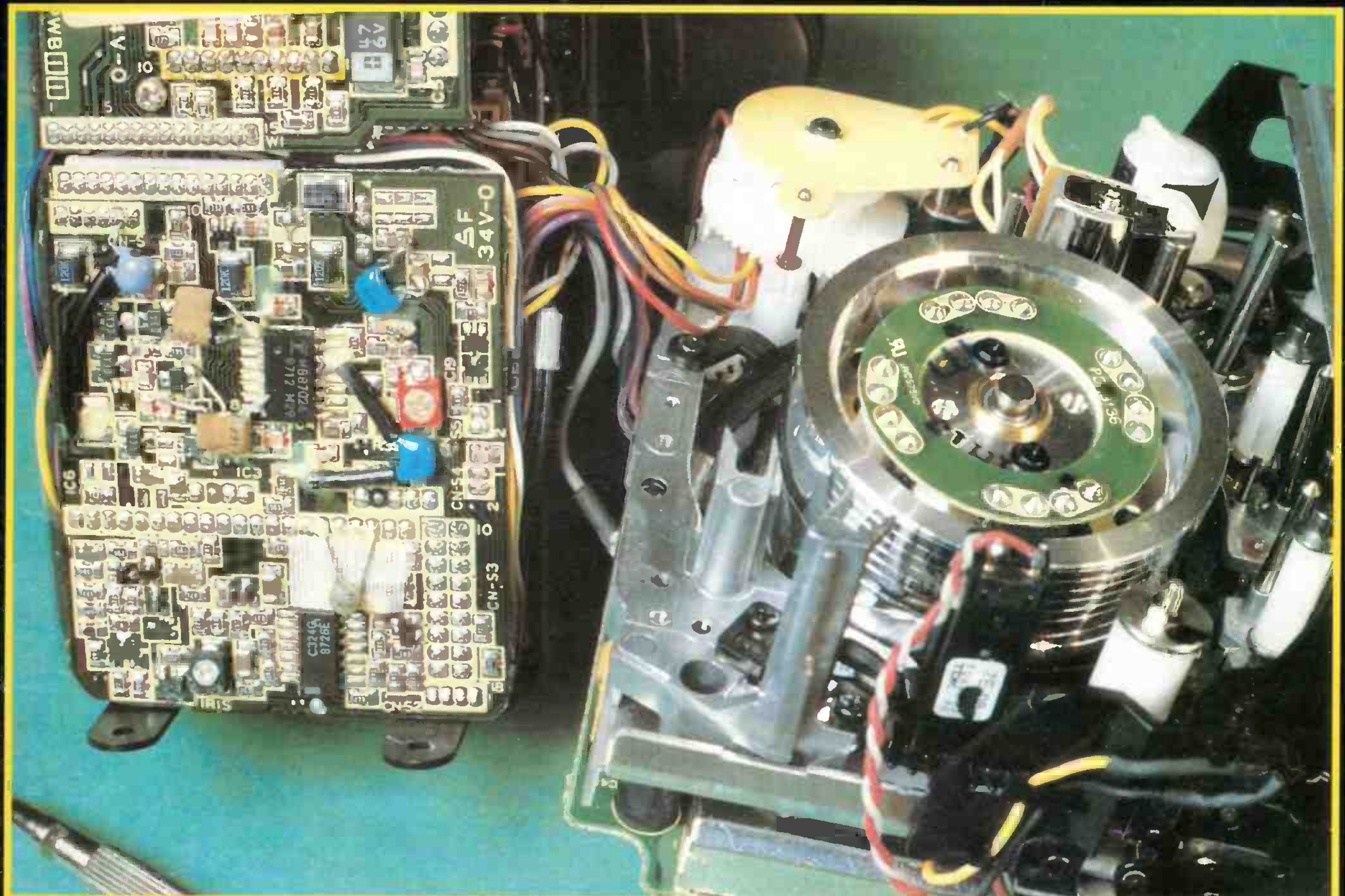
FEBRUARY 1989
Australia $3·25, New Zealand $4·70 (inc. GST), Malaysia $6·30, Ireland £IR2·13 (inc. VAT)
£1·50

TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS

Free this month
Assorted TV Semiconductor Devices



New Series: Servicing Camcorders
The Use of j Notation • DX-TV
Servicing the Sanyo CTP7130/1/2
Video Head Position Checker
TV Fault Finding • VCR Clinic

ISSN 0032-647X
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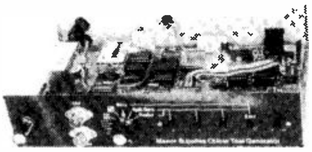
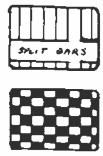
MANOR SUPPLIES

MKV PAL COLOUR TEST GENERATOR FOR DOMESTIC TV & VCR.

TEST DEMONSTRATIONS AT 172 WEST END LANE





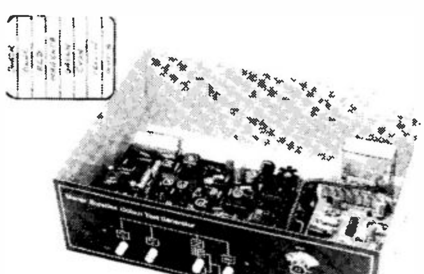
- ★ 40 different patterns and variations.
- ★ Fully interlaced sync pulses with correct picture blanking.
- ★ EBU colour bars, BBC colour bars, whole rasters & split bars (specially useful for VCR service), white, yellow, cyan, green, magenta, red, blue and black.
- ★ Chequerboard.
- ★ Mono outputs with 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 £3.00
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 £3.00).

MK 4 (BATTERY) BUILT & TESTED £58.00 + £3.00 P & P.
MK 4 (MAINS) BUILT & TESTED £68.00 + £3.00 P & P.
VHF MODULATOR (CH 1 to 4) FOR OVERSEAS £5.75.
EASILY ADAPTED FOR VIDEO OUTPUT & C.C.T.V.

ADD VAT 15%

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 £3.20 p.p. £1.40.)
ADDITIONAL GREY SCALE Kit £2.90 p.p. 45p.
UHF SIGNAL STRENGTH METER KIT £22.00 Alum. Case £3.20. De Luxe Case £8.60 (Built & Tested £48.00) p.p. £2.50.
CRT TESTER & REACTIVATOR KIT For Colour & Mono complete with Case, Panel Meter Indicator – can be adapted for latest CRTs £29.50 p.p. £3.00.

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BACKED BY TWENTY YEARS EXPERIENCE & STAFF OF TECHNICAL EXPERTS

LOPTs, TRIPLERS, PANELS, TUNERS, SELECTORS ETC.

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KT3, K30 PANELS, tested, exchange, sound, power, bridge rect, frame, RGB £7.50 each. Decoder (Non-text) £10.00 p.p. £1.50.
G11 PANELS (tested), frame, IF, decoder £12.50 each. p.p. £2.00. Scan £20.00 p.p. £2.80. Power tested exchange £18.00 p.p. £2.80.
G11 PANELS EX-RENTAL (untested) Scan, Frame, Decoder £5.00 p.p. £2.00.
G11 IF PANEL (new) less Tuner £2.50 p.p. £1.30.
G11 6POS Touch Tune Channel Selector (replaces old type) incl. instructions £20.00 p.p. £1.80
G9 POWER SUPPLY UNIT £5.00 p.p. £2.30.
G8 6 Position Channel Selector (sloping buttons) £2.50 p.p. £1.00.
HANDSETS (new replacements) p.p. £1.50.
G11 ULTRASONIC non-text £19.50, infra-red text £19.50. Others available.
KT3 non-text (RC4001) £22.50. KT3, K30 etc. Text £22.50.
HANDSETS EX-RENTAL, TEXT UNTESTED. KT, TEXT/VIDEO TYPE £3.50 p.p. £1.00.
MANUALS p.p. 80p. G11, K35, 2A £3.50. KT3 £4.50, CTX-E, CTX-S, CF1 £1.50 each.

THORN/FERGUSON SPARES

8000, 8500, 8800, 9800 PANELS tested, exchange. Power £8.80, Frame £10.00 p.p. £2.30.
8000, 8500, 9000 IF/DECODER PANELS salvaged £2.50 p.p. £1.80.
9000 Series IF/Decoder tested £10.00 p.p. £2.30.
TX9 Panels complete & tested £28.00 exchange (shop only)
TX9 Panels ex-factory for small spares includes IC's & semiconductors, etc. £3.00 p.p. £2.00.
TX9 panels salvaged ex-factory for spares incl. electronic & mains transformer. £8.50 p.p. £3.00.
TX9/TX10 Facia, control panel incl. infra-red receiver £8.50 p.p. £2.00
TX10 Focus control £8.50 p.p. £1.00.
TX9/TX10 Saw filter IF panel £5.00 p.p. 80p.
TX9/TX10 Remote & tuning control panel 1515 (incl. SAA5012) £7.50 p.p. £1.80.
TX Remote & tuning control panel 1509 (incl UAA1008A, battery) £5.00 p.p. £1.80.
TX REMOTE PANEL 1564 (incl. SAA5012, M923) £5.00 p.p. £1.80.
REMOTE CONTROL HANDSETS — TX9, TX10 infra-red (non-text) £18.00, TX9, TX10 inred-red text £19.50 p.p. £1.20. Grundig, Sony available.

ITT SPARES: CVC30 series convergence & purity panels £2.50 p.p. £1.50. CVC30 series panels surplus (untested) £2.50 each, CMP31, CMF31, CMA30, CM532 p.p. 80p. CMD33 p.p. £1.80.
CVC20/30 series chassis for small spares (shop only) £2.50.

BUSH SPARES: T20/T22 panels, tested, exchange, power £18.00. Scan £25.00 p.p. £2.50. T20/T22 touch tune panels + controls £3.50 p.p. £1.50.

GEC SPARES: 20AX MKII line time base £18.00 p.p. £2.00. Power (PC778) tested exchange £18.00 p.p. £2.00.
TELETEXT DECODER PANELS (tested) — Mullard VM6101 Type £25.00, Philips KT3, K30 £20.00 p.p. £2.30.
MULLARD VM6230 teletext decoder (similar to VM6101) plus additional Prestel units.

VARICAP TUNERS: Grundig 8630 series £5.00 p.p. £1.00. U321, U322/NSF204, ELC1043 (equiv), SC4, VHF NSF203 £7.80 p.p. £1.80. UHF/VHF ELC2000 £9.80 p.p. £1.00.
LOPTS New and guar. P/P £1.50, Bobbins 80p.

FERG., HMV, MARCONI, ULTRA		R.B.M. T20, T22	£9.80
1590, 1591, 1612, 1613, 1712	£4.80	R.B.M. T20, T22 Bobbin	£5.60
FERGUSON 3787 (Normende)	£9.80	DECCA Bradford (state Mod No)	£8.80
THORN 1600, 1615, 1690, 1691, 1790	£9.00	DECCA 100	£8.80
THORN 3000/3500 SCAN, EHT	£6.90	FIDELITY ZX2000, 3000 (Not 22″)	£15.50
THORN 8000	£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
ITT VC300	£4.80	PHILIPS G9	£7.80
GEC 2114J/Junior Fineline	£1.00	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	£1.00	PHILIPS CTX-S	£22.50
PYE 691-7 chassis type only	£5.00		

OTHERS AVAILABLE, PRICES ON REQUEST.

TRIPLERS: THORN 9000 £8.80.
UNIVERSAL (best quality) £7.80.
CONTINENTAL TVK & BG RANGE (quote exact no.) replacements £13.80 p.p. £1.50.
THORN 1500 30R5 stick £1.50 p.p. 80p. Others available.
6·3V CRT Boost Transformers for Colour & Mono £5.90 p.p. £1.40.
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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MANOR SUPPLIES

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W. Hampstead Brit. Rail Stn. (Bedford, Luton, Kings X, Crawley, Gatwick, Brighton)
Access from all over Greater London.

PLEASE ADD VAT 15% TO ALL PRICES INCL P+P

TELEVISION

February 1989

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On sale January 18th

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.

INDEXES
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SUBSCRIPTIONS
An annual subscription costs £18 in the UK, £21 overseas (by surface mail). Send orders with payment to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex, RH16 3DH.

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QUERIES
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

OUR NEXT ISSUE DATED MARCH WILL BE PUBLISHED ON FEBRUARY 15

VIDEO BELT KITS

★ PRICES DOWN ★

VKIT 1	AKAI	9300/9500/9800	2.40
	JVC	HR3300/3320,3360	
	TCE	8903/3V00/16/22	
VKIT 2	PANASONIC	NV7000/7200	1.45
VKIT 3	SONY	SLC5/7	2.25
VKIT 4	SONY	SL8000/8500/8600	3.60
VKIT 5	SONY	SL3000UB	2.10
VKIT 6	PANASONIC	NV3000B	1.99
VKIT 7	SANYO	9300P	2.75
VKIT 8	PANASONIC	NV2000B	1.73
VKIT 9	PANASONIC	NV8600/8610/V0111	1.50
VKIT 10	TOSHIBA	V8600	1.45
VKIT 11	SHARP	VC7300	1.50
VKIT 13	SANYO	VTC5000	0.95
VKIT 14	SANYO	VTC5300	1.85
VKIT 15	JVC	HR7650-3V31	2.00
VKIT 16	HITACHI	5000	1.90
VKIT 17	SHARP	8300	1.76
VKIT 18	SHARP	9300	1.50
VKIT 19	HITACHI	VT8000	1.05
VKIT 20	HITACHI	VT11/33	1.50
VKIT 21	HITACHI	9500	1.12
VKIT 22	SONY	SLC6	1.90
VKIT 23	SANYO	5500	1.05
VKIT 24	PANASONIC	NV300/333	1.55
VKIT 25	TOSHIBA	V7540	1.90
VKIT 26	JVC	HR7000	0.96
VKIT 27	THORN	3V29/HR7200	1.75
VKIT 28	AMSTRAD	7000	1.45
VKIT 29	PANASONIC	NV777	1.80
VKIT 30	SONY	T9	2.20
VKIT 31	TOSHIBA	9600	1.20

★ PRICES DOWN ★

VIDEO PINCH ROLLERS

PANASONIC	NV7000	3.75
SANYO	VTC9300/VBS7000	3.75
SONY	C7/J7/SL17	3.75
JVC	TCE3V00/01/06/16/23/24	3.75
JVC	HR2200/3320/3330/3660/1100/7700	3.75
AKAI	VS9700	3.75
HITACHI	VT5000	3.75
SHARP	VC6300/6500	3.75
SONY	TC6 GEN	3.75

★ PRICES DOWN ★

VIDEO IDLER TYRES

	O.Dia	I.Dia	Width	
SONY	23.7	17.4	4.9	50p
SONY	24.2	18	5.1	50p
HITACHI	31.8	25	4.9	50p
PANASONIC	37	29	3.9	52p
AKAI	26	20	3.9	50p
JVC	39.3	32.8	3.9	56p
JVC	33	23.9	4	56p
NATPAN	31.2	25	3.1	56p

ANTEX

C15 Iron 240v	6.20
C240 Element	2.75
Bits 102, 106, 820, 821	1.10
CS 17W Iron 240v	6.40
CS240 Element	2.75
Bits 1100, 1101, 1106	1.10
XS25W Iron 240v	8.50
XS240 Element	2.75
Bits 50, 51	1.10
Temperature Control 30W Iron CSTC	16.95
40W Iron XSTC	16.95
Unit TCSV1	88.95
Antex Stand	2.10
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Tips for Gas Iron	5.00
Turbo Rech. Iron Kit	18.99
Philips 25 Watt Iron	4.50

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Aero Klene	1.84
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Video Head Cleaner	0.96
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Solda Mop Std	0.70
Hylosil Silicone Rubber	2.98
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WE HAVE A LARGER RANGE LISTED UNDER SPECIFIC MANUFACTURERS IN CATALOGUE FOR THORN, SONY, HITACHI, FIDELITY, NATIONAL PANASONIC, PHILIPS.

REFURBISHED HEADS (Exchange)
Equivalents Chart in Catalogue

THORN NEW LIFE (Most VHS types)	19.00
THORN NEW LIFE (National Panasonic)	21.00

ORDERS WELCOME FROM SCHOOLS, COLLEGES, GOVERNMENT ESTABL.

SPECIAL PRICES ON 5+ MIX VIDEO HEADS PLEASE ASK

REPLACEMENT VIDEO HEADS

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VS3	3HSSV	18.00
VS5	3HSSV	18.00
VS10	3HSSV	18.00
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VS88	3HSSV	18.00
VS7100	3HSSV	18.00
VS7200	3HSSV	18.00
VS9300	3HSSV	18.00
VS9500	3HSSV	18.00
VS9700	3HSSV	18.00
VS9800	3HSSV	18.00

FERGUSON

3V00	3HSSV	18.00
3V01	3HSSV	18.00
3V06	3HSSV	18.00
3V16	3HSSV	18.00
3V22	3HSSV	18.00
3V23	3HSSV	18.00
3V24	3HSSV	18.00
3V29	3HSSV	18.00
3V30	3HSSV	18.00
3V31	3HSSV	18.00
3V35	3HSSV	18.00
3V36	3HSSV	18.00
8903	3HSSV	18.00

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VT8000	3HSSHA	25.50
VT8040	3HSSHA	25.50
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VT9300	3HSSHA	25.50
VT9500S	3HSSHA	25.50
VT9700	3HSSHA	25.50
VT9900	3HSSHA	25.50
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VT5000	3HSSH	25.50
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HRD121	3HSSV	18.00
HRD220	3HSSV	18.00
HRD225	3HSSV	18.00
HR2200	3HSSV	18.00
HR3300	3HSSV	18.00
HR3320	3HSSV	18.00
HR3330	3HSSV	18.00
HR3350	3HSSV	18.00
HR3360	3HSSV	18.00
HR3660	3HSSV	18.00
HR3860	3HSSV	18.00
HR4000	3HSSV	18.00
HR4100	3HSSV	18.00
HR7200	3HSSV	18.00
HR7600	3HSSV	18.00
HR7610	3HSSV	18.00
HR7650	3HSSV	18.00
HR7700	3HSSV	18.00

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N832	3HSSV	18.00
N833	3HSSV	18.00
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SLC33	PS482S	29.95
SLC40	PS482S	29.95
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SLK95	PS583S	39.95
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NV7000	3HSSN	18.00
NV7200	3HSSN	18.00
NV7500	3HSSN	18.00
NV7800	3HSSN	18.00
NV7850	3HSSN	18.00
NV8170	3HSSN	18.00
NV8200	3HSSN	18.00
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NV8620	3HSSN	18.00

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384	3HSSSP	26.95
385	3HSSSP	26.95
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9400	3HSSSP	26.95
9500	3HSSSP	26.95
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V57	3HSSV	18.00
V5470	PS38S2	25.00
V9600	PS38T	30.00

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FVHP910	3HSSSF	35.00

PHILIPS

DV462	3HSSU1N	25.99
6460	3HSSU1N	25.99
6520	3HSSU1N	25.99

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SONY SLC9	49.39
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HITACHI VT33E/GEC 4004	35.62
SANYO 9300/9435/9500	53.00
SANYO 5000/4700/5300	53.00
PHILIPS V2000	64.00
PHILIPS 1700	71.00
AMSTRAD 7000	58.68

SUNDRIES

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VHS CAPSTAN MOTOR	25.50
SANYO REEL MOTOR (5000)	12.95
SHARP REEL MOTOR	19.50
VHS (Gen. Purp.) THORN/JVC TAKE UP CLUTCH ASSY.	4.95
SHARP TAKE UP IDLER 0005GEZZ	2.20
0006 GEZZ	2.20
SANYO REEL DRIVE PULLEY	5.10
HITACHI F F IDLER VT11E/33E	2.90

PHILIPS VHS IDLER £3.50

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E240	3.45

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E120	2.89
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MS07	011 On/Off	1.50
MS20	011 On/Off Remote	1.50
MS03	Rotary On/Off Gen	0.86
MS02	1TT CUCS On/Off	1.24
MS25	1TT With Solenoid	5.31
MS20	Rank 120 On/Off	2.50
MS21	Rank with Solenoid	4.50
MT01	Thorn 1591	2.90
MS48	Thorn TX9/10 with solenoid	3.42
MS14	Thorn TX10	2.74
MS09	GEC 2040	0.97
MS31	Philips KT3	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 UCR7000	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
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150878	VCR9000	18.00

DECCA

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101	NON TXTUS8513	23.50

TATUNG

Remote £17.50

SONY

C5	RM75T	29.94
C6	RM72	22.62
C7	RMT200	45.00
C9	RMT213	45.00

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305	IR8649	29.84
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.

