154	10p
BC157a	10p
BC158	10p
BC159	10p
BC160/16	25p
BC171	5p
BC172	5p
BC173	5p
BC174	5p
BC183	5p
BC184	5p
BC204	5p
BC207	5p
BC212	5p
BC213	5p
BC214	5p
BC237	5p
BC238	5p
BC239	5p
BC250	5p
BC251	5p
BC252	5p
BC262	10p
BC263b	20p
BC294	30p
BC298	10p
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BC416	10p
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BC455	10p
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BD239	15p
BD240	50p
BD243c	30p
BD244	50p
BD250a	30p
BD252	20p
BD253B	50p
BD331	20p
BD373b	20p
BD416	25p
BD433	25p
BD437	25p
BD438	30p
BD439	50p
BD544D	40p
BD650	50p
BD678	30p
BD681	30p
BD682	30p
BD507	50p
BD508	30p
BD509	30p
BD510	30p
BD517	30p
BD519	30p
BD534	30p
BD535	30p
BD544D	30p
BD562	30p
BD610	40p

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