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FD09156	F14R	12 butt	13.81
FD09111	AVS	14 butt	13.75
FD09141	CTV14S 20R/22R/140R	4 butt.	13.75

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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

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GC56520831	C1404H-C1656H	31.80
GCA512220	C1653	22.00
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GCA510710	C2067H	23.50
GCA514620	C2089H, C2090H C2889H, C2290H	21.00
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IR8613	TP400TT	IR	13.50

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B1	EUROBELL (No. S.A.B.)*	21.00
B2	EUROBELL (with S.A.B.)*	26.95
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S4	1010/2010 EXTERNAL SIREN	(116db)	5.95
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S14	SOUND BOMB 2	(111db)	5.17
S15	SOUND BOMB 3 MULTITONE		4.50
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S17	MIKRO	(110db)	5.20
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M801	722 BUZZER		0.60
802	PMB27 BUZZER		0.70

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C13	4 WIRE SURFACE SLIMFIT	0.62
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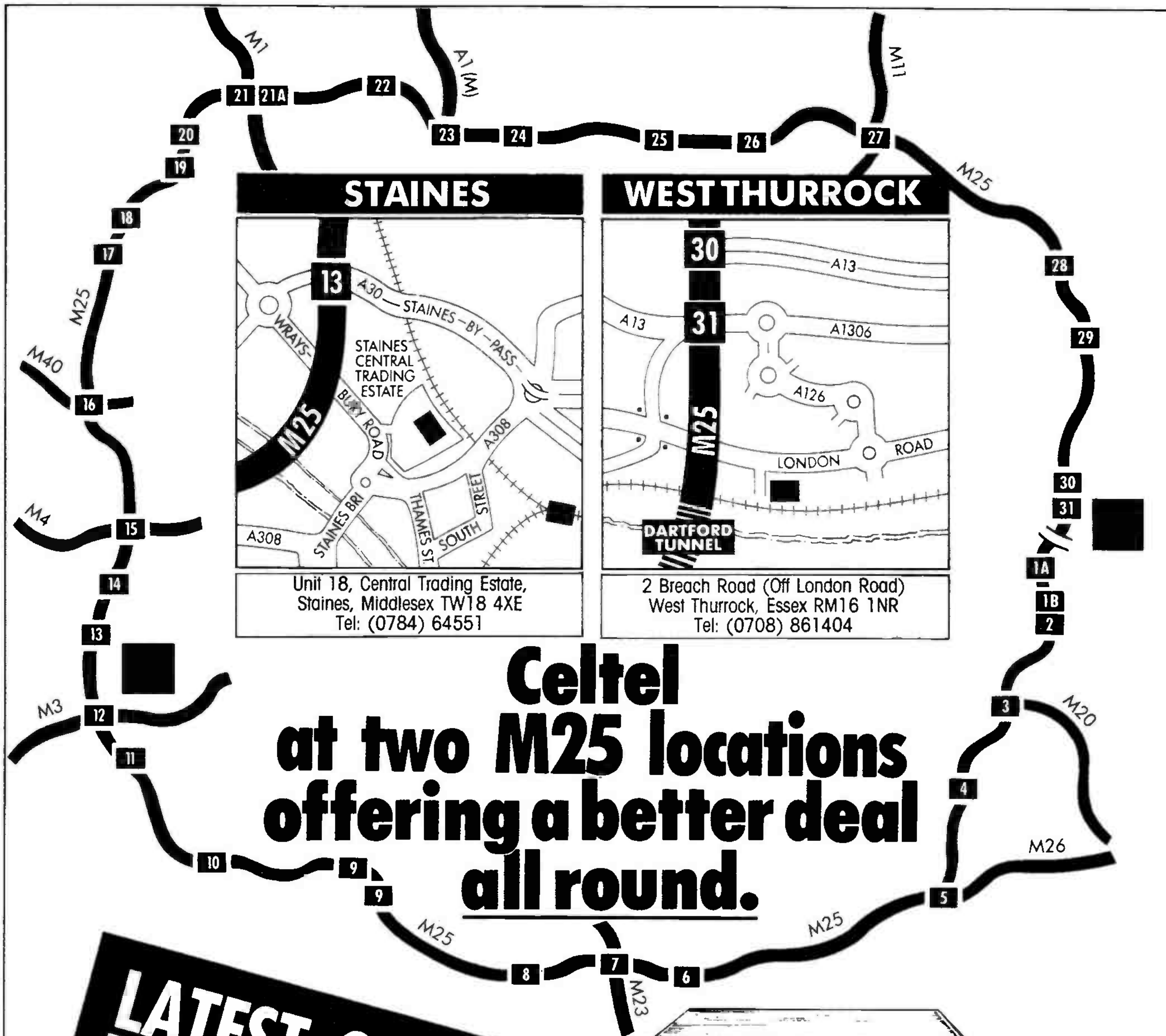

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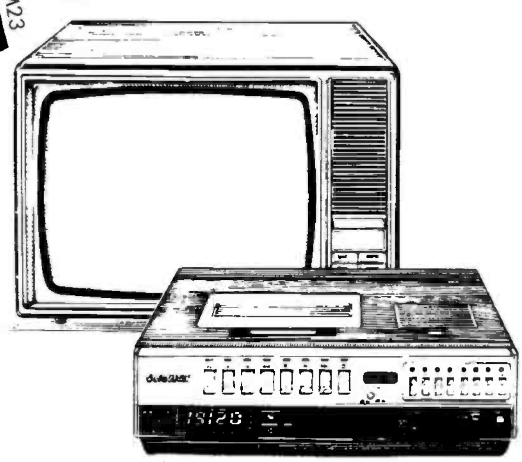

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BY179	.65
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BYX55/600	.30
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PHILIPS G8 (550)	7.90
PHILIPS KT3	7.95
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THORN 8500/8800	7.20
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HA1366WR	1.85
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HA1377	2.95
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SAA1250	3.85
SAA1251	4.95
SAA3027	3.95
SAA5000A	3.95
SAA5010	4.95
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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
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STK7308	8.95
STR4090	6.50
STR40090	7.95
STR4211	3.95
STR441	4.95
STR451	5.35
STR454	4.95
STR5412	6.95
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
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TBA530	1.25
TBA800P	.85
TBA810S	1.25
TBA820	1.50
TBA820M	1.25
TBA920S	1.95
TBA950/2X	2.25
TBA1440G	2.95
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

TYPE	PRICE (£)
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	6.35
TDA2611A	1.50
TDA2653A	3.50
TDA2655B	5.95
TDA3190	1.95
TDA3330	3.95
TDA3540	2.95
TDA3541	2.95
TDA3560	4.95
TDA3561A	4.95
TDA3562A	5.50
TDA3565	4.95
TDA3571 B/Q	3.95
TDA3650	4.75
TDA3651	1.95
TDA3651AQ	3.80
TDA3652	2.95
TDA3653AQ	4.95
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
UPC1365C	4.20
UPC1378H	3.70
UPC1382	4.35
UPC1394C	2.95
Z80ACPU	1.75

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

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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
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FERGUSON TX100 90°	19.95
FERGUSON TX100 110°	20.95
FIDELITY ZX2000 (Inc. Mod.) 14"/20"	12.50
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FIDELITY 22"/26"	20.95
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ITT CVC40	22.95
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
Hitachi CPT2650	1.95
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
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Sony KV1612	4.95
Sony KV2022 (Rem)	4.95
Tatung 140	2.75
Tatung 165 chassis	1.50
Tatung 140	2.50
Tatung 160/161	1.25
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TRANSISTORS

TYPE	PRICE
BC107	.15
BC147	.10
BC148	.10
BC307	.12
BC327	.11
BC328	.12
BC337	.11
BC338	.12
BC360	.35
BC546	.10
BC547	.10
BC548	.10
BC557	.10
BC558	.10
BC639	.25
BC640	.25
BD131	.50
BD132	.50
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
BF460	.95
BF470	.50
BF757	.70
BF871	.80
BR103	.75
BR303	.95
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
BU705	3.95

TYPE	PRICE (£)
BU807	1.30
BU826A	2.25
BU907	2.95
BU908	1.95
BUT11A	2.95
BUT11AF	2.95
BUW81A	3.95
BUX84	.80
R2540	2.35
R4050	1.38
SG613	8.95
T6071V(KIT)	5.75
T9053V	3.50
T9054V	3.50
T9064V	1.95
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
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 (phono)	16.95
U344C	9.95
U411	11.95
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DECCA 80 (400/800)	4.50
FIDELITY ZX(220/385)	3.95
PHILIPS G8(600/300)	3.95
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

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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
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On/Off Switch (Remote)	1.75
Push Button TX90	12.95
Tuner	14.35

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3V29/30

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Pilot Lamp	.80
Reel Idler	2.85
Take-Up Clutch	2.45
Take-Up Idler	1.40
Video Head	17.95

3V35/36

Capstan Motor	22.95
Cassette Housing	25.95
Mains Trans.	21.95
Reel Idler	2.85
Take-Up Clutch	2.45
Take-Up Idler	1.40
Video Head	17.95

3V44/45

Capstan Motor	37.95
Cassette Housing	28.95
Loading Motor	8.95
Take-Up Clutch	1.95
Video Head	32.95

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

V4001H/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	22.95

V4004H/VT33E

Capstan Motor	29.95
FF/Rew Idler	2.50
Video Head	22.95

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
ITT CVC5 7 WAY	11.75
ITT CVC8/9	12.80
ITT CVC20/30	8.50
ITT CVC45 (PORT.)	19.95
PYE G11 TIP SWITCH	29.95
RBM T20A 6 WAY	11.95

REMOTE CONTROLS

Ferguson TX9 U/S Basic	14.50
Ferguson TX9/10 N/Text	12.95
Ferguson TX9/10 Text	12.95
Ferguson TX Stereo Text	12.95
Ferguson 3V23 Video	14.95
Ferguson 3V31 Video	19.95
Ferguson 3V35 Video	17.95
Fidelity CTV14S	12.95
Fidelity Teletext	17.95
Grundig TP200	14.70
Grundig TP400 Text	12.95
Nat. Pan NV7200	15.95
Philips G11 U/S Full Rem.	15.95
Philips G11 U/S Text	15.95
Philips G11 I/R	13.95
Philips G11 I/R Text	13.95
Philips KT3/30 N/Text	12.95
Philips KT3/30 Text	12.95
Philips RC5 (Genuine)	19.95
Philips RC5 (Equivalent)	14.50
Redifusion Mk.4 Text	15.95
Sony RM604-RM606	14.50
Sony RM613/5	14.50
Sony RM630-RM635	14.50
Tatung RTP40	15.95

REPAIR KITS

Philips KT3/30 N/Text	6.50
Philips KT3/30 Text	6.50
Philips RC5	7.70

SANYO/FISHER VIDEO SPARES

5000/5300

Capstan Motor	32.95
Loading Roller	1.95
Pinch Roller	6.95
Reel Motor	7.95
Reel Idler	5.70

FVH615

Reel Idler	5.95
Clutch Assy	5.95

SERVICE MANUALS

TELEVISION

Ferguson TX9	27.95
Ferguson TX10	38.95
Ferguson TX90	11.95
Ferguson TX100	15.95
Ferguson 1790/1	1.95
Fidelity AVS1600	4.95
Fidelity AVS2000	4.95
Fidelity CTM2000T	5.95
Fidelity CTV14R	4.95
Fidelity CTV20R	4.95
Fidelity CTV20T	4.95
Philips CTX-E	2.50
Philips CTX-S	2.50
Philips G11	3.50
Philips KT3	3.50
Philips K30	3.50
Philips K35	3.50
Philips KT4/40	5.95
Philips 2A Chassis	6.95

VIDEO RECORDERS

Ferguson 3V35/36	28.95
Ferguson 3V44/45	11.95
Ferguson 3V46/47/52	11.95
Ferguson 3V54/55	11.95
Ferguson 3V59	11.95
Ferguson 3V65	11.95
GEC V4005H	6.95
Philips 6460/00/05	6.50
Philips 6462/00/05	6.50
Philips 6467	6.50
Philips 6520/00/05	6.50
Philips 6660	7.95
Philips 6560	7.95
Philips 6542	8.95

SHARP VIDEO SPARES

9300/381

Capstan Motor	28.05
Cassette Lamp	1.95
Pinch Roller	4.50
Reel Idler	2.50
Reel Motor	16.95
Unlock Assembly	.40
Video Head	23.95

481/483

Capstan Motor	20.75
Reel Idler	2.60
Reel Motor	17.95
Video Head	23.95

SONY SPARES

C5/C7

Ace Head Assembly	33.95
Capstan Motor	27.95
Pinch Roller	1.95
Rewind Kit	4.65
Timer Lid	1.50
Video Head	19.50

C6

Capstan Motor	23.95
Pinch Roller	1.95
Reel Motor	14.95
Reel Motor (C6MKII)	19.90
Rewind Kit	3.45
Video Head	19.50

C9

DC-DC Convertor	22.95
Door Assembly	4.95
Front Door Assembly	4.95
Gear Kit	6.70
Guide Pin Kit	5.95
Pinch Roller	8.50
Video Head	42.95

VIDEO BELT KITS

Akai VSI/7 EK	1.95
Amstrad VCR7000	1.50
Ferguson 3V00/16/22	2.50
Ferguson 3V23	1.75
Ferguson 3V29/30	1.80
Ferguson 3V29 L/Belts (5)	1.95
Ferguson 3V31	1.85
Ferguson 3V35/39	1.95
Hitachi VT8000	1.95
Hitachi VT9300/9500	1.80
Hitachi VT11E	1.95
JVC HR7200	1.80
JVC HR7650	1.85
JVC HR7700	1.75
JVC HRD120-140	1.95
Nat. Pan. NV333	1.95
Nat. Pan. NV370	1.90
Nat. Pan. NV2000	1.95
Nat. Pan. NV3000	1.75
Nat. Pan. NV7000	1.95
Fisher FVH 520/615	1.95
Sanyo VTC5000	1.00
Sanyo VTC5300	1.95
Sanyo VTC5500	1.75
Sanyo VTC9300	2.95
Sharp VC7300	2.55
Sharp VC8300	2.40
Sharp VC9300	2.40
Sony SLC5/C7UB	2.50
Sony SLC6UB	1.95

V.C.R. PILOT BULBS

Amstrad 7000	1.95
Ferguson 3V00/22	.50
Ferguson 3V23 (Plug)	.85
Ferguson 3V29 (Plug)	.80
Hitachi VT8000	.95
Hitachi VT9300/9500	.95
Nat. Pan. NV2000	.70
Nat. Pan. NV7000	.70
Sharp VC8300	.70
Sharp VC9300	1.95
Universal	.50

VIDEO HEADS

Amstrad VCR4500/9000	24.95
Amstrad VCR7000	26.95
Ferguson 3V00/22/29/39	17.95
Ferguson 3V32	48.70
Ferguson 3V42/44/45/47/50	32.95
Fisher FVH-D520/P615/D720	25.95
Hitachi VT8000	22.95
Hitachi VT9300/9500	22.95
Hitachi VT11/33E (genuine)	27.95
Hitachi VT11/33E (equivalent)	22.95
JVC HR3300/HRD225	17.95
JVC HR7655	48.70
JVC HRD140/160	32.95
Nat. Pan NV230	34.95
Nat. Pan NV333	17.95
Nat. Pan NV366	39.95
Nat. Pan NV370	21.95
Nat. Pan NV430	24.95
Nat. Pan NV730	39.95
Nat. Pan NV777	30.95
Nat. Pan NV2000	17.95
Nat. Pan NV7000	17.95
Philips VCR6460/6520	23.50
Philips VCR6462	38.95
Sanyo VTC5000	35.00
Sanyo VHR1100/1300	37.95
Sanyo VHR1500	48.35
Sharp VC9300/9700/381/482	23.95
Sharp VC581/583/682	29.95
Sony SLC5/6/7UB	19.50
Sony SLC5/6/7UB (genuine)	47.50
Sony SLC20/30UB	27.95
Toshiba V9600/V31B	24.95
Toshiba V55/57	17.95

ORDERING

Please add 75p for p/p U.K. Add 15% VAT to this total. Service Manuals p/p £1.00 each. Export Orders p/p charged at cost. Delivery by return on all stock items.

POPULAR BAKERS DOZEN PACKS (Still available)

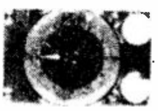
All packs are £1 each. if you order 12 then you are entitled to another free. Please state which one you want. Note the figure on the extrme left il the pack ref number and the next figures is the quantity of items in the pack, finally a short description.

BD2	5	13A spurs provide a fused outlet to a ring main where device such as a clock must not be switched off
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 unit 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
BD32	2	humidity switches, as the air becomes damper the membrane stretches and oeprates a microswitch
BD34	48	2 meter length of connecting wire all colour coded
BD42	5	13A rocker switch three tag so 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 puzzel, 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 variations such as water level in water tanks
BD91	2	mains operated motors with gearbox. Final speed 16rpm. 2 watt rated
BD103A	1	6 750MA power supply, nicely cased with input and output leads
BD120	2	stripper boards each contains a 400v 2A bridge rectifier and 14 other diodes and rectifiers as well as dozens of condensers etc
BD122	10m	twin screened flex with white pvc cover
BD128	10	very fine drills for p.c.b. boards etc. Normal cost about 80p each
BD132	2	plastic boxes approx, 3" cube with square hole through top so ideal for interrupted beam switch
BD134	10	motors for model aeroplanes, spin to start so needs no switch
BD139	6	microphone inserts – magnetic 490 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 msockets – 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 makes 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
BD210	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 soild but OK
BD242	2	6" × 4" speakers 4 ohm made from Radiomobile so very good quality
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
BD283	3	mild steel boxes approximately 3" × 3" × 1" deep – standard electrical
BD293	50	mixed silicon diodes
BD305	1	tubular dynamic mic with optional table rest
BD667	2	4.7uf, non-polarised block capacitors, pcb mounting
BD400	4	Books. Useful for beginners. Describes amplifiers, test equipment and kit sets
BD653	2	Miniature driver transformers. Ref LT44. 20k to 1k, centre tapped
BD553a	2	3.5 volt operated relays, each with two pairs CO contacts

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

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.



25A ELECTRICAL PROGRAMMER

Learn in your sleep. Have radio playing and kettle boiling as you wake – switch on lights to ward 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.

ATARI 65XE COMPUTER

At 64K this is most powerful and suitable for home and business. Brand new, complete with PSU. TV lead, owner's manual and six games. Can be yours for only **£45 plus £3 insured delivery.**

DATA RECORDERS. ACORN for Acorn Electron, etc., reference number ALF03, with TV lead, manual and PSU. Brand new. Price £10 plus £1.50 post. Order ref 10P44.
ATARI XC12 for all their home computers. With leads and handbook. Brand new. Price £10 plus £2 post. Order ref 10P53.

JOYSTICK FOR ATARI OR COMMODORE for all all Atari and Commodore 64 and Vic20. New Price £5. Order ref 5P126.

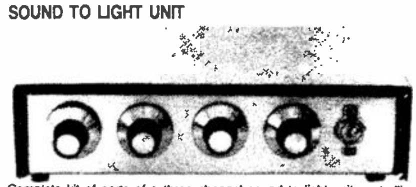
EXTRA SPECIAL OFFER. The ATARI Compendium contains computer 65XE, data recorder XC12, joystick and six games for £57.50 plus £4 insured delivery.

Ex-Electricity Board. Guaranteed 12 months.

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 24 hr. 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.

SOUND TO LIGHT UNIT



Complete kit of parts of a three channel sound to light unit controlling over 2000 wats of lighting. Use this at home if you wish but it is plenty rugged enough for disco work. The unit is housed in an attractive two tone metal case and has controls for each channel, and a master on/off. The aduio input and outputs are by ¼" sockets and three panel mounting fuse holders provide thyristor proection. A four pin plug and socket facilitate ease of connecting lamps. Special price is £14.95 in kit form.

ORGAN MASTER is a three octave musical keyboard. It is beautifully made, has gold plated contacts and is complete with ribbon cable and edge connector. Brand new, only £12 plus £3 postage. Order ref 12P5.

MUSIC FROM YOUR SPECTRUM 128. We offer the Organ Master three octave keyboard, complete with leads and the interface which plugs into your 128. You can then compose, play, record, store, etc., your own music. Price £19 plus £3 special packing and postage. Order ref 19P1.

CAMERAS. Three cameras, all by famous makers, Kodak, etc. One disc and two different instant cameras. All in first class condition, believed to be in perfect working order but sold as untested. You can have the three for £10 including VAT, which must be a bargain – if only for the lenses, flash gear, etc. Our ref 10P58.

ALBA TWIN CASSETTE RECORDER AND PLAYER WITH STEREO RADIO. This is a mains/battery portable made to sell, we understand, at about £50 but the ones we have are line rejects. They are brand new still in the manufacturers; boxes but have a slight defect associated with the cassette section. The radio and amplifier section, both mono and stereo, is perfectly OK. If you are handy at mending things then this should be for you. Price £20 or two for £38 plus £3 insured post, either package. Our ref 20P7 or 2 × 20P7.

1/8th HORSEPOWER 12 VOLT MOTOR. Made by Smiths, the body length of this is approximately 3in, the diameter 3in and the spindle 5/16th of an inch diameter. It has a centre flange for fixing or can be fixed from the end by means of 2 nuts. A very powerful little motor which revs at 3,000rpm. We have a large quantity of them so if you have any projects in mind then you could rely on supplies for at least two years. Price £6. Our ref 6P1, discount for quantities of 10 or more.

PHILIPS LASER

This is helium-neon and has a power rating of 1.6mW. Completely safe so long as you do not look directly into the beam when eye damage could result. Brand new, full spec, £30 plus £3 insured delivery. Mains operated power supply for this tube gives 8kv striking and 1.25kv at 5mA running. Complete kit with case £13. No extra for post if ordered with tube.

HIGH RESOLUTION MONITOR. 9in black and white, uses Philips tube M24/306W. Made up in a lacquered frame and has open sides. Made for use with OPD computer but suitable for most others. Brand new, £16 plus £5 cost. Our reference 16P1.

TANGENTIAL HEATERS. We again have good stocks of this quiet running, instant heat units. They require only a simple case or could be fitted into the bottom of a kitchen unit, etc. 1.2kw, which is a very compact little unit and also a 2.5kw, which is approximately 10in long plus motor. Price for either model £5. Being rather fragile needs special packing so add £2 per heater for post and packing. Control switch for 2.5kw model giving full heat, half heat or cold blow. Price 50p.

MINI MONO AMP on p.c.b. size 4" × 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 £12.00.

FDD BARGAINS

3½in made by Chinon of Japan. Single sided, 80 track Shugart compatible interface. Interchangeable with most other 3½in and 5¼in drives. £28.50 plus £3 post. 3in Hitachi, reference 305SXA. Standard Shugart connection, works with most computers but particularly suitable and recommended for Amstrad 6128, etc, £30 plus £3 post.

Generous discounts for quantities

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 £1.50 service charge. Monthly account orders accept from schools and public companies. Access & B/card orders are accepted – minimum £5. Brighton (0273) 734648 or 203500.

BARGAINS STILL AVAILABLE

SUB-MIN TOGGLE SWITCH. Body size 8mm × 4mm × 7mm SBDT with chrome dolly fixing nuts. 4 for £1.00. Order ref BD649.

VERY POWERFUL MAGNETS. Although only less than 1in long and not much thicker than a pencil these are very difficult to pull apart. Could be used to operate embedded reed switches, etc. Price 50p each, 2 for £1.00. Our ref BD642.

CLEAR LACQUER. Quick drying for the protection of transfers, markings, maps, etc. Also protects wood and metal. Exceptionally clear. Large can for £1.00. Order ref BD660.

PAPST AXIAL FAN. MANUFACTURERS REF NO TYP4580N. This is mains operated 15watt rating and in a metal frame with metal blades so OK in high temperatures. Body size approximately 4¾in square × 1⅝in thick. £6.00 each, plus £1.00 postage. Our re 6P6.

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.

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" × 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.

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

SPRING LOADED TEST PRODS – heavy duty, made by the famous Bulgin company. Very good quality. Price four for £1. Ref. BD597.

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 construction 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 powertytic 39,000uF at 50V. £3. Our Ref. 3P41.

4-CORE FLEX CABLE. Cores separately insulated and grey PVC covered overall. Each copper core sized 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. Unused but old and may be slightly soiled. Sleeved prong type. £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. 200-245 upright mountings £4. Order Ref. 4P24.

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

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

FLIP-OVER DIGITAL CLOCK – Quite an eyecatcher, this is mains operated. The figures flip-over per minute and per hour and give a larger than usual visual display. Supplied complete with front and perspex panels to glue together to make its case. £2.00 each. Our Ref. 2P205.

QUICK FIX MAINS CONNECTOR – A must for your workshop. Saves putting on plugs as you just push the wires under the spring clips. Automatically off when lid is up. Price £7.50. Our reference 7P5/1.

BT HANDSET with curly lead terminating at BT plug. Colour cream. Price £5.00. Our reference 5P123.

SINGLE SCREENED FLEX 7.02 copper conductors, pvc insulated then with copper screen, finally outer insulation. In fact quite normal screened flex. 10m for £1. Our ref BD668. Ditto, but solid conductor, 10m for £1. Our ref BD668A.

WHITE CEILING SWITCH 5 amp 2 way surface mounting with cord and tassle. Made by the famous Crabtree Company. Price £1 each. Our ref BD528.

13A SWITCH SOCKETS – Top quality made by Crabtree, fitted in metal box with cutouts so ideal for garage, workshop, cellar, etc. Price £2 each. Our ref 2P37.

EHT TRANSFORMERS – Normal primary, secondary 3.5v at 3mA continuous or 20mA intermittent. Ideal as a spark generator for boiler lighting, etc., or with a simple voltage doubler circuit would make a good ioniser. Price £7. Our ref 7P7. 8kv secondary 3mA. Price £10. Our ref 10P56.

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.

FEBRUARY SPECIAL OFFER

ONLY £5.99 QUARTZ-HALOGEN SPOTLIGHT

Hand held or hanging. Heat resistant poly-carbonate housing; highly polished reflector. Protective lens cover, doubles as base stand. With On/Off switch and 12ft curly cable terminating in cigar lighter plug. Produces 250,000 candle power – 5 times the intensity of average car headlamps.
Power: 12Vd.c. 4.5A 55W. Dims: 160 × 88 × 110mm.

12V Twin Fluorescent Lamp 12" Double Tubes

Attractive white fitting, ribbed perspex diffuser. On/off switch. 3ft cable. Transistorised circuitry. Keyhole fixing. 12V D.C. 8W Tubes. Dimensions: 368 × 67 × 43 mm.
Ideal for Caravans, Boats, Vans etc.

	1+	10+	50+
PRICE	£5.99	£4.99	£4.50

SAFEBLOC

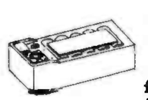
FOR QUICKLY AND SAFELY TESTING EQUIPMENT ON MAINS VOLTAGE. SIMPLY CONNECT WIRE TO CLIPS AND CLOSE LID. £6.75

ANOTHER SPECIAL OFFER
UNIVERSAL P.C.B. ASSEMBLY JIG

TO ACCOMMODATE P.C.B. SIZE UP TO MAXIMUM: 265 × 238mm

OUR PRICE £15.00 (NORMAL PRICE OVER £50.00)

12 VOLT RECHARGEABLE UNIT



10 × D × Size Ni-Cads (4 Ah) encapsulated in a black plastic case. Fuse holder. Gives 12 volt output when charged. Ex-equipment. Fully guaranteed. Dimensions: 245 × 75 × 75mm.
£7.99 each + P&P £1.85 + VAT
£7.25 for 10 +P&P £4.50 + VAT

"CLOSED-CIRCUIT" TELEVISION SYSTEM
PRICE £150.00

Comprising: 1 × CAMERA 1 × MONITOR 1 × CAMERA BRACKET

Illustrations not to scale. For guidance only – actual items supplied may vary from those illustrated.

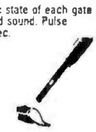
CHARGING UNIT FOR THE ABOVE 12V UNIT

Manufactured by Saft, these chargers are suitable for the above battery packs (as advertised in the May issue of "WHAT VIDEO" — Page 6). The chargers are stated as we have modified them to a standard charger. Full charge of the packs is obtained after 10-12 hours (overnight) charging. Supplied complete with main lead and charging lead fitted with a 4-pin plug (6 pin plug version available upon request). Although ex-equipment, these chargers are fully tested and guaranteed. Dimensions 335 × 260 × 150 mm.

4-PIN £10.00 6-PIN £10.00 + £1.85 P&P + VAT

LOGIC PROBE

Simple to use – good quality – logic probe. Displays the logic state of each gate of TTL, C-Mos, etc. devices. Logic state displayed in light and sound. Pulse enlargement capability allows pulse detection down to 25nsec. Supplied complete with comprehensive instruction manual.
Specification:
Working voltage: 4-16Vdc
Thresholds: HI – 70% Vcc; LO – 30% Vcc
Input impedance: 1 Mohm
Max. input frequency: 20MHz
Order Code – **TEST/LOGIC**
PRICE – £7.99



NI-CAD BATTERY CHARGER

Universal PRICE:	1+	£4.50 each
	10+	£4.25 each
	100+	£3.75 each

HELPING HANDS WITH MAGNIFIER **£3.99**

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

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

RESISTORS — CARBON FILM 5%

1/4W 1R0 to 10M (E12 Range)	2p each. 15p/10. 75p/100
1/2W 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

1/4W pack 10 each value E12 – 10R to 1M 610 pieces	4.50
1/4W pack 5 each value E12 – 10R to 1M 305 pieces	2.95
1/4W pack Popular – 10R to 10M 1000 pieces	6.50
1/2W pack 10 each value E12 – 2R2 to 2M2 730 pieces	7.75
1/2W pack 5 each value E12 – 2R2 to 2M2 365 pieces	4.70
1/2W 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

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

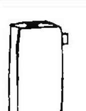
2A, 3A, 5A, 13A — £1.00/10

1 1/4 QUICK FUSES

500mA, 1A 1.25A, 2A, 12A — 50p/10

FM TRANSMITTER

Very High Quality 'MINI-BUG' – Ideal for Baby Alarm etc.!!
A Very good range is obtainable – we have obtained over 1/2 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

SOLDERING SECTION

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

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

SOLDER: 60% TIN 40% ALLOY

22g. Non-corrosive Multi-core Solder. 500gm Reel £4.99 each. 10 Reels 18g £3.75 each

BT APPROVED EQUIPMENT

Master Socket (Flush)	£2.90	Extension Lead 5 Mtr	£2.90
Master Socket (Surface)	£2.75	Wiring Tool	36p
Secondary Socket (Flush)	£1.90	Plug – 431A	25p
Secondary Socket (Surface)	£1.70	Slimtel Phone	£17.35
B.T. Cable (per metre)	15p	Viscount Phone	£26.04
Per 100 metres	£12.00	Conversion Kit & Wiring Diagram	£6.90
Line Jack Cord with Plug	£1.25		

TRANSISTORS + DIODES

Type	Price (£)	Type	Price (£)	Type	Price (£)
AC128	0.30	BD438	0.64	MJ3000	1.80
AC128K	0.38	BD587	0.88	MJ3001	1.10
AC141	0.58	BDX32	1.75	MJE341	0.70
AC141K	0.38	BF115	0.32	MJE371	0.85
AC142	0.40	BF125	0.42	MP8111	0.40
AC142K	0.38	BF127	0.42	MP8112	0.44
AC152	0.48	BF157	0.46	MPS6521	0.40
AC153K	0.46	BF167	0.30	MPSA12	0.30
AC176K	0.32	BF178	0.30	MPSA55	0.30
AC187	0.40	BF180	0.27	MPSU05	1.05
AC187K	0.42	BF182	0.32	MPSU51	1.04
AC188K	0.38	BF183	0.32	MPSU56	1.40
ACY22	1.50	BF195	0.12	MPSU60	1.48
AD142	0.88	BF224J	0.20	MR510	0.55
AD161/162	1.60	BF240	0.15	MR815	0.78
AF114	0.88	BF270	0.30	MR854	0.86
AF115	2.10	BF271	0.28	MRF475	3.25
AF124	0.70	BF273	0.22	OA10	0.45
AF125	0.50	BF337	0.38	OA47	0.20
AF127	0.50	BF338	0.28	OA85	0.25
AF139	0.56	BF371	0.27	OA90	0.06
ASY80	5.20	BF450	0.30	OA91	0.14
ASZ17	2.00	BFR61	0.32	OA95	0.20
AU110	2.90	BFR90	0.86	OA200	0.06
AY102	4.32	BFT41	0.68	OA202	0.10
B40C200	1.03	BFY50	0.32	OC42	0.71
BA115	0.12	BFY51	0.32	OC44	0.72
BA121	0.40	BFY90S	1.34	OC139	1.30
BB105B	0.32	BR100	0.20	ORP12	0.95
BB105G	0.30	BR101	0.76	R2008B	1.40
BC108	0.10	BR103	0.60	R2010B	1.20
BC115	0.15	BRY39	0.80	R2540	2.70
BC119	0.43	BRY56	0.42	TIC47	0.70
BC125	0.14	BSX20	0.20	TIP29	0.30
BC141	0.36	BSY52	0.35	TIP30A	0.35
BC149	0.12	BSY95A	0.25	TIP31B	0.34
BC149C	0.14	BT100A/02	0.68	TIP32B	0.28
BC159	0.14	BT101/300	2.73	TIP33A	0.75
BC161	0.30	BT101/500	3.25	TIP34B	1.00
BC170/A/B/C	0.12	BT106	2.00	TIP36B	1.40
BC182	0.10	BT151/650R	0.90	TIP41C	0.24
BC182L/LB	0.10	BU133	1.90	TIP42B	0.42
BC183L/LA/LB	0.10	BU208A	0.78	TIP42C	0.25
BC184	0.08	BU326S	0.85	TIP110	0.45
BC184B/C/L/LC/LB	0.10	BUY69A	2.90	TIP122	0.45
BC212/B/C	0.10	BUY69B	1.62	TISp2	0.34
BC212L/LA/LB	0.10	BY100	0.80	TV20	2.45
BC213L/LA/LB	0.10	BY103	0.50	Y969	2.80
BC237	0.06	BY122	0.60	ZTX212	0.26
BC238	0.07	BY126	0.10	ZTX300	0.13
BC302	0.38	BY127	0.08	1N4001	0.03
BC317B	0.26	BY133	0.10	1N4002	0.03
BC323	0.90	BY135	0.35	1N4003	0.03
BC327	0.06	BY182	0.80	1N4004	0.03
BC328	0.07	BY184	0.38	1N4005	0.03
BC337	0.08	BY187	0.65	1N4006	0.03
BC338	0.10	BY189	6.75	1N4007	0.04
BC350A	0.24	BY198	0.64	1N4148	0.02
BC351	0.16	BY199	0.72	1N5400	0.08
BC547	0.08	BY206	0.21	1N5401	0.08
BC548A	0.08	BY210/400	0.21	1N5402	0.09
BC549/C	0.07	BY226	0.24	1N5403	0.10
BC550	0.08	BY238	0.65	1N5404	0.10
BC558A	0.10	BYX10	0.28	1N5405	0.11
BCY70	0.16	BYX22/400	0.68	1N5406	0.12
BCZ10	3.20	BYX38/300	0.60	1N5407	0.12
BCZ11	2.60	BYX55/350	0.26	1N5408	0.12
BD129	0.90	BYX70/500	0.28	2N222A	0.32
BD130Y	0.68	BYZ12	0.78	2N3053	0.28
BD131	0.46	C106D (400V)	0.44	2N3055	0.38
BD132	0.50	D40C1	1.08	2N3773	1.05
BD135	0.18	E1222	0.30	2N3903	0.10
BD137	0.20	E5024	0.30	2N3904	0.10
BD138	0.20	GET872	0.60	2N4248	0.45
BD140	0.29	GET881	1.70	2N4427	1.80
BD142	1.60	ITT827	1.20	2N5415	1.02
BD145	1.82	ITT921	0.10	2N6109	0.40
BD160	1.50	ITT2001	0.18	2SC1172Y	1.70
BD183	0.70	KP3002	0.88	2SC1413A	2.70
BD225	0.40	ME0462	0.26	2SC1678	1.80
BD235	0.28	ME4101	0.28	2SC1758	0.68
BD236	0.30	ME4102	0.28	2SC1957	0.95
BD237	0.38	ME8003	0.34	2SC1969	2.80
BD410	0.50	MJ2995	0.50	40409	1.20
				40595	1.25
				40673	1.80

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Co-Ax Cable 75 Ohm 100 Metre Reel	£11.00
	1+ 10+
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DAF96	1.05	EZ41	2.85
DF96	0.80	GY501	1.40
DK96	2.70	GZ32	1.25
DM71	3.00	KT77	11.50
DY86/87	0.65	KT88(G.E.C.)	19.00
DY802	0.95	PC88	1.45
CV850	2.55	PC92	3.05
CV4015	2.85	PC900	1.45
E180F	6.55	PCC88	0.85
EABC80	0.85	PCC89	0.80
EAF42	1.55	PCC189	0.90
EB91	1.35	PCF80	0.95
EBC41	3.50	PCF82	1.00
EBF80	0.80	PCF84	0.80
ECC81	1.05	PCF86	1.30
ECC82	0.95	PCF87	0.60
ECC83	1.20	PCF200	2.00
ECC84	0.78	PCF201	2.00
ECC85	0.95	PCF800	1.25
ECC88	1.25	PCF801	1.10
ECC189	0.90	PCF802	1.10
ECF80	0.85	PCF805	1.75
ECF82	0.85	PCF806	1.25
ECF83	1.95	PCF808	1.60
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ECH81	1.45	PCL83	2.55
ECH84	1.55	PCL84	1.05
ECL85	0.80	PCL86	0.90
ECL86	1.80	PCL88	2.55
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EF86	1.85	PD500	2.95
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EF183	0.95	PL36	1.80
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EM80	0.90	PY801	0.69
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EM87	3.90	UAF42	1.30
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EY86/87	0.68	UBC81	1.75
EY88	0.80	UCC85	0.80
EY500A	2.20	UCF80	1.25
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		UCH81	2.05
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NV8400	18.00
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AKAI. 7100/77EG/1EG/2EG/10EG/5EG/9300/9500/9700/9800	2.85
FERGUSON. 3V00/3V01/3V16/3V22/3V23/3V24/3V29/3V30/3V31/3V36/3V38/3V39/3292	2.85
HITACHI. VT3000/11EG/14/33/34/4000/4200/5000/7000/8000/9300/9500/9700	2.85
J.V.C. HR2200/2200/2650/3300/3330/3160/4100/7200/7600/7610/7650/7700/D110/D111/D120/D121	2.85
N.E.C. N830/N831/N832/N838/PVC2300/PVC2400	3.46
NAT. PAN. NV2000/3000/332/333/370/430/460/7000/7200/8400/8600/8610	2.85
SANYO. VTC3000P	3.45
SHARP. VC200/300/3300/387/60000/9300/9500/9700	2.85
SONY. SL-C44/5/6/7/F1/F30/3000/20/24/30	3.45
TOSHIBA. 5470/55/57	3.45
V-LAMP 01	0.45

VIDEO BELT KITS

AKAI		2.15
HITACHI	VT5000E	1.05
JVC/FERG	3V00/3Y22	2.20
JVC/FERG	3V29	1.30
JVC/THORN	3V35	1.45
JVC	3330	2.40
	3360	2.34
	7700	0.56
	7650	0.68
NAT. PAN.	NV300	1.62
	NV777	1.16
	NV2000	1.44
	NV3000	1.50
	NV7000	1.30
	NV7200	1.30
SANYO	VTC5000	0.45
	VBS9000	1.25
	VTC9300	2.48
SHARP	SHARP 5	1.62
	SHARP 11	3.05
	VC6300	2.10
	VC7300	1.72
	VC9300	1.10
SONY	SL-C5/7	1.64
	SL-C8000	2.58
	SL-C6	1.90
TOSHIBA	V7540	1.85

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SANYO	REEL DRIVE PULLEY VTC 5150 143-0-662T-01201	4.85
FERG/JVC	TAKE UP IDLER PU51402/A	1.30
THORN/JVC	PU48967B	2.25
PANASONIC	VXP 0344	.75
PANASONIC	VXP 0521	1.85
V-LAMP		0.45

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EDITOR

John A. Reddihough

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CORRECTION

In the Japan Electronics Show report last month the Sony GV-8 Videowalkman was incorrectly described as having a 20mm drum. It uses the standard 40mm drum. The new 20mm drum will be used in the CCD-V88 camcorder and later versions of the Videowalkman.

COVER PHOTO

This month's cover photograph shows the JVC GR-C7 camcorder's internal arrangements. See new series on camcorder servicing starting on page 262.

TELEVISION

The Coming of Astra

Congratulations are due to all those involved in the successful launch of the Astra TV satellite. Now for the programmes: the first Sky Television services are due to start in early February. How many will be watching when this historic (in TV terms) event occurs? How many will continue to watch? And how many will take it up once Sky begins to build a reputation? All this depends to some extent on the sales pitch. Sky is understood to be kicking off with a launch budget of more than £20m. This might seem a lot, but is not all that great when you consider that Sky is going to have to persuade viewers to adopt a wholly new method of reception and buy or rent the equipment required, not just press a different button. British Satellite Broadcasting (BSB), whose services from a high-power (61dBW) satellite are due to begin in the autumn, is starting off with a £60m publicity campaign. It is going to have to try, amongst other things, to persuade viewers that its MAC transmissions will be worth the extra expense. BSB has been put in an awkward position: first pipped to the post by Sky's use of the 10·9-11·7GHz band as opposed to the 11·7-12·5GHz band officially allocated for DBS use by the 1977 WARC, and more recently threatened with additional competition by the proposals in the government's white paper on broadcasting. BSB had to go through a lengthy vetting procedure to obtain its DBS franchise from the IBA: Sky merely took advantage of an orbital slot and section of the spectrum not otherwise committed. It's an unfair world, but this seems to be a part of what the new era of deregulated broadcasting involves.

To date, Sky has had a lot of luck. Only five years ago those in the know would have considered it unthinkable to start regular broadcasting from a medium-power satellite using PAL signal encoding. Perhaps the broadcasting authorities were being unduly conservative in their view as to what was feasible. But we still have to see what the quality provided by Astra's 52dBW signal will be. Will heavy rain produce excessive attenuation for example? Be that as it may, the technology has been advancing apace, making Sky's life that much easier. Inexpensive, low-noise front-end units have come along at just the right time. One wonders why it was ever thought that microwave technology was inevitably a matter of high-quality precision engineering and great expense. Simply, perhaps, because that was the case in the days when the use of microwaves was restricted to specialist, professional applications (and recondite know-how). We are now seeing prices falling rapidly in the same way that they did when video passed from the exclusively professional to the mass-market field. It looks as if over most of the country a modest dish will suffice to give perfectly adequate reception. Given a bit more development work on low-noise microwave semiconductor devices and dish size will shrink further.

As Sky's operation is about to begin, a certain amount of nervousness amongst the various competing broadcasters is becoming apparent. Various claims and counter-claims have been made, and there have been threats of litigation. There was to start with BSB's knocking advertisement about the size of dish that would be required for Astra reception in different parts of the UK. They'd looked at the wrong footprint map, though the fact is that the coverage of the different groups of channels varies so that different results will be obtained as more channels come into use – Astra was originally planned as a pan-European rather than a UK-orientated satellite. More recently the ITV companies have been seeking ways to prevent advertisements for Sky Television and BSB appearing on their channels: at present the 1981 Broadcasting Act prevents discrimination against potential advertisers. And BSB has approached the Office of Fair Trading asking it to act under the 1987 Misleading Advertising Regulations over an advertisement that appeared in *The Times* and *The Sunday Times*. The advertisement suggested that many viewers would not benefit from the use of the MAC transmission standard.

There are one or two technical points that should perhaps be made clear. First, PAL and frequency modulation of the video signal do not go well together. This is because noise increases with frequency with f.m. It thus affects the colour section of the channel bandwidth more than the main luminance section, the result being a poor colour-to-noise ratio. We shall have to wait to see how noticeable this effect will be. Secondly, optimum results with a MAC transmission are obtained only when the MAC signal is demodulated to baseband video then processed in the TV set. The disadvantages of PAL – cross-colour effects and subcarrier patterning – are reintroduced if the MAC transmission is decoded, re-coded in PAL form and then modulated on to a u.h.f. carrier for feeding into the aerial socket of a standard TV receiver. How much benefit is obtained from the undoubted advantage of MAC coding thus depends on the arrangements used at the receiving site. Further misunderstandings have arisen over the dish and LNB. A dish for Astra will serve for BSB, provided the dish is steerable, which adds to the expense. But most present LNBs do not have the bandwidth to cover both bands, and polarisation differences add to the complications – Astra uses linear polarisation, vertical or horizontal depending on channel, while BSB's DBS services are to use circular polarisation.

We had hoped to be able to include with this issue a sponsored card on the Astra services. The problems of getting the information and arranging for printing, especially as this issue is being produced during the Christmas/New Year holiday period, have made this impossible however. Instead, a cover-mounted promotional gift has been included. Basic information on Astra services has appeared in recent issues (see November page 46 and December page 125) while a map on page 259 this month shows the footprint for the initial Sky Television services.

TV Fault Finding

Reports from Philip Blundell, Eng. Tech., S.A. Featherstone, H. MacMullen, Chris Avis, Mick Dutton, Ian Bowden, Colin Doman and J.R. Armagh

Philips CP110 Chassis

I've had a few cases where, when the chopper transistor has failed, two of the diodes in the bridge rectifier and the chopper control chip have failed as well. In this particular case however the 210V supply rectifier had gone short-circuit. When I switched on again I was rewarded with an over-bright monochrome picture: the transistors in the green output stage had gone short-circuit and the resulting high voltage had taken R3445, R3410, D6406, T7413 and R3416. Had there been a thunder storm perhaps?

The problem with another of these sets was field foldover that varied as the chassis was flexed. No dry-joints could be seen, so attention was directed to the top of the board. The area around C2574 was most sensitive to probing and when this electrolytic was removed the cause of the problem could be seen – it had lost its electrolyte all over the board. **P.B.**

Grundig CUC2410 Chassis

This set had no picture as the RGB output stages weren't being driven. The anti-screen-burn circuit was coming into action though the field hadn't collapsed. A check on the field output waveform revealed that it was about half the normal size, which was reasonable as the supply was only 10V. R525 (0·33Ω) had gone high-resistance. **P.B.**

Philips/Pye System 4 Chassis

The customer reported that the set would go dead. Our field engineer went out and resoldered the connections to the line output transformer, but as this didn't provide a cure the set was brought into the workshop. On test we found that the set lost its picture, but not sound, every ten-fifteen minutes or so. When the fault was present there were no video waveforms at the c.r.t., nor at the outputs of the TDA3561A colour decoder chip IC7150. The latter was receiving its inputs but the sandcastle pulse was 9V with the fault present, 10V otherwise. This gave us a clue: we suspected the TDA3650 field timebase chip IC7110. Fitting a replacement made no difference however. We next found that the 26V supply at pin 13 rose when the fault was present while the voltage at pin 4 fell to 12V. The flyback booster diode D6107 between these pins was going leaky intermittently.

I've had the equivalent diode D6400 in the CTX chassis cause trouble, but in this case the symptom is field collapse, not chopping off the video. **S.A.F.**

Grundig 6445 (GSC200 Chassis)

This was a real Grunpig snorter of a fault. The channel indicator was on but there was no sound or picture and the set was apparently tripping at a rate of about twice a second. Symptoms like these usually indicate a dry-joint, a faulty thyristor or the occasional defective capacitor, but not this time. Even the reliable line output and commutator transformers were tried. As a secondary symptom we found that all the l.t. supplies were low at about 9V. This should have pointed us in the right direction but a certain amount of time was spent checking with external l.t. supplies connected. One thing we discovered was that the set worked with an external 13V supply connected to the line oscillator but went off again as soon as this supply was disconnected. Diode D637 (1N4001) which provides isolation between the start-up supply and the other l.t. supplies at switch on was open-circuit. **C.A.**

Philips K30 Chassis

This set was a real dinger having been messed about with in the region of the EW amplifier transistors on the mother board. I nearly gave up when I suddenly realised that the transistor markings are printed incorrectly on the panel. Inserting them the correct way round put matters right. **H.MacM.**

Decca 100 Chassis

Severe ringing and poor luminance looked very like a mistuned i.f. stage but we eventually found that the 47μF luminance coupling capacitor C208 on the colour decoder panel had gone very low in value. **H.MacM.**

Philips G11 Chassis

No sound or raster was due to no little trouble in the line generator circuit. The TDA2590Q chip had split apart, D2015 was short-circuit and C2001 (100μF) had exploded. **H.MacM.**

Grundig 7400

This set suffered from vertical shading on the screen. There were two vertical green bars with a bright-up on the edge, one roughly in the centre of the screen and the other towards the right-hand side. The cause of the problem was that C632 (220μF) had gone rotten. It's the reservoir capacitor for the 27V supply, which was low at 22V. The problem was made more confusing because another dealer had attempted to solve it by advancing the HS control to give 59V instead of 54V at point C on the line output transformer. This gave the impression of no EW correction, so a lot of time was wasted. **M.D.**

Ferguson TX100 Chassis

This was the first of these sets that has come our way. The problem was fairly simple – no red because the 100kΩ feedback resistor R609 in the red output stage had gone open-circuit. **M.D.**

Pye 2260 (Philips CTX-E Chassis)

This set came in dead. The mains fuse had blown and the surge limiter resistor R3291 (4·7Ω) was open-circuit. A quick check showed that the bridge rectifier had gone short-circuit negative to one a.c. leg. We replaced these parts and switched on. Result: the set tripped. Replacing the sync chip IC7375 (TDA2577) cured that but the set then had a blank raster with no sound. We found that the TDA2541 i.f. chip IC7151 had no supply at pin 11 because R3153 had gone open-circuit. Replacing this resistor restored the voltage at pin 11 but there was still no improvement. A new TDA2541 produced a ghost outline of snow and we next found that the video emitter-follower T7148 (BC548) was also short-circuit. Replacing this gave us more snow. R3103 which feeds 12V to the tuner was open-circuit. After this had been replaced there was a nice snowy picture with no sound. R3170 in the 12V feed to the TBA120S intercarrier sound chip had gone open-circuit. With a replacement fitted the set worked but it was impossible to stop it searching and make it store channels. This proved to be due to the MSM5840M-63R3 microcomputer chip on the remote control panel. The customer thought that the set simply had a blown fuse . . . **M.D.**

Sanyo CTP6102

This oldie suffered from very intermittent field jump with occasional rolling. The problem was eventually cured by replacing the transistors in the field oscillator circuit, Q401 (2SA564) and Q402 (2SC536), although they measured perfectly. **M.D.**

Pye 3030 (Philips NC3 Chassis)

Intermittent picture failure with this almost new set was traced to a dry-joint on R608 (18Ω). **M.D.**

Sanyo CTP4100 (79P Chassis)

The picture brightness varied – it would become bright enough to produce flyback lines and poor focusing. Checks revealed that the tube's first anode supply was varying and we then noticed a glow near one end of R363 (270kΩ, 1W). This resistor forms part of the first anode supply network and was going open-circuit, causing voltage variations at one end of the first anode supply potentiometer VR361. **I.B.**

Panasonic TC1475 (Z1 Chassis)

The only sign of life with this set was a whine from the switch-mode power supply. Protection diode D854 (R2G) on the 103V line was found to be short-circuit. Incidentally this diode isn't listed in the parts list – the part number is just R2G. Another diode was fitted and the set was run up on a variac. At around 145V input the set would come on from standby, but with the 103V line at 140V. The cause was a faulty chopper chip IC801 (STR55041-M). When this was replaced everything worked fine. **I.B.**

Ferguson TX10 Chassis

The problem with this set was a faint vertical white line approximately four inches from the left-hand side of the screen. The cause was found as soon as the set's back cover was removed. The RGB and earth leads that run from the right side end of the upright signals panel to the c.r.t. base panel were incorrectly routed. Instead of being clipped along the upper edge of the signals panel before going to the c.r.t. base PCB they were resting on the main panel close to the line output transformer. Just moving the leads a few centimetres away from the transformer, e.g. by hinging down the signals panel, cleared the problem. **I.B.**

Sony KV1400

This set would work for about twenty minutes then go dead. We found that the power supply protection circuit was coming into operation – in the fault condition Q652 and Q651 were both on. The set was switched off to deactivate the protection and a voltmeter was connected to the base of Q652. When we switched on the voltage was correct at approximately −0·3V but after a few minutes it started to rise slowly until it reached about 2V when Q652 switched on and shut down the power supply. The protection circuit comes into operation when the voltages in the line output stage are excessive. Sensing is via the 18V zener diode D653. The problem was that this device was leaky. **I.B.**

Thorn 9000 Chassis

The power supply was tripping and the two beam limiter resistors R724/5 were overheating – the classic signs of tripler failure. So a new tripler was fitted, along with a couple of new resistors, and the set was tried again. This time the power supply stopped tripping, the sound returned and the c.r.t.'s heaters lit up, indicating correct timebase operation. R725 once again overheated however, due to a high negative voltage from the clipper diode in the tripler via R724. The line output transformer had to be replaced because of interwinding leakage between the e.h.t. overwinding and the other coil on the same bobbin. **C.D.**

Nikkai BG001

With a dead set you might find the fuse open-circuit or intact. If the set starts up with heavy tripping when the Avo 8 (on a.c.) is connected to the cathode of Q811 or the junction of R812/3 and continues to do this we've found that either R812 or R813 is open-circuit – the manual for sets sold in Ireland may read R812 and R828 or just R883.

In one case the raster shrank by an inch all round then went dim with the h.t. down at about 80V. Q815 was open-circuit. **J.R.A.**

Hitachi CPT2626

This set suffered from an intermittently snowy picture. Tapping the tuner indicated that it had a dry-joint, so a new one was fitted. Within a few seconds the set went into standby with R717 in the 12V rail open-circuit. Another tuner was tried, with a new R717, and while fitting this we noticed that the row of wire links near the tuner in fact passed partly below it: one end of one of them had popped up a bit while desoldering the tuner so that it shorted to the tuner's body when the new unit was fitted – why do these things happen to us?!

This was not the end of the story however. We now had a whistle on sound, pitched at about middle C. It appeared only at the mid-range of the volume rocker bar and the rotary analogue control had no effect on it. The big can of microfarads was applied to all rails in the audio and i.f. areas with no effect (don't forget to switch off, discharge, connect and switch on each time!). We then found that the whistle wobbled while changing channels with the remote control unit, and that volume up/down raised and lowered the pitch. Adding microfarads to the remote control receiver panel did nothing. Increasing the value of C428 which decouples the d.c. volume control voltage from 4·7μF to 47μF provided an 80 per cent cure, so we settled for 100μF. The set had to be sent out before we could scope across C428 to see the frequency and waveform coming from the control panel. Can anyone add to this? **J.R.A.**

Letters

VINTAGE TV

Those who read Jeffrey Borin's interesting articles on running vintage TV receivers might like to know that the old 405-line transmitters from the Isle of Wight stations were given to our Wireless Museum, together with the standards converters and ancillary equipment. The small (?) 1kW standby transmitter is now back in working order and could be put on air at the touch of a button. I must hasten to add that we have no intention of carrying out such a dastardly deed however – despite having been granted the special exhibition callsign GB3WM . . .
Douglas Byrne, G3KPO,
Hon. Curator, C.E.M. Trust,
The Wireless Museum, Arreton Manor, I.O.W.

MAKING IT PAY

I feel that I must reply to Mr. McHugh's letter in the December issue. If he is as well qualified to carry out repair work as he says, he's clearly working for one of the "rip-off" merchants – only in this case it's he who is being ripped off. He should realise that his employer, who is clearly not having any problem making a living or staying in business, is banking £108 a *day* clear as a result of the work that Mr. McHugh is doing for him.

I've been on my own for two years now and have had no problem at all in making a very good living. I agree wholeheartedly with those other readers who have said that specialist workshops and high skill qualifications are the way to make money and stay ahead of the game these days. I applied for government grants and took on industrial premises in an enterprise zone, then used my contacts built up over many years to start getting work in.

If Mr. McHugh wants to try it and has belief in his abilities he will find that many independent workshops are grossly overloaded and are only too pleased to farm out some of their overflow to a skilled engineer. They will often even send the lad round with the repairs to ensure that the maximum time is spent at the bench doing their work. Payment for work of this nature is usually immediate, and an added bonus is no direct contract with Joe Public.

If Mr. McHugh wants to get some quality work in he should look to the computer market. Many computers are owned by industry and often all they're interested in is getting their machines back up and running, cost not being the prime factor. Video monitors go wrong with alarming regularity, and when all is said and done they are only stripped out TV sets. Believe me, there's little industry expertise in this field. Most digital engineers run a mile when high-voltage analogue circuitry is at fault, preferring to return monitors either to the manufacturers or to specialist workshops like mine.

CD players, cordless telephones and telephone answering machines are other areas where there is little servicing expertise. Try getting any of these repaired and see how many shops will turn you away. All these shops are potential customers for Mr. McHugh, as they would rather take in the repair than turn away the customer and risk losing his future custom.

In conclusion, it's not necessary to exist on £108 a week. Get in there yourself, do a good job at a sensible and reasonable price – and start to live. You'll probably find it a good deal easier than you think to get into and stay in business – if you really are good. If you can live on £108 a week, that's all you need to make at first not to notice the difference – except that you may find yourself a little more tired and rather more fulfilled!
G. R. Darby, Proprietor Monitech,
Earls Barton, Northampton

TRIPPING PHILIPS KT3

The cause of the permanently tripping Philips KT3 chassis (Service Bureau, December) is almost certainly that the mains bridge rectifier's reservoir capacitor C1460a (200μF) has gone open-circuit. I've had two sets recently with this same fault.
Ron Parfitt,
Melksham, Wilts.

ORACLE PUZZLES

After successfully solving the ITV Oracle Televox enigma (Letters October-November) can readers offer any ideas about pages 701-3, 713-5, 719 and 799?
C. Russell,
London NW2

HELP WANTED

Can anyone supply a service sheet/circuit diagram for the Steepletone monochrome TV plus a.m./f.m. radio receiver Model STVR45? The set was made in Taiwan.
F. C. Bailey,
2 Elmridge, Leigh, Lancs WN7 1HN.

Can anyone supply an audio chip that no longer seems to be available, type TDA1004A?
D. O'Brien,
420 Mourne Road, Drimnagh, Dublin 12, Ireland.

Despite trying several sources I have been unable to obtain a TDA1004 i.c. Can anyone help with this?
G. A. H. Geary,
30 Burbages Lane, Longford, Coventry.

VIEW FROM ZIMBABWE

In this former outpost of the Empire one of the highlights of the month is the arrival of the magazine from the "old country". As I was a small, independent dealer in the UK in the 405-line era I particularly enjoy the letters pages. I find that many of the problems encountered by dealers and servicemen in the fifties still seem to be very much the same today and satisfactory solutions as far off as ever.

I must take issue with R. A. Holmes (August) on the subject of monochrome receiver prices. No 9in. set cost as much as £100 in the early fifties. Pye produced an excellent "Dark Screen" table model for 39 guineas (retail prices were than always quoted in guineas and were strictly controlled). Incidentally it was a serviceman's delight: after unscrewing just two bolts the chassis and tube slid out of the cabinet as one unit. By 1959 the first of the 17in. 110° "Slimline" models – built down to a price rather than up to a standard – cost about 60 guineas. Retail price maintenance was soon to be swept away and

with it many of the smaller dealers who could no longer compete with the bulk order buying power of the high street multiples. Soon afterwards I though it wise to get out, while my head was still above water, and search for greener pastures.

Here in Zimbabwe a twenty-year old, well-preserved monochrome set with doors and legs (referred to here as a "cabinet model") sells for the equivalent of £200-£250. A line output valve for this sort of set, if you are lucky enough to find someone able to sell you one, costs about £16. A good G8 changes hands for about £500. New, large screen black-and-white cabinet models (if and when available) cost about the same. All new colour TV sets and VCRs have to be privately imported under licence by those fortunate enough to have external funds. I hope to be visiting the UK before long. If any reader knows of a supply of PL504s, PY88s, DY86s, PCL805s and TBA240s at competitive prices I'd be delighted to hear from him.
H. J. Attwood, 3 Van Praagh Avenue, P.O. Belvedere, Harare, Zimbabwe.

Teletopics

SATELLITE TV

Once again the main news this month is provided by satellite TV developments. As you will all know by now, Astra has been successfully put into orbit: initial transmissions are due to start on January 20th and the first four Sky Television services are due to start on February 5th. The Disney Channel will commence operations in the spring and there is to be a sixth Sky Television channel which will be devoted to classic films, documentaries and arts programmes. This channel is provisionally known as Sky Arts and Education: it will be financed by advertising and corporate sponsorship and is due to come on air later in the year.

Sky Movies has signed agreements with Warner Brothers and Orion Pictures. The deal with Warner provides exclusive use of all future films over a five-year period plus substantial access to the Warner library. It also includes material from Lorimar Pictures and Television. The deal with Orion covers major releases plus pay-TV and basic rights to 167 other films in the Orion catalogue for a period of four years. The two Sky Television pay-TV channels, Sky Movies and The Disney Channel, are to use a scrambling system known as Palcrypt which has been jointly developed by Thomson and News Data Security Products Ltd. It uses the line cut and rotate method, with digitisation of the picture elements, and is exactly the same as the system proposed for use with MAC-packet systems and approved by the EBU. Thomson will be building the initial decoders and the system will subsequently be made available to other manufacturers under licence, enabling them to integrate the decoder circuitry within receivers.

Plessey is to supply microwave gallium-arsenide field-effect transistors for use in the TVRO system that is to be produced by Sir Clive Sinclair's company Cambridge Computer (see Teletopics, December). An order worth £3-4m for two million transistors has been placed and the TVRO systems are expected to be available from March. Further collaboration between Plessey and Cambridge Computer is aimed at producing a range of microwave gallium-arsenide chips for TVRO system use next year. Other Plessey TVRO system components will include a SAWF and a silicon decoder chip.

BSB, which already has agreements with Columbia, Cannon, MGA/UA and Warner Brothers, has entered into an agreement worth some £170m with Paramount Pictures and MCA/Universal, covering a total of around 650 feature films from the two US studios. BSB now has rights to show over 1,750 feature films during a five-year period. It's reputed to have paid around £400m for these rights. The Virgin Group's stake in BSB has been bought by the Australian Bond Corporation, which is best known in the UK for its Castlemaine lager, increasing Bond's interest in BSB from 22·47 to 33·7 per cent. The Virgin Group, which was one of BSB's founder members, is to concentrate on programme making and providing services to the television sector.

The sad saga of SuperChannel, which is at present in receivership, continues. Creditors are to be offered payment of a quarter of what they are owed. The Italian Beta Television company, which has a 55 per cent stake, has agreed to finance the channel until February.

ESPN, the US satellite TV sports channel, has increased its interest in Screensport from 3·5 to 25 per cent by buying part of the W.H. Smith Television stake. Screensport is moving to Astra with an extended 24-hour a day service.

There are to be at least six Eutelsat II second-generation, medium-power satellites. The first is scheduled for

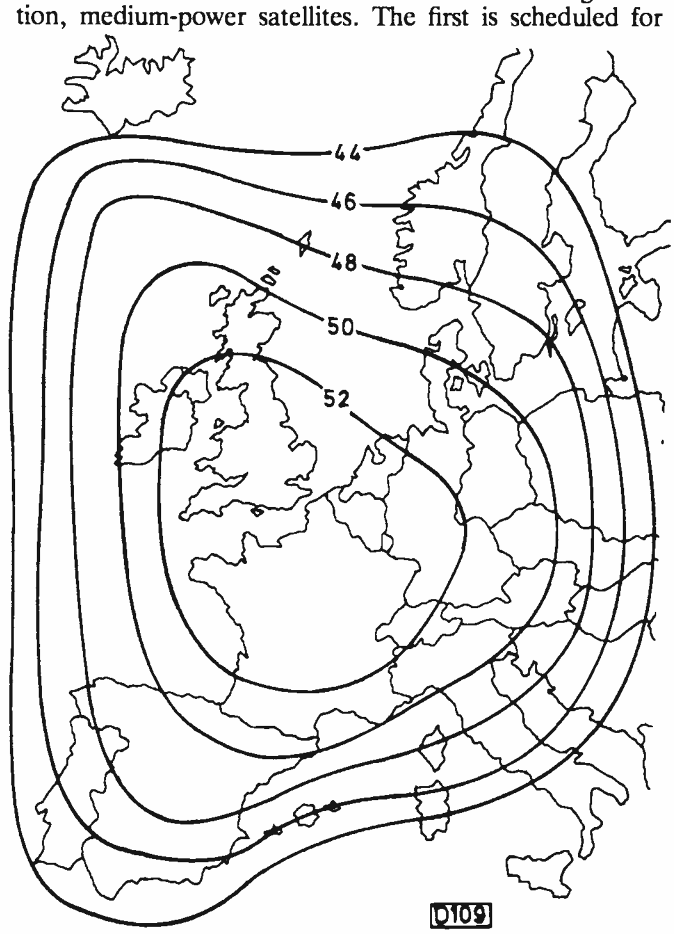

Fig. 1: Approximate service area of Astra's channels 4, 8, 12 and 16, which have been allocated to Eurosport, Sky Channel, Sky News and Sky Movies respectively. Polarisation is nominally vertical. Figures represent e.i.r.p. in dBW. Centre frequencies are as follows: channel 4 11·2585GHz, channel 8 11·3175GHz, channel 12 11·3765GHz and channel 16 11·4355GHz. The f.m. video deviation is 16MHz/V.

launch in the spring of next year, at 13°E. A further four satellites will be launched at six-monthly intervals at 7°E, 10°E, 16°E and 36°E. The sixth satellite, expected to be in operation in early 1992, will be designed to meet Turkish requirements.

ITT Nokia has introduced a range of satellite receiving equipment and TV sets. The SAT1100 set-top unit is preprogrammed for the Astra transmissions and is MAC extendable. Features include an output for direct control of an electromagnetic polariser, a low threshold demodulator, 48-channel capability, wide and narrow band audio selection, a scart output socket and a user-friendly, full-function remote control system with LED display and a "TV release" function. The ITT Nokia LNB is optimised for use with the company's 55cm dish and receiver unit. The package sells at around £400. There are also two satellite-ready TV sets, Models SAT6390 and SAT7190, with built-in satellite tuners or the option of retrofit tuners. Other retrofit items that can be used with these sets are a NICAM stereo decoder and a picture-in-picture module. Both sets have a built-in f.m. radio.

Announcements of readiness for satellite TV are coming from various High Street traders. Dixons/Currys say that "they intend to be the dominant retail force in the satellite TV market" with receiving equipment priced from £199·99. An installation service is being provided by the Group's Mastercare service division. The Focus/Multibroadcast rental chain expects to instal some 32,000 receivers during the first year of Astra broadcasting out of an anticipated market of 600,000 units.

THE CAMCORDER MARKET

Sales of camcorders worldwide are beginning to rise substantially. When figures become available it's expected that some 6m camcorders will have been sold during 1988, representing a turnover of $7·3bn. The largest markets, the USA and Japan, are expected to have taken 2m and 1·5m units respectively. For the UK deliveries of around 120,000 are anticipated – BREMA figures show that 82,000 camcorders were delivered during the first nine months of 1988. Sales growth of over fifty per cent was seen in Japan, where one household in ten now owns a camcorder. Matsushita has suggested that camcorder sales will soon outstrip sales of still cameras.

CABLE TV

It's understood that Robert Maxwell has put up for sale his loss-making British Cable Services, which includes the old Rediffusion networks and several more recent multi-channel franchises – it's the UK's largest cable TV operation. US firms continue to be the only ones prepared to put money into cable TV in the UK: the latest franchise awarded by the Cable Authority has gone to East London Telecommunications which is owned by Jones Intercable and Pacific Telesis. The franchise covers Barking, Bexley and Redbridge.

THE CD-R DISC

A blank, recordable compact disc, which is expected to be known as CD-R, has been demonstrated by the Tokyo electronic components and magnetic tape manufacturer Taiyo Yuden. The characteristics of the disc meet the basic Philips/Sony specification for compact discs. This is the latest in a series of announcements that have come from various firms which are conducting research in this field. Taiyo Yuden say that initially the aim would be to make the discs available for professional use. Copyright presents a serious problem in the domestic context, as it does with DAT. Once the technology has been mastered however its seems inevitable that it will eventually be offered on the consumer market. Recorders are still under development. The principle involved is to use a laser to alter the magnetic state of a disc layer, to give digital indication of either one or zero. With the Taiyo Yuden disc a 7-9mW laser is used for recording and a 2mW laser is used for playback. The disc is not erasable. Kodak however has recently announced the development of an erasable, recordable CD using what is known as thermo-magneto-optical technology.

TUNER PROVIDES MONITOR CONVERSION

Feedback Instruments Ltd., Test and Measurement Division, Park Road, Crowborough, E. Sussex TN6 2QR (telephone 0892 653 322) has introduced a tuner system, designated Model AV7300, to enable a dedicated colour monitor to be used as a TV receiver in addition to its monitor function. The unit can be permanently connected to the computer and a TV aerial, with simple switching between the two uses via the TV/computer switch. A green LED indicates the set's operational state. The tuner itself is a Philips type and the system gives push-button selection of up to twelve channels.

BLACK LINE 45AX TUBES

The new Black Line series of 45AX FS tubes from Philips Components provide bright, high-contrast pictures and, when switched off, an unobtrusive screen. The low expansion invar shadowmask used in the tubes combines improved contrast with excellent colour purity and white colour balance. Use of an invar shadowmask enables the tube to be driven at fifty per cent higher beam power than with a conventional steel shadowmask without discolouration being introduced. As a result a lower light transmission faceplate glass can be employed, giving a dark screen while retaining improved brightness. The invar shadowmask has an expansion coefficient less than seven per cent of that of a steel shadowmask. This leads to a dramatic reduction in beam displacement due to doming with high-energy mask loading. The new shadowmasks are used with the unique 45AX corner pin suspension system.

NEW FROM CROFTON

Two new video products have been introduced by Crofton Electronics of Kingshill, Nextend, Lyonshall, Herefordshire HR5 3HZ (telephone 054 48 557). The first is a miniature monochrome camera with solid-state image sensor, Model CCD2, which is claimed to be the smallest on the market today at 5·7 × 5·7 × 4·8cm and weighing 140g (less lens). The half-inch CCD image sensor provides a total pixel count of 276,450 with a sensitivity down to 3 lux. Output is 1V peak-peak at 75Ω and the signal-to-noise ratio better than 46dB with the a.g.c. off. There's a standard C lens mount and operation is at 11-16V d.c.

The second product is a time/date and message generator with stop-watch facility, known as Model TDMS1. It's available in two basic forms, as an assembled PCB for incorporation in other equipment or boxed as a free-standing unit complete with mains transformer, input and output BNC sockets and setting push-buttons. The design is based around a single microcomputer chip with all the functions under software control, making specialised customisation possible. It can be interfaced with almost all video signals regardless of line standard and mains frequency. Applications are wide and diverse, ranging from a simple time/day insert generator for video signal chains to use as an event timer, a video editing ident signal etc.

VIDEO EQUIPMENT

Akai's latest VCR, Model VS66EK, is a digital LP machine with a suggested price of £499·90. The digital features include picture-in-picture and freeze frame. The universal remote control handset that comes with the machine is a computerised unit with the ability to learn up to 45 functions from other infra-red handsets so that it can be used to control a TV set, midi-system etc. in addition to the VCR. Other features include a DX4 head, next function memory, child lock, scart socket, digital auto-tracking and QSS, which enables a picture to appear on the screen in 1·5sec. Step-by-step programming instructions are displayed on the screen through the Akai interactive monitor system.

The Matsui VX850 VCR from Currys is of interest in incorporating a teletext decoder at only £350. There's also programmable remote control with LCD display.

The latest 8mm camcorder from Pentax, Model PV-C880E, has a high-resolution 320,000 pixel CCD image sensor that works in conjunction with an automatic exposure system and automatic white balance. Features include an interval recording facility and an over-record facility. The former enables one-second images to be recorded for up to twelve hours at selected intervals of 0·5sec, 1, 2 or 5 minutes. The latter enables the user to make an insert on the tape for up to 3secs. Amongst the many other features is a high-sensitivity, unidirectional electret microphone with a wind-noise cutout device. The suggested price is £1,099·95.

Video Head Position Checker

F.M. Martinez

This simple strobe unit can be used to check the position of video heads. As the circuit (Fig. 1) shows, it's based on an MC1455 timer chip which is used as a monostable triggered by the negative-going edge of the VCR's head switching pulse. The output from the monostable is used to drive a yellow LED for a period of approximately 1msec – see Fig. 2.

If the LED is placed directly over the head drum when the VCR is in the play or record modes the three holes above the head can be clearly seen as head A starts its scan across the tape and head B leaves the tape path. In addition, scanning the drum with the strobe unit enables the wiring and any label to be identified.

Two LEDs in parallel were used in the prototype. The chip is capable of handling the source current without damage. As the on time is slightly less than 1msec (with the component values shown) no limiting resistor is required.

If the drum above one of the heads is marked with a small adhesive label tinted with yellow text marker and a line coincident with the centre of the drum is drawn on the label, head A or head B can be clearly identified by scanning the strobe around the circumference of the drum.

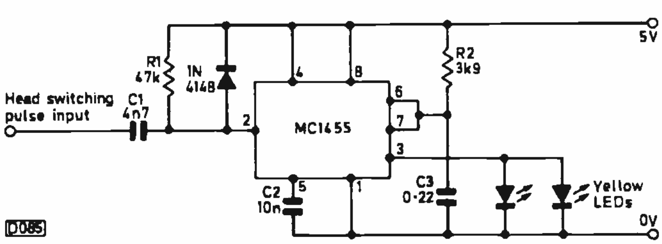

Fig. 1: Circuit of the video head position checker.

By using a suitable circuit to invert the head switching pulse input to the MC1455 chip the position of head B can be monitored as it starts to scan the tape.

The values of C1 and R1 were chosen so as not to load the head switching pulse generator. The values of C3 and R2 determine the LED on time, in this case 1msec.

The unit can be used for experimental or educational purposes where tracking effects with early models can be seen and the effects of the PG1, PG2 and record phase adjustments on the position of the heads can be demonstrated.

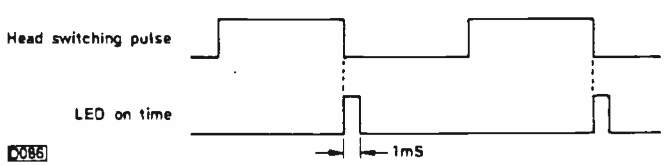

Fig. 2: Timing diagram.

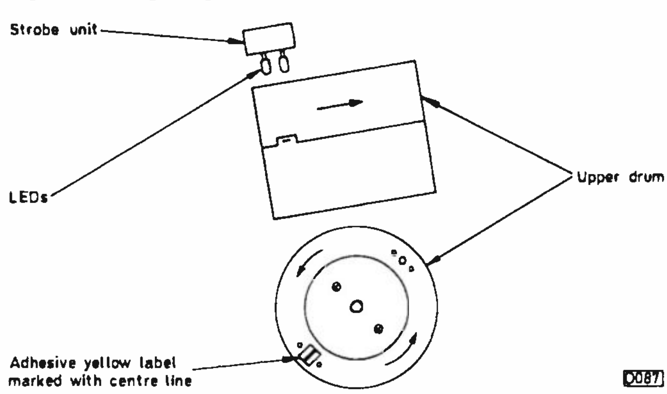

Fig. 3: Method of using the video head position checker. Use with low background light.

Camcorder Servicing

Part 1 **Steve Beeching, T. Eng.**

The camcorder is one of the latest items of domestic electronic equipment that the owner/user takes for granted and often abuses. A large proportion of owners seem to assume that the camcorder contains something like a clockwork mechanism and have no idea of the internal complexities. Whenever I open one in front of the owner there's a gasp before the cliches start to come out – "how tiny/complicated/don't know how you can see" etc. As a result of this attitude camcorders get dropped in the sea/sand, on concrete, on the lens, and are generally slung about – until something goes wrong when there's a moan about the cost of repair.

The technology is developing rapidly as chips grow more legs and get smaller. More diverse functions are being designed into individual i.c.s, and as a result of this failures often produce fault symptoms that are not necessarily indicative of the source of the problem.

Camcorder servicing cannot be carried out on the principle of replacing components until the fault clears. With this approach you will introduce more faults as you go along, adding to the final cost. The source of a fault must be tracked down carefully, then only a few components replaced, either on a logical basis or for elimination purposes.

It's not a good idea to plague manufacturers' technical departments. The answer you get will depend on the information you provide: if you are not correct, you will be given incorrect repair suggestions. It's my fate in life that such conversations usually end up with "when you've tracked it down, let us know for our records".

Much of the development that has gone into camcorders has been undertaken to improve the manufacturers' market share and profitability. The aims have been to reduce size, maximise usability and maintain a competitive price in worldwide markets. Unfortunately ease and speed of manufacturing tend to be incompatible with ease of servicing. Generally, manufacturers don't consider servicing, which is of little interest to them. As an indication of the scale of production at present, JVC recently increased the output of its camcorder plant at Yokohama from 120,000 to 150,000 units a month – that's about 6,000 a day.

Workshop Requirements

It's possible to service camcorders profitably, but to be successful a number of basic principles must be understood and observed. First, there's no point in attempting to repair high-technology products using surface-mounted components unless you are fully equipped to handle them – otherwise only damage will result. Surface-mounted components are not well marked, just coded to indicate what they are: with transistors and diodes there are two letters, resistors have three numbers and capacitors nothing at all. Tools required consist of tweezers and cutters. They should be the most expensive types available (£20-£30). You then have to grind them down to obtain a cutting point for i.c. legs spaced at less than 0·5mm apart. Soldering equipment should be of the hot-air type (Weller AG700), with a solder sucker or a hot-air desoldering station – irons are too large to use for desoldering. Sacrifice components for the sake of the PCB. If a board is damaged a new one will be required, and this isn't cheap (£150-£250). The soldering iron should have a tip size down to 0·4-0·8mm and, to preserve the workability of the tip, be temperature controlled. I find that I have to replace my 0·4mm Weller tips, at a cost of around £3 each, every couple of weeks. The workbench must be clean, tidy and anti-static, with no components, solder blobs, food etc. lying about.

Servicing Equipment

Each manufacturer's camcorder will require extension leads and odd jigs to support the camera section. Expect to pay about £150 per set for JVC camcorders, somewhat less for Panasonic. Some leads for one manufacturer will work with another's models but it's very frustrating to find the right kind of connector with one pin short or one pin too many.

Colour and grey-scale charts are required for camera work, lit by a quartz-iodine lamp as close to 3,200°K as possible. A chart of red and blue sections side-by-side is useful for R/B matrix systems. Some pornographic calendars are good for flesh tone and a general check on colour reproduction, with a mixture of reds, blues, yellow, browns and greens.

An oscilloscope with dual traces and external triggering is required – a bandwidth of 20MHz will do. For the camera section of the workshop a precision colour pro-monitor and a vectorscope should be permanent fixtures.

In other words, camcorders are not for the unskilled, the faint-hearted or the enthusiastic amateur. Unless you are prepared to spend £3,000-£5,000 on equipment, leave them alone. Camcorders that have been "got at" could well cost several hundred pounds to put right. We hope you'll find the rest of this article of interest, but inevitably the interest for many readers will be academic.

The VHS-C Format

The VHS-C format uses a small version of the standard VHS cassette: its size is about a third of that of the standard cassette, though the recordings are compatible. Initial JVC VHS-C camcorders provided only up to thirty minutes' recording time. Other manufacturers produced

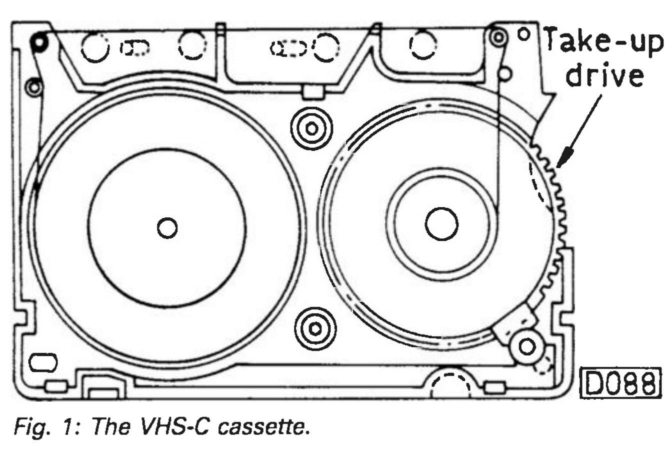

Fig. 1: The VHS-C cassette.

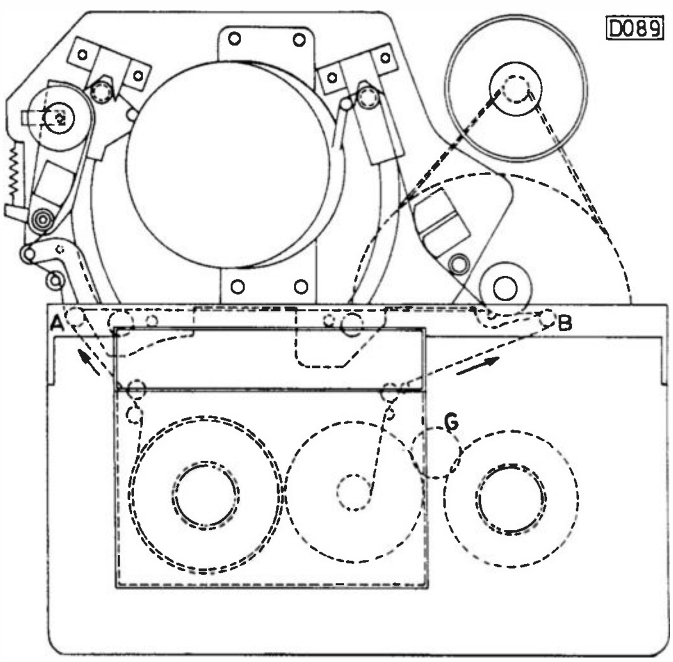

Fig. 2: The VHS-C cassette adaptor.

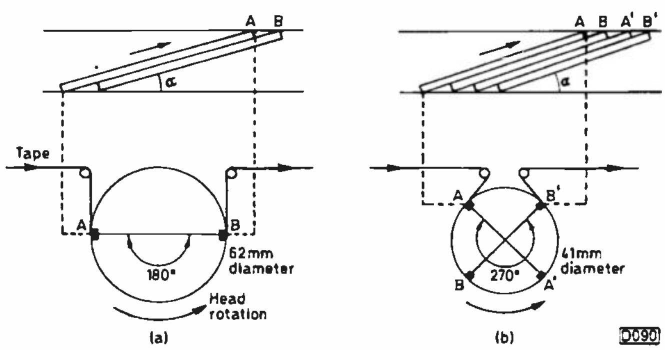

Fig. 3: VHS and VHS-C compared, (a) VHS with 62mm drum, (b) VHS-C with 41mm drum.

full-size VHS camcorders. The size of the unit is determined largely by the size of the cassette housing. While a full-size camcorder is not heavy it's bulky and difficult to balance for long periods of time. With these camcorders the tape runs for three hours but the batteries don't, so external battery power is necessary.

To overcome the short recording time of its initial camcorders JVC designed the GR-C7 VHS-C camcorder which has a CCD image sensor and half-speed, long-play facility. The ability to record for up to an hour with a very light-weight camcorder proved to be popular. As a result, JVC-manufactured versions of the GR-C7 appeared in the ranges of other Japanese manufacturers and some European companies. Later, in 1986, record-only models were introduced. These weighed less than 1kg with the cassette and battery included.

The supply spool in a VHS-C cassette is a small version of the standard VHS cassette spool. It can sit on an open turntable within a VHS VCR. Despite the small diameter of the spool, the socket is the same as that of a standard cassette. The take-up spool in the VHS-C cassette is mounted internally on a small spindle. It's driven by a toothed gear on its circumference, as shown in Fig. 1.

When a VHS-C cassette is mounted in a cassette adaptor the recording can be played back via a full-size VHS VCR. The supply spool sits on the VCR's supply spool turntable while the take-up spool is driven by the VCR's take-up turntable via a small intermediate gear – G, see Fig. 2 – within the adaptor. Early versions of the cassette adaptor were "manual": loading arms A and B were moved outwards and forwards manually to match the tape path by a side mounted wheel and internal gears. Later versions use a battery-driven motor which is actuated when a VHS-C cassette is inserted in the adaptor. In either case the tape is pulled out of the VHS-C cassette to the front of the adaptor, thus matching a standard cassette. A small point worth noting is that when a VHS-C cassette is put into an adaptor a few seconds of the beginning of the recording are "lost" within the adaptor, because the internal take-up path is increased.

The VHS-C Drum

VHS-C camcorders have a very small, light-weight video-head drum assembly. Various features ensure that VHS compatibility is maintained. Most full-sized VHS camcorders use the same small head assembly. It's two-thirds the size of a standard VHS drum and has four heads mounted on it, designated A, A', B and B'. These are used in turn to play or record video tracks on the tape. The four heads enable the standard VHS tracks, ch. 1 or A and ch. 2 or B, to be laid down on the tape and played back: the switching sequence is determined by the amount of tape wrapped around the drum. The standard VHS drum is 62mm in diameter while the small camcorder drum is 41mm in diameter.

A comparison of the two types of video-head drum is shown in Fig. 3. Table 1 lists specifications. In the VHS format successive tracks are recorded with an azimuth of ±6°: the azimuth for head A is +6° while the azimuth for head B is −6°. From Fig. 3(a) you can see that in the standard VHS system head A comes into contact with the lower edge of the tape as head B leaves the upper edge. Thus head A will follow and record or play back an A track. As head A leaves the upper edge of the tape head B comes into contact with the lower edge and so on along the length of the tape. As the video head travels around with the drum the tape moves, very slowly in comparison, in the same direction. Thus each head produces a slanted track as it rotates through 180° which, with an overlap margin of about 3° at the beginning and end, gives a total tape wrap of 186°.

Let's call the length of the track and of the drum circumference while the tape is in contact with it l. Ignoring the overlap, we can say that the length of path l is $\pi \times D/2$, where D in the drum diameter, 62mm. Thus l is about 97·4mm.

For compatibility, the track length produced by the small camcorder drum – see Fig. 3(b) – must be the same, i.e. 97·4mm. Since the drum diameter is 41mm, the circumference πD is 128·8mm. So to maintain the same track length the wrap must be 97·4/128·8 or three-quar-

Table 1: VHS and VHS-C specifications.

Parameter	*VHS*	*VHS-C*
A head azimuth	+6°	+6°
B head azimuth	−6°	−6°
A' head azimuth	—	+6°
B' head azimuth	—	−6°
Drum diameter	62mm	41mm
Tape wrap	180°	270°
Drum speed	25 r.p.s.	37·5 r.p.s.

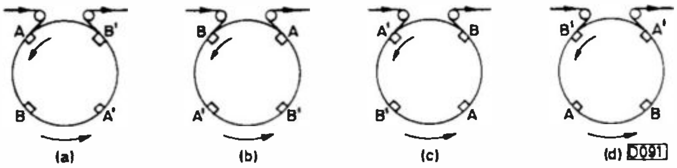

Fig. 4: Video head sequence.

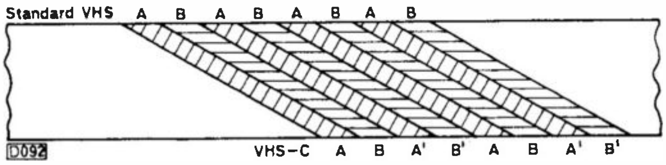

Fig. 5: How the tape is scanned in the VHS and VHS-C systems, showing how compatibility is achieved. Tape viewed from the head side.

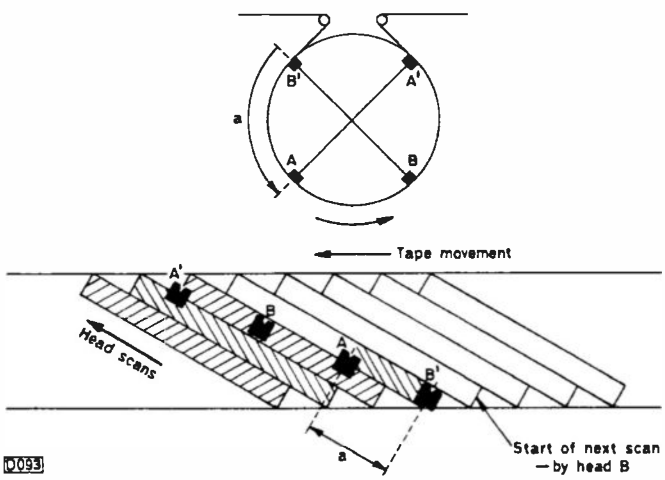

Fig. 6: Video head on/off switching in both the record and playback modes is required with the VHS-C system.

ters. This is 270° and with an overlap of 3·5° at the beginning and end we get a total wrap-round of 277°.

So far then we have established that the small camcorder drum requires a greater wrap-round to maintain the same track length as with a standard VHS drum, giving compatibility between the systems. Ingenious use is made of the four heads which are mounted in the order A, B, A', B', recording and playing back in that order. Whichever head is in use, the next one to be used is 90° ahead of it. Fig. 4 illustrates this. Thus the tracks are recorded in the sequence A, B, A', B'. Heads A and A' have a +6° azimuth while heads B and B' have a −6° azimuth. Fig. 5 shows the compatibility achieved in this way.

Fault Conditions

While the compatibility is good, when faults occur the symptoms may not be as obvious as one might expect. The main problems that produce picture disturbances are rotational jitter, eccentricity and very small changes in rotational speed. While the tracks are recorded in the order A, B, A', B' there's no arrangement to ensure that this order is observed during playback. Thus there's a 50:50 chance that playback will be in the order A', B', A, B, i.e. 180° out of phase. In this condition no head is replaying its own tracks. As a result of offsets such as eccentricity and lack of rotational inertia, picture distortion can be produced when head A plays A' tracks. Since the drum is light-weight and the flywheel is small, there's little inertia. The drum is therefore subject to timing

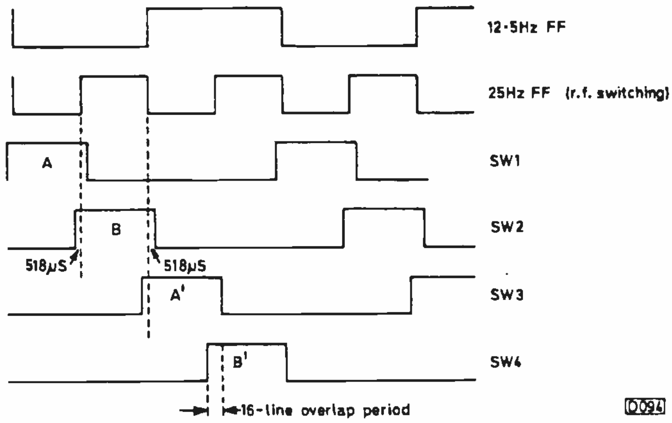

Fig. 7: The main VHS-C switching waveforms.

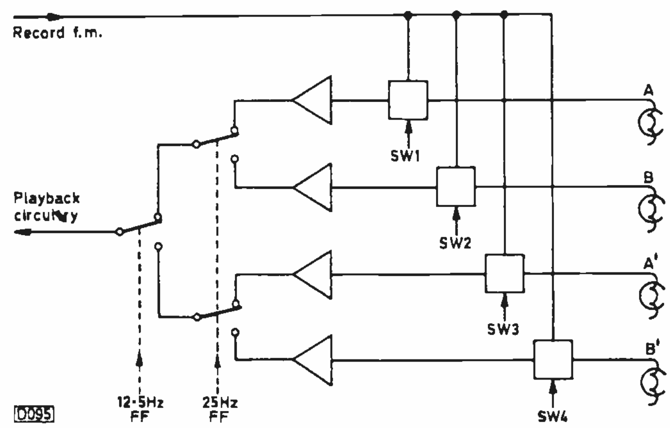

Fig. 8: The VHS-C head switching system.

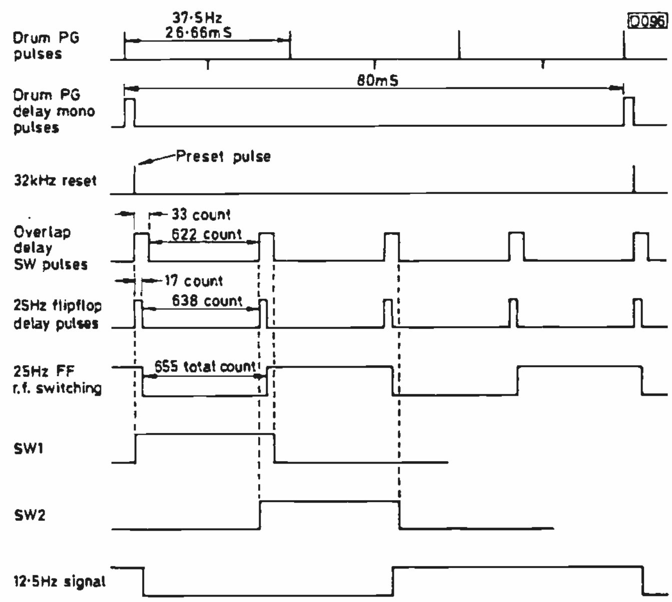

Fig. 9: VHS-C timing diagram.

errors – very small accelerations and decelerations.

If a video-head drum changes speed during a single track, say increasing then decreasing, there's no effect on the picture so long as the changes are the same during playback. When the heads are not playing back their own tracks however the speed changes can be reproduced as an S-shaped jitter over the whole screen, or rippling of the verticals. This distortion takes the form of a small side displacement of the verticals, either as a lot of small sinewaves or a large, single S-shaped curve, over the whole field scan.

Causes of this trouble are: irregular drum bearings; drum eccentricity; an offset drum; tolerances in the Hall-effect devices used in the head drum drive system; and tolerances in the drum motor windings.

When a tape recorded on a VHS-C machine is played back on a standard, two-head machine you can find that there's a small line of horizontal displacement about a third and again at two-thirds of the way down the screen. This is caused by the extra heads in the VHS-C drum hitting the tape as they come into contact with it: although they are not switched on, the physical shock produced by initial contact disturbs the tape tension value.

A quick test of whether the four VHS-C heads are out of phase during playback is to momentarily touch the pinch roller, causing a quick pause. This makes the A and A' (and the B and B') heads change over. It happens because there's only one control track pulse per pair of video tracks, so that any one control track pulse can be for the AB pair or the A'B' pair. When you make the capstan servo skip a control track pulse in this way the relationship between the heads and the tracks skips through 180°, giving the changeover. The same effect can be achieved by brief use of the pause button.

This test can also reveal tracking problems resulting from tip height differential between the A and A' or the B and B' heads. On one occasion I had an "intermittent" tracking fault due to a faulty drum which would track or not depending on the chance start-up from play. If the playback sequence ABA'B' matched the recorded tracks there was no problem, but if the sequence was out of phase the playback would not track.

The cure for these troubles: replace the whole drum assembly, upper (video head) and lower (drum motor) section, and in some machines the head preamplifier in order to match it to the heads.

Drum Speed

When servicing a VHS-C camcorder there's a trap that even experienced video engineers can easily fall into. With standard VHS machines the servo timings equate to field rate, i.e. 40msec periods. The VHS-C drum speed is different however, resulting in servo waveforms that may be unexpected.

To meet the requirement that a TV field is recorded on a single track during half a drum revolution, the standard VHS drum speed is 25 r.p.s. The TV field has a duration of 20msec: thus the track path is traversed in 20msec and a full revolution takes 40msec, which is 25 r.p.s. or 1,500 r.p.m.

With a VHS-C drum the track is laid down over a 270° revolution of the head. This 270° rotation must still take 20msec to maintain compatibility. If 270° = 20msec, 360° = 26·6666msec, i.e. a single rotation takes 26·6msec which is a rotational speed of 37·5 r.p.s. or 2, 250 r.p.m.

Video Head Switching

In a standard VHS VCR the video head not in contact with the tape in the playback mode is switched off, to prevent noise pick-up. This switching is not necessary in the record mode.

Three heads are normally in contact with the tape in a VHS-C machine. Only one is doing any work, so it's essential to switch off the others to prevent crosstalk between the heads. The switching system used switches the heads on individually in succession in both the record and playback modes.

This is illustrated in Fig. 6. Head B' is about to scan the tape, on which head A is recording a track – as shown it has moved a third of the way along the tape. At this particular point all four heads are in contact with the tape. As a recording is taking place, the need to switch off heads A', B and B' is clear – to prevent heads A' and B damaging the previous track and head B' altering the A head track being recorded. If the machine was in the playback mode at this time, head B would produce severe crosstalk if not switched off. Heads A' and B' would not produce much interference as they are of the wrong azimuth for the tracks they are covering.

With a standard VHS two-head drum the heads are 180° apart and both are driven by the f.m. recording signal. The wrap is 186°, taking into account the two overlap periods at the beginning and end of each track. This overlap provides a "window" area in which head switching occurs during playback, ensuring signal continuity and interference-free switching points.

We can's use the overlap technique in quite the same way with the VHS-C system since the heads are switched on and off in the record as well as the playback mode. To get an overlap we must adjust the record switching so that interference-free playback switching is achieved. Consider Fig. 4(b), where head A is nearly at the end of its scan and head B has just come into contact with the tape. The heads are 270° apart and the wrap is 277°m, so for 7° both these heads are in contact with the tape. To get the result we want head B is switched on for about 1msec before head A is switched off. This corresponds with an overlap of about 16 lines, and as the playback head switching signal is centred within this overlap period there's a margin of ±8 lines.

Fig. 7 shows the main switching waveforms, at 12·5Hz and 25Hz. As with standard VHS machines, the 25Hz signal is referred to as the r.f. switching signal or flip-flop and the 12·5Hz signal is derived from it by dividing by two. The four switching signals SW1-4 are synchronised to the 25Hz r.f. switching signal but the timing is modified so that each head is switched on (high level) eight lines (518μsec) before the 25Hz signal transition and off eight lines after the next 25Hz signal transition. Thus the recorded overlap period is centred within a 16 line period, leaving sufficient margin of error for interchange tolerances in the playback mode. Accurate timing signals are developed digitally within a single i.c. and are not dependent on timing capacitors. In consequence they are not susceptible to drift.

Fig. 8 shows in block diagram form the VHS-C video head switching system. In the record mode the f.m. carrier is applied to the heads via switches SW1-4, the switching signals being timed to give the required overlap. Switches SW1-4 remain active in the playback mode to prevent crosstalk. The input to the playback circuits is determined by the combined logic of the 25Hz and 12·5Hz signals. This means that the switching transition is the same as the r.f. switching signal transition and the switching is therefore centred within the 16-line overlap.

The timing network doesn't differentiate between record and playback. It can be seen from Fig. 8 that switches SW1-4 determine the record switching while the combined effect of the 25Hz and 12·5Hz switches provides the required playback switching. Record/playback control is normally carried out within the preamplifier module.

The head switching waveforms are produced by the main servo chip, which operates in conjunction with a single 32·768kHz crystal clock to determine the timing of all the switching and servo signals.

The timing diagram is shown in Fig. 9. There are two inputs to the system, the 32·768kHz clock with a pulse period of 30·53μsec (in round figures) and the drum pick-up PG pulses. The latter are at a frequency of 37·5Hz and are divided by three to give 12·5Hz or 80msec. The pulse derived from the drum PG delay monostable is of about 1·9msec duration and is adjustable. It provides a delay between the drum PG pulses and the start of the 25Hz flip-flop. This delay can be used to set the timing of the playback switches and set the r.f. switching point to 6·5 lines prior to the start of the field-sync period. The adjustment is done by means of a single potentiometer (PG1) instead of the two (PG1 and PG2) used in standard VHS machines. The rest of the timing is determined digitally. Note that it takes three full revolutions of the drum to complete the sequence, i.e. for all four heads to record or play back.

The 1·9msec pulses from the drum PG delay monostable have a period of 80msec. On the falling edge the 32kHz oscillator is reset and a single preset pulse is generated. This preset pulse resets all the counters and initiates the start of the 80msec timing period. Two counter networks produce the overlap delay pulses and the 25Hz flip-flop delay pulses. The overlap pulse is a count of 33 clock pulses for the high state and 622 clock pulses for the low state. Four of these overlap pulses occur between each preset pulse. It can be seen that the 33 count is in fact the overlap period. The 25Hz flip-flop delay signal is in the high state for a count of 17 clock pulses and in the low state for 638 clock pulses. There are again four of these pulses between each preset pulse.

In both cases the total count is 655, where 655 × 30·53μsec = 20msec. In order to time the overlap period each video head switching pulse (SW1-4) is set by the rising edge of the overlap pulse and reset by the falling edge of the next overlap pulse. This extends each head switching pulse for 688 counts or 21msec. The 25Hz r.f. switching pulse starts on the falling edge of a delay flip-flop pulse. The effect of this is to place the r.f. switching pulse transitions precisely in the middle of the overlap delay pulses. The 12·5Hz signal is derived from the 25Hz r.f. switching pulses by division.

General Points

This completes our outline of the differences between the standard VHS and VHS-C systems. Note however that some full-size camcorders such as the Panasonic NV-M1, 3, 5 and 7, the Hitachi VM200 and the Grundig VS150 us the small head drum. Any problems associated with the VHS-C four-head system also apply to these larger models therefore.

In VHS-C camcorders the preamplifier is plugged into the main PCB and a minor shock can disconnect one or more of the timing signals, leading to a fault symptom not unlike that produced by dirty heads. If the technician is not aware of this he may well change the drum before discovering the cause of the problem.

If one head is clogged, the noise flashes at about 12Hz, whether colour noise or spots. Always be aware of the four-head sequence, and when using a dual-trace scope to check the playback signals display at least two periods of the r.f. switching signal in order to see all four f.m. outputs.

The next article in this series will deal with pick-up devices, signal processing and fault finding in this area.

Still Swimming

Les Lawry-Johns

First I'd like to thank John de Rivaz for his helpful suggestions on medical matters. I think however that for the time being I'll carry on in this daze and see how things turn out. Maybe it's something to do with all those TV sets over the years. It could of course be the effects of whisky, about half a bottle per night, just to keep the blood thin you understand. But it could affect my head as well. Something's wrong, because I can't repair some of the Bush models that keep coming in – the T20s and T22s I've written so much about over the years. Lately they seem to be beating me.

The Decca/Tatung 120

Then there was the Decca (Tatung) set that came in the other day. Fitted with the 120 series chassis. It kept blowing the 1A d.c. fuse in the power supply. I checked the BU426A chopper transistor and found that it was short-circuit, so I looked around for a reason. R810 was open-circuit. It's 150kΩ, so I fitted two 330kΩ resistors in parallel in its place. With these, a new BU426A and fuse the set worked all right, making me feel a little better. But I still wish all these people wouldn't keep coming in and expecting me to work miracles on their sets for nothing, saying things like "I'd do it myself but I haven't got the time".

Arcing

This happened when a bloke brought in a Ferguson set fitted with the TX10 chassis. The focus unit was arcing over and I'd just used my last one. I released the screws that secure it to the chassis, hoisted it up and secured it well clear of the metalwork with insulating tape. After that it performed quite well and the chap was pleased to take it away, tending not to hear me say "on your head be it". A similar sort of thing happened some time ago when I was out of triplers for an hour or two. A Ferguson set was brought in with the tripler arcing over to the metal frame on which it's mounted. I released it from the frame and let it hang down by an inch or two, suspending it in this position with tape. Once again the remedy was successful and the customer departed in high spirits, having had an estimate for a lot of money somewhere else. I'll learn, some day. Cries of "when?".

A Relative's G11

Look what happened when a relative brought in a large Philips set fitted with the G11 chassis. He complained about the bottom of the set scratching the large table on which he kept it at home. Not looking at the set properly I turned it on its side and removed the screws securing the bottom box. When I swung the box open I was surprised to find a large panel containing over sixty i.c.s and lots of other stuff.

"It's got teletext and viewdata" explained my relative. I unplugged the panel and removed it. Next I tucked all the leads inside the cabinet and, after a struggle, removed the housing. The set looked more normal and we swung it upright to test it. On switching it on there was a good picture with normal sound on all channels.

"You won't get teletext and all that lark" I told him.

"That's all right Les, as long as that bottom bit's no longer there."

I helped him take the set out to his car and he drove off in good humour, leaving me with his unwanted bits and pieces, including the complicated panel. I kept looking at it and felt pleased that I wasn't expected to repair it.

The Decca Hybrid CTV

Here's another example of the daft things that keep happening here. A Decca colour set was brought in, fitted with the late hybrid chassis. The complaint was excessive red. To save me having to think I changed the video panel. The resultant display was nicely balanced. I tried the pushbuttons and tuned one of them for London reception, at the same time noticing that the others weren't all that good at holding in. The owner had said however that all he wanted done was the red picture, nothing else. When he came to collect it I showed him the panel and mentioned the pushbuttons. He said they were all right and agreed that the picture was good. So he paid up and left.

Just as I was eating my lunch the phone rang. It was him again, moaning his head off about the buttons and saying it must be because of the new video panel I'd fitted. I told him that the panel had nothing to do with the buttons, and that there was nothing more I could do as he didn't want to bring it back to the shop. So that's it. He'll have to keep hitting the buttons until they click in.

Well that's it for now. Be seeing you!

The Use of j Notation

Peter Richards

Most jobs in all spheres of life call for special tools. Electronics is no exception. Imagine trying to repair a VCR without a torque cassette r an alignment tape. The job can be done, but it takes bout three or four times longer than it need do. Use of the correct tools makes the job in hand much simpler, and you find that the investment in tools pays for itself over and over again.

The world of mathematics is like a vast tool kit. If we can master the use of as many of these tools as possible, the physical problems and calculations we have to deal with will be greatly simplified. With mathematics it's the effort required to master the techniques that will pay for itself over and over again.

One such technique is the use of complex numbers (otherwise known as j notation) to assist in the analysis of a.c. circuits that use inductors, resistors and capacitors. Vector methods are normally used to illustrate simple cases, but their use requires that you memorise all sorts of different rules. Vector methods cannot, by any stretch of the imagination, cope with complicated problems easily. With j notation however all problems can be handled with the same ease.

This article is not intended to be a complete course on j notation – there are many excellent textbooks for that purpose. Instead the aim will be to try to unify our ideas of numbers by showing that real numbers form a subset of the complex numbers and that in a corresponding fashion resistance is a subset – or special kind of – impedance. A rule will be established enabling all impedances, whether resistive or reactive, to be combined directly. Thus phase changes can be calculated without recourse to scale drawing, sketches or graphs.

The mathematics may at first glance look long and complicated, but this is only because every step is shown, something that most text books don't do. Let's start by consolidating our ideas of numbers.

Numbers

Most people are introduced to numbers before they even go to school. They learn to count discrete quantities, such as of apples or sweets, using the natural numbers or whole numbers as we used to call them. This principle serves us well until we come to the problem of dividing three apples between two people. We then have to learn about fractions, which we later get to know as rational numbers – because they can be represented as one integer number divided by another one, e.g. 1/2, 4/2 or 3/2. At about this stage of our education we also get to know about negative numbers. The final type of number we meet in primary school is the irrational number, such as π or $\sqrt{2}$. These go on for ever without recurring. The collective name for all these sorts of numbers is "real numbers".

At each stage in our education our concept of numbers expands to suit our needs. The previous concept is not abandoned however: instead it's refined by adding more families of numbers. Real numbers can be represented on a line, as shown in Fig. 1, where a few examples have been included.

This scheme serves us well enough for most purposes, but it still presents a few problems. For example we know that $2^2 = 4$ and that $-2^2 = 4$. We can work out that $2^{2.5} = 4\sqrt{2}$ which is approximately 5·66, but $-2^{2.5}$ is not approximately 5·66 as might be expected. In fact $-2^{2.5}$ is undefined in the real number system. Why is it that we can raise positive numbers to any power but raise negative numbers to only an integer power? A positive number has two square roots, one cube root, two fourth roots and so on. Wouldn't it be nice if any number had two square roots, three cube roots, four fourth roots etc.?

This leads us to the next question, which is why can't we find the square root of a negative number?

The common denominator of all these problems is that $\sqrt{-1}$ is not defined in the real number system. If we can define it however all these problems vanish. Thus $-2^{2.5}$ will be defined and any number will then have two square roots, three cube roots, four fourth roots and so on.

As there's no real number corresponding to $\sqrt{-1}$ we have to imagine one. Mathematicians call this number i (for imaginary), but to avoid confusion with current electrical engineers call it j. It's defined as $j^2 = -1$, or $j = \sqrt{-1}$.

We can now find the square root of any negative number, e.g. $\sqrt{-9} = \sqrt{9}\sqrt{-1} = 3j$. The above example of $-2^{2.5}$ solves as:

$$-2^{2.5} = (-2)^2 \times (-2)^{0.5} = (-2)^2 \times \sqrt{-2} = 4 \times \sqrt{2} \times \sqrt{-1} = 4\sqrt{2}\,j.$$

Numbers that are multiples of j only are called imaginary. It's possible to combine a real number and an imaginary number into one quantity that's called a complex number. For example, 4j is imaginary while $3 \times 4j$ is complex. A complex number like $3 \times 4j$ is one number. Provided it is treated as such, complex numbers follow all the usual rules of algebra and can be manipulated just as easily as real numbers.

Operations with Complex Numbers

Complex numbers cannot be represented in a straight line as real numbers can. But remember how at each stage in our education our concept of numbers has to expand rather than change. Complex numbers are no different. We can expand our number line "up and down", utilising the whole plane. The real number line remains as a subset of the set of complex numbers thus represented. This type of diagram is called an Argand diagram. Fig. 2 shows an example.

The complex plane can be thought of as a map or graph with x and y co-ordinates which must be handled separately. For those who were wondering what all this has to do with electronics, the resemblance of complex numbers to vectors should now be clear. Complex numbers are far easier to manipulate however than are some of the methods of vector addition used in a.c. theory problems.

Addition of complex numbers is straightforward: the real parts are added and the imaginary parts are added, giving another complex number, i.e.:

$$(a + jb) + (c + jd) = (a + c) + j(b + d)$$
e.g. $(3 + 2j) + (6 + j) = 9 + 3j$.

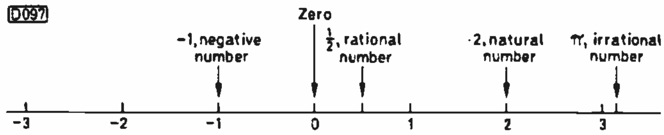

Fig. 1: The real number line, with some examples of real numbers included.

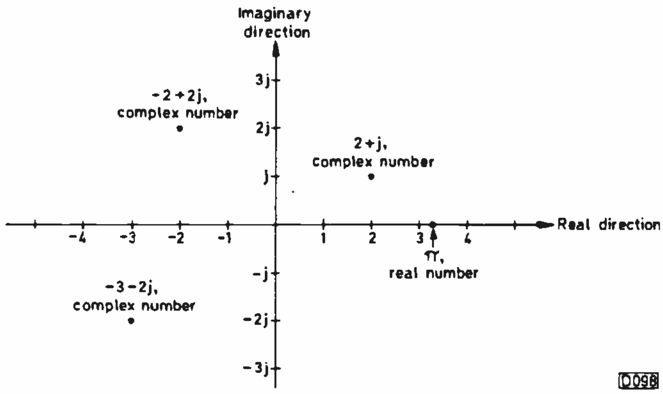

Fig. 2: the complex plane, with some examples of complex numbers shown.

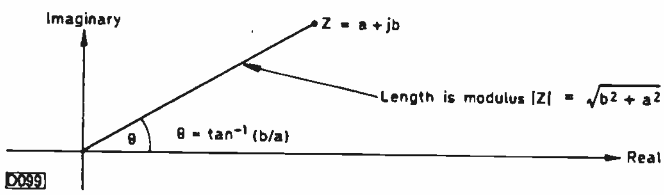

Fig. 3: Modulus and angle of a complex number.

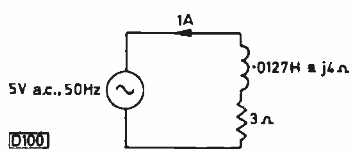

Fig. 4: Inductor with series resistor.

Subtraction is simply the reverse of addition, i.e.:

$$(a + jb) - (c + jd) = (a - c) + j(b - d)$$

e.g. $(9 + 3j) - (6 + j) = 3 + 2j$.

Multiplication and division by a real number are also as you'd expect, e.g.

$$(3 + 2j) \times 6 = 18 + 12j.$$

To multiply one complex number by another, once again the ordinary rules of algebra apply. We must remember that $j^2 = -1$ when we collect the terms together. Thus:

$$\begin{aligned}(a + jb)(c + jd) &= ac + jad + jbc + j^2bd \\ &= ac - bd + j(ad + bc).\end{aligned}$$

For example:

$$\begin{aligned}(3 + 2j)(1 + 3j) &= 3 + 9j + 2j + 6j^2 \\ &= -3 + 11j.\end{aligned}$$

Notice that in this example the number $-3 + 11j$ is still written with the real part first, even though this is a negative quantity.

Division of one complex number by another requires more thought. We can however use the trick of multiplying the top and bottom of the equation by the same quantity, which must be the complex conjugate of the bottom line. The top and bottom lines are then expanded separately. This will make the bottom line a real number, enabling division to be carried out easily. The following example should make this clear:

$$\begin{aligned}\frac{a + jb}{c + jd} &= \frac{a + jb}{c + jd} \times \frac{c - jd}{c - jd} \\ &= \frac{ac - jad - jbc - j^2bd}{c^2 + jdc - jdc - j^2d^2} \\ &= \frac{(ac + bd) + j(bc - ad)}{c^2 + d^2}\end{aligned}$$

It looks far more complicated than it is! Take this example:

$$\begin{aligned}\frac{-3 + 5j}{2 - 3j} &= \frac{(-3 + 5j)(2 + 3j)}{(2 - 3j)(2 \times 3j)} \\ &= \frac{-21 + j}{13} = \frac{-21}{13} + \frac{j}{13}\end{aligned}$$

Finally we can define the modulus of a complex number Z as being

$$|Z| = \sqrt{a^2 \times b^2}$$

where $Z = a + jb$.

The modulus represents the magnitude of the number, or in graphical terms its distance from the origin. The angle that this modulus makes with the real line is given as $\tan^{-1}(b/a)$. Fig. 3 should make this clear.

j Notation

Now that we've met the complex variable j and seen how to perform simple arithmetic with complex numbers we can apply these techniques to problems involving the impedances of capacitors, inductors and resistors, and see how these quantities can be simply combined.

Taking inductors first, we originally learnt that the impedance of an inductor $X_L = 2\pi fL$, with a phase lag of 90° for the current. It's this phase lag that prevents direct addition to other impedances. Suppose however we say that the impedance of the inductor is given by $X_L = j\omega L$, where $\omega = 2\pi f$ (ω is angular velocity, and removal of the terms 2π simplifies the algebra). The presence of the j term carries the information about the 90° phase difference. More importantly however this impedance of $j\omega L$ can be combined directly with other complex impedances. For example, suppose we have a 12·7mH inductor in a circuit operating at 50Hz. Its impedance will be

$$X_L = j\omega L = j2\pi fL = j \times \pi \times 2 \times 50 \times 12{\cdot}7 \times 10^{-3} = 4j\Omega,$$

or 4Ω inductive as we may say. If we connect this inductor in series with a 3Ω resistor, the composite impedance is simply $(3 + 4j)\Omega$. If there were more calculations to do we would simply carry the composite impedance as $(3 + 4j)\Omega$ through to the next step.

The modulus of the impedance would be $\sqrt{(3^2 + 4^2)} = \sqrt{25} = 5\Omega$ (which means that it would draw 1A from a 5V, 50Hz a.c. source), and the phase difference between voltage and current is $\tan^{-1}(4/3)$ which is approximately 53°. A look at Fig. 4 should make this clear.

Let's now consider capacitors. We can replace our original concept of $X_C = 1/(2\pi fC)$ by $X_C = 1/(j\omega C)$. Notice that if j is transferred to the top line the formula becomes $X_C = -j/(\omega C) = -j/(2\pi fC)$.

To take an example, consider an 800µF capacitor working at 50Hz. Its impedance is

$$X_C = \frac{1}{j\omega C} = \frac{1{,}000{,}000}{j \times 2 \times \pi \times 50 \times 800} = \frac{4}{j} = -4j\Omega.$$

This may seem very strange: how does something have a negative impedance?! Remember that the j carries the information about the phase difference. Here −j simply tells us that the current leads the voltage by 90°.

Both the impedances we've been considering can be represented on one diagram, as shown in Fig. 5. Any impedance, no matter how complicated, can be represented by a point on this diagram. Point Z, 3 + 4j, might represent a 12·7mH inductor with a 3Ω d.c. resistance winding, working at 50Hz. Point C, 0 − 4j, would represent an ideal 800µF capacitor, again working at 50Hz.

This diagram will look familiar to anyone who has worked out this type of problem using vectors. But, as subsequent examples will show, the use of j notation makes things so much simpler. Notice also that any simple concept of resistance and d.c. circuits will fit in without any changes to the concept being required.

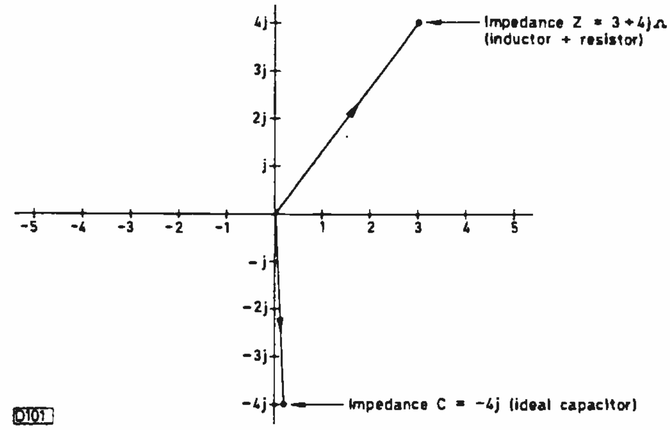

Fig. 5: Impedance diagram for a real inductor and an ideal capacitor.

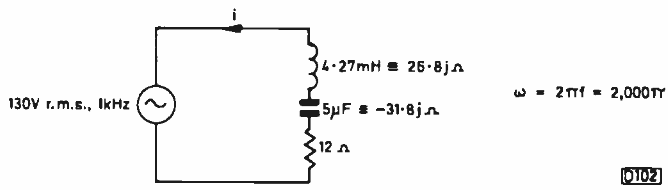

Fig. 6: Series LCR circuit.

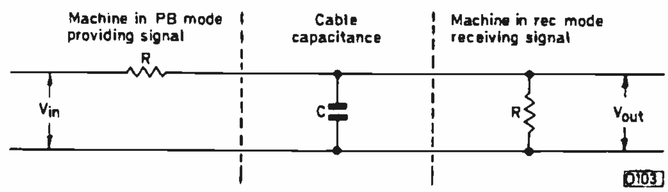

Fig. 7: Video signal transfer between two VCRs.

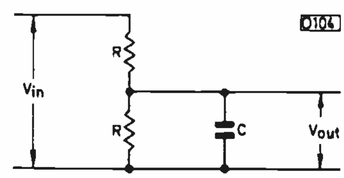

Fig. 8: Essential elements of Fig. 7 redrawn.

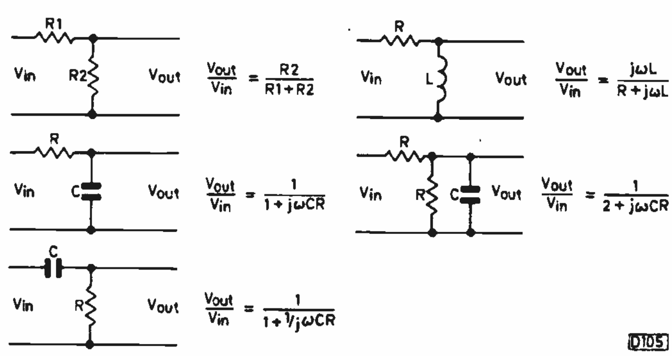

Fig. 9: Transfer functions of common circuits.

Example: Series LCR Circuit

The circuit shown in Fig. 6 has an inductor, a capacitor and a resistor in series, all fed from a 1kHz a.c. supply of 130V r.m.s. If the circuit consisted of three resistors in series analysis would pose no problems. By using j notation we can however combine the three impedances directly, just as we can with resistors. The combined impedance $Z_T = R + j\omega L + 1/j\omega C = R + j\omega L - j/\omega C = R + j(\omega L - 1/\omega C)$. Putting the numbers into this formula gives us:

$$Z_T = 12 + j\left(\frac{2{,}000 \times \pi \times 4{\cdot}27}{1{,}000} - \frac{1{,}000{,}000}{2{,}000 \times 5 \times \pi}\right) = (12 - 5j)\Omega.$$

Thus the combined impedance of the three components in series works out to be the complex quantity (12 − 5j)Ω. We could also work out the current by dividing the supply voltage by 12 − 5j, as follows:

$$\frac{130}{12 - 5j} = \frac{130\,(12 + 5j)}{(12 - 5j)\,(12 + 5j)} = \frac{1{,}560 + 650j}{144 + 25} = 9{\cdot}23 + 3{\cdot}846j \text{ Amps.}$$

The modulus of this current, which is the value we measure, is given by

$$\sqrt{(9{\cdot}23^2 + 3{\cdot}846^2)} = 10\text{A}.$$

We would, incidentally, have obtained the same result by first working out the modulus of the impedance then dividing this into the voltage, i.e.

$$|Z_T| = \sqrt{(12^2 + (-5)^2)} = \sqrt{169} = 13\Omega,$$

hence the current is 130/13 = 10A.

Notice however that the complex expression for current enables the phase angle to be worked out as:

Angle $\theta = \tan^{-1}(3{\cdot}846/9{\cdot}23) = 22{\cdot}62°$.

The current leads by this angle θ, by virtue of the +j in the expression for current. We would expect this anyway since there is more capacitive reactance in the circuit than inductive reactance, but the correct manipulation of the numbers involved confirms this without any need to remember rules about phase lead or lag.

It's important to interpret the phase lead or lag correctly. A $-j$ in the impedance expression will give rise to a $+j$ in the current expression (since current = voltage/impedance): both these forms represent a phase lead for the current.

What happen if we change the value of the inductor to 5mH? Well, let's put numbers into the formula again:

$Z_T = R + j\omega L + 1/j\omega C = R + j(\omega L - 1/\omega C) = 12 + j(31{\cdot}8 - 31{\cdot}8) = 12 + 0j = 12\Omega$.

The expression has become entirely resistive! In other words the inductance and capacitance have cancelled each other out, so that all the external source sees is a 12Ω resistive load. This condition is known as resonance of course. In the series circuit the lowest impedance occurs at resonance while in the parallel LC circuit the opposite happens at resonance, the capacitance and inductance "cancelling" to create an infinitely large impedance. The proof of this is similar and is not worth repeating here.

Case Study

At this point textbooks generally provide a proof of the properties of most RC and LC circuits. There's little point in doing so here – proofs are seldom required in real life. To illustrate the way in which circuit responses are calculated however we'll look at a practical example.

The circuit shown in Fig. 7 is being used to couple a video signal from one VCR to another nearby machine for copying purposes. The essential elements of the circuit can be redrawn as shown in Fig. 8. The point we are interested in is the frequency response fall off caused by the cable capacitance. If the circuit consisted of a resistive potential divider we could simply say that $V_{out}/V_{in} = R_{bottom}/R_{total}$. If we change resistance to complex impedance we can use the same potential divider rule, i.e.

V_{out}/V_{in} = (R parallel C)/((R parallel C) + R) =

$$\frac{\dfrac{R \times 1/j\omega C}{1/j\omega C + R}}{\left(\dfrac{R \times 1/j\omega C}{R + 1/j\omega C}\right) + R} = \frac{R/(1/j\omega CR)}{(R/(1+j\omega CR) + R}$$

Now multiply every term by $1/(1 + j\omega CR)$.

$V_{out}/V_{in} = R/(R + R(1 + j\omega CR)) = 1/(1 + 1 + j\omega CR) = 1/(2 + j\omega CR)$.

In this example R is 75Ω. Let's consider the response at the chroma carrier frequency of 4·43MHz. If the loss of response at the chroma carrier frequency is too great the burst will be weak and there will be attenuation of the h.f. signal components, causing all sorts of colour problems (not to mention poor luminance etc.).

At 4·43MHz, $\omega = 2\pi f = 27{\cdot}8 \times 10^6$ Rad Sec^{-1}. Hence $V_{out}/V_{in} = 1/(2 + j(27{\cdot}8 \times 10^6 \times 75 \times C)) = 1/(2 + j(2{\cdot}085 \times 10^9 \times C))$.

We can now calculate the ratio V_{out}/V_{in} for all values of C from this one equation. Suppose that the connecting cable has a capacitance of 1,000pF (10^{-9} Farad). The voltage ratio would be:

$V_{out}/V_{in} = 1/(2 + j(2{\cdot}085 \times 10^9 \times 10\text{-}9)) = 1/(2 \times j(2{\cdot}085))$ which is approximately $1/(2 \times 2j)$. To tidy up:

$$\frac{1}{2+2j} = \frac{1}{(2+2j)}\frac{(2-2j)}{(2-2j)} = \frac{2-2j}{4+4} = \frac{1}{4} - \frac{1j}{4} = \frac{1}{4}(1-j)$$

which is approximately V_{out}/V_{in}.

This result immediately tells us two things. First that the chroma carrier frequency at 4·43MHz has been reduced in amplitude to about $\sqrt{2}/4$, i.e. approximately 0·35 of its original strength, and that it is phase shifted by about 45°. All of which points to the need for a much smaller cable capacitance!

In Conclusion

In practice of course it's not necessary to derive everything from first principles. We could look up in a table that the circuit's response is $V_{out}/V_{in} = 1/(2 + j\omega CR)$ and the phase difference $\theta = -\tan^{-1}(\omega CR/2)$, then put our numbers into the formula to work out what we wish to know. Fig. 9 provides details of common simple networks.

One big advantage of using j notation in design is that it lends itself readily to repetitive calculation. It's very attractive to those who use computers to design their circuits for them. The input and output of a circuit can be related by an equation involving j, and hence the output for any input can be readily calculated.

We know that when calculations on a.c. circuits are done we have to make allowances for the phase shifts introduced by the capacitors and inductors. This can be done by using vector methods or the "j operator" method. For circuits with more than a few components the vector method is very tiresome, especially if it's necessary to change from voltage reference to current reference and vice versa.

By assuming that an inductor has an impedance of $j\omega L$ and a capacitor an impedance of $1/j\omega C$, where $j = \sqrt{-1}$, it is very simple to analyse all circuits directly, just as if we are dealing with resistors.

Resistance can be considered as a special type of impedance, i.e. an impedance that contains no complex component. So for purposes of calculation resistance corresponds to the real numbers and impedance to the whole complex plane, which of course contains all the real numbers.

We've illustrated this by the worked example of the loss of h.f. response due to cable capacitance when one VCR is coupled to another one.

I hope that this basic introduction to the topic of j notation will stimulate readers to further reading and development.

Problems with the Philips VR2021

B. Ross

Three of these machines have come our way recently. The problem with the first one was that it threaded, played for about two seconds, then unthreaded. The Philips manual is helpful in providing fault-finding sections which we followed. The head drum rotated, the pinch wheel pulled in, the capstan was working and the reel motors operated correctly. Whilst working on another of these machines we realised that though the head drum in the first one rotated it did so more slowly than it should have done. Checks around the drive transistor then revealed that the voltages were about fifty per cent low, but no obvious fault could be found. We next checked the drum motor, comparing it with a known good one. The resistance of the windings, and rotation of the motor while applying meter probes, confirmed that the motor was in order.

It seemed likely that the fault was on the U280 head servo oscillator board, so a substitute known good board was fitted. Still no change. Checks around this board revealed that there were no head drum speed pulses at pin 11 – they had definitely been there earlier on when checked. These come from optocoupler P61 whose emitting diode is in series with module P60, P64 and R3001. The diode in P60 (winding motor detector) was open-circuit, a replacement curing the fault.

Intermittent Lock-up

Another of these machines would operate correctly though the control system would spasmodically lock up, so that no functions, including turn off, could be selected. When this happened switching the power off for fifteen seconds, to reset the computer system, would restore normal operation. These machines have a memory clear button on the front panel, accessible when the cassette carrier is raised, but resetting this made no difference to the fault condition.

The machine was used beneath an ageing Rank colour receiver (A823 chassis). This has a thyristor power supply which we thought might have been interfering with the machine, since moving it away from the set lengthened the time between failures. The fault still occurred in the workshop however.

Some time was spent on the power supply, as the mains plug was a sloppy fit and we suspected that transient sparks and arcs travelling through the power supply could be causing problems. We then found that when trying to record manually or via the timer the channel number could be selected but not held, i.e. the channel display reverted to 00. At this point a scrap machine was dragged out of the dungeon so that panels could be swapped. The front panel keypad was o.k., but changing the U20 computer panel provided a cure.

The machine was returned after a long soak test. Three days later it was back again. This time the protection circuit was operating, switching off the relay in the power supply. This is located on the U180 motor control board. Replacing T7025 and C2028 seems to have produced a lasting cure.

Deck Trouble

The third machine would also thread up then unthread after a couple of seconds. This time the problem was mechanical. During threading the pressure roller assembly didn't travel quite far enough to the end of the carriage guide and fully into the locating slots of the scan unit brackets. When the pressure roller mechanism operated the roller was not secured against the capstan. The roller could be held in by hand whilst the mechanism operated, normal playback then being obtained with a good picture.

Attempts were made, without success, to alter the pressure roller position on the threading cord and to move the position of the cord slightly. Fitting a pressure roller from a known good machine produced no improvement either. As no way of repositioning the threading cord easily could be seen we concluded that a new cord or complete removal and rethreading would be required. Instead, the scrap machine was again raided, the cassette deck being swapped over. The machine now threaded up and played back correctly mechanically, but there was no picture as the video heads were badly corroded – liquid spillage?

The scanning unit from the original deck, known to be in good condition, was refitted. The advantage of swapping over the scan unit is that it contains the complete tape path as a subassembly, i.e. the heads, capstan, guides and motors, so that no realignment is required. We were upset to be rewarded with a weakly contrasted picture with random colour splashing and bands of static-like interference. All connections were checked and found to be o.k. Further playback then produced the good picture we'd expected. Our thoughts about this are that connector H5 from the rotary transformer to the playback amplifier may have been making poor contact or that there had been poor earth contact on one of the earthing wires.

Repair Viability

When it comes to the viability of maintaining these machines, in view of their age, the general cost of spares, the small number of machines that come in for repair and the points raised by R. Caley in a letter earlier last year (Letters, March 1988), the use of components from scrap machines has to be seriously considered. There appear to be quite a lot of 2020 and 2021 machines on the surplus market. Can anyone advise on the cost and availability of the service program plus adaptor for tracking faults in the computer section of these machines?

Miniature CCTV Camera

The Crofton CCD2 is claimed to be the world's smallest CCTV camera at only 5·7 × 5·7 × 4·8cm plus lens. For further details see Teletopics, page 260.

Servicing the Sanyo Models CTP7130/1/2

John Coombes

Many Sanyo sets produced over the period 1981-1985 were fitted with the 80P series chassis. There were however several different versions of the chassis, involving a number of component variations. The main changes come with different tube sizes. The present article is based on Models CTP7130, CTP7131 and CTP7132 which are fitted with the A56-540X 22in. c.r.t.

No Sound or Raster

No sound or raster is the most common fault symptom so we'll deal with this first. The simplest initial check to make is to see whether the c.r.t.'s heaters are alight. If they are the power supply and line timebase are functioning. Check whether C253 (47μF) and/or C241 (0.01μF) is short-circuit. These capacitors decouple the supply to the colour decoder chip and will pull down the l.t. supplies if shorted.

If the c.r.t.'s heaters are not alight, check whether the 145V h.t. supply is present at point 4B1 on the main board. If this supply is present, check out the line timebase as follows.

Check for the presence of a squarewave signal at the base of the line driver transistor Q461 (2SC2482). Absence of this waveform casts suspicion on the LA7800 sync/timebase generator chip IC401 which should be checked by replacement. If this fails to restore the drive waveform, check whether this i.c. is receiving its 12V supply at pin 15. If not, R458 (2·7kΩ) could be open-circuit or C458 (100μF) short-circuit. If the 12V supply is present check whether a sawtooth waveform is present at pin 2. Absence of this waveform should lead to checks on the line hold control VR901 (300Ω) — check the condition of its carbon track; on the line phase control VR451 (5kΩ) which should be checked by replacement; on R452 (12kΩ) which could be open-circuit; and on C451 (5,600pF) which could be open- or short-circuit. If the sawtooth waveform is present at pin 2 of IC401 check whether the driver transistor Q461 is short-circuit or its base feed resistor R450 (330Ω) is open-circuit.

If there's a squarewave drive at the base of Q461 move on to check for the presence of a drive signal at the base of the line output transistor Q462 (2SD871A). Correct drive here could indicate that Q462 is open-circuit or that the line output transformer T471 is defective. No waveform at the base of Q462 could indicate that this transistor is short-circuit, that the line driver transformer T461 has an open-circuit winding or dry-jointed pin or that its feed resistor R462 (330Ω) is open-circuit. In the latter event the decoupling capacitor C463 (22μF) could be short-circuit.

Note that failure of the line output transistor Q462 can be caused by a dry-joint on the heatsink support tag. Resolding will cure this.

Power Supply Troubles

If there's no 145V h.t. supply at point 4B1, move over to the power supply section. The circuit is shown in Fig. 1. It's basically a Siemens type self-oscillating chopper circuit, with transistors Q302/3 acting as a thyristor which when triggered by the waveform developed across R313 switches the chopper transistor Q304 off. Chopper transformer T301 provides mains isolation.

The first thing to check in the power supply is the mains fuse F302 (2AT). If this has blown, check the bridge rectifier diodes D301-4 (4 × RM11C), the associated protection capacitors C304-7 (1,000pF), the filter capacitors C301 and C309 (both 0·1μF) and the reservoir capacitor C308 (200μF).

If F302 is o.k. check the d.c. fuse F301 (1A). The usual cause of this having blown is the chopper transistor Q304 (2SD1279) or C315 (2,700pF) in the snubber network going short-circuit. Other items to check if necessary are the three other transistors in the circuit, Q301 (2SC536), Q302 (2SA1246) and Q303 (2SC2274) – check these by replacement – zener diode D305 (EQA02-08RG), the 145V rectifier D323 (GF8-30G or 3JH61), diodes D307 and D308 (both type ES-1), C314 (220μF) and, if fitted, C326 (2,700pF). If these items are all in order suspect the chopper transformer T301 of having shorted turns.

If F301 is intact, check the voltage across C308. If there is no voltage here check the mains input circuitry, the on/off switch and the filter coils L301/2. If C308 has some 300V across it, check Q303 (2SC2274), D306 (ES-1), C329 (150μF), C469 (47μF), R318 (0·33Ω), R315 (39Ω), R302 (470kΩ), R314 (18Ω), and T301 for being open-circuit. If a reading of 300V is obtained between the collector and emitter of the chopper transistor Q304 it's open-circuit. R302 can be dry-jointed and can go high in value.

C312 (10μF) smooths the supply for the error detector transistor Q301 which, with zener diode D305, sets the d.c. conditions for the trigger transistors Q302/3. If C312 looses capacitance the set will be erratic in starting up. Check it by replacement.

Field Faults

For field collapse, first check that IC401 has 12V at pin 12. If not, check zener diode D412 (EQA02-11D), R400 (150Ω) and C411 (470μF). The most common cause of field collapse however is failure of the field output transistors Q442 (2SD843) and Q443 (2SB753). One or both may have failed – check them by substitution. The LA7800 chip or the field driver transistor Q441 (2SC2002) could be responsible – again check by substitution. We've had R441 (470Ω), R442 (470Ω) or R437 (1·5Ω) go open-circuit and C443 (0·18μF) or C444 (4,700pF) go short-circuit. The scan coils can go open-circuit.

For lack of height (may be all right with the height control VR431 at maximum) check the field output transistors Q442/3, then if necessary check R4105 (68Ω) and R4106 (33Ω). These resistors are in series with the 15V regulator transistor on the scan correction panel. They can go open-circuit and dry-joints can occur in this area. In later models these resistors are wirewound types.

No Sound

For no sound, first check for an open-circuit loudspeaker. Then check that the LA4250 audio amplifier chip

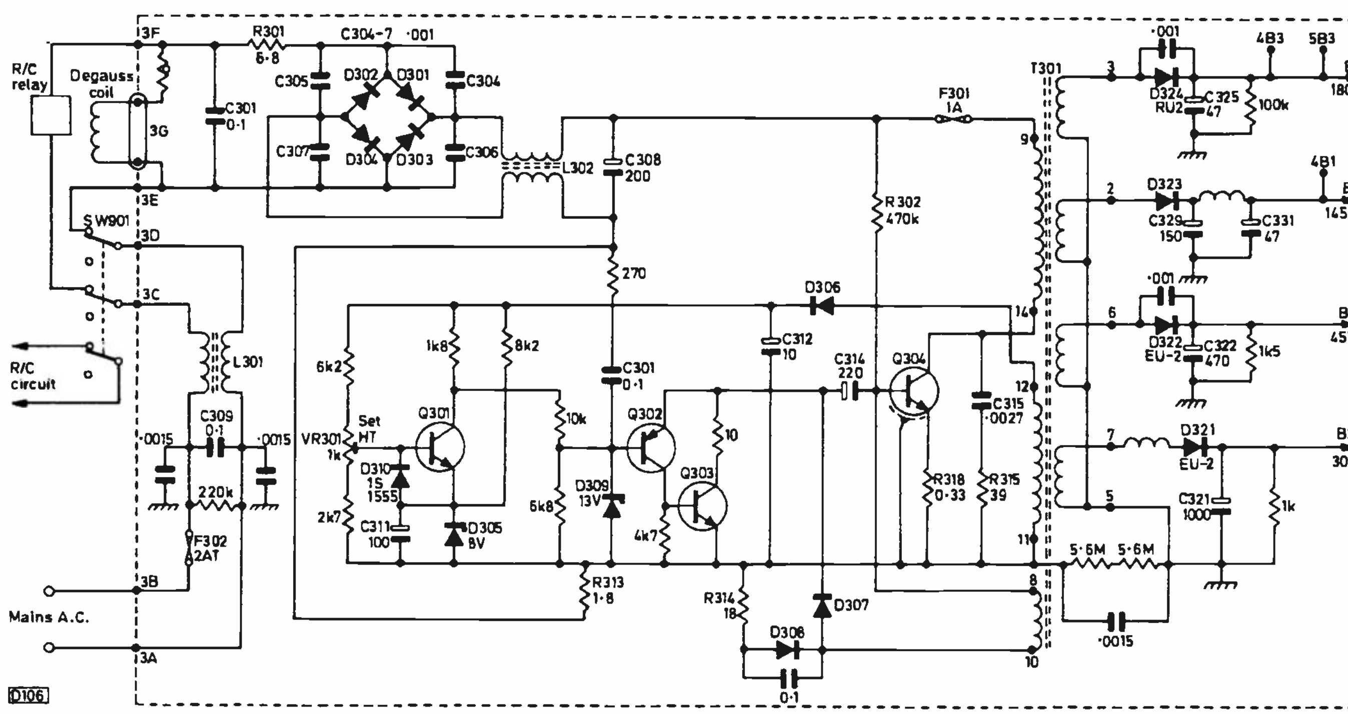

Fig. 1: The Siemens type self-oscillating chopper circuit used in Sanyo Models CTP7130, CTP7131 and CTP7132 – the 22in. sets in the 80P chassis series. When chopper transistor Q304 conducts, current flows via R313, R318, Q304 and the primary winding on T301. When the negative-going sawtooth voltage thus developed across R313 reaches a certain level Q302/Q303 switch on, shorting the base and emitter of Q304 via C314 so that it switches off. Q302/3 also switch off. The next cycle of operation occurs when the secondary winding rectifiers cease to conduct and feedback from winding 8/10 of T301 to the base of Q304 switches it on again. The supply provided by D306/C312 depends on the voltage conditions in the circuit and serves as feedback for the error detector transistor Q301.

IC171 has 30V at pin 2. If this supply is missing, check D321 (ERC44-04) and C321 (1,000μF). If necessary check IC171 by replacement, check whether C179 (1,000μF) is open-circuit, check the volume control VR908 (50kΩ) then if still in trouble replace the M51356P i.f. chip IC101.

Sync Problems

For sync problems check IC401 (LA7800) by replacement. No or poor line sync can also be caused by a defective pulse shaper transistor – Q421 (2SC536).

Tuning Drift

For tuning drift check D701 (μPC574J) by replacement. Other possibilities are Q705 (2SC945A) and R713 (150Ω) which can change value or go open-circuit intermittently.

If the drift occurs on one channel only, check the tuning potentiometers VR791-8 (100kΩ) by replacement. This problem can also be caused by diodes D791-8 (type 1S1555). To check, tune the potentiometers to one channel: when the drift stops you've found the culprit.

The tuner can also be responsible for tuning drift.

Colour Faults

For no colour the first item to check is the M51393P colour decoder chip IC201, by replacement. The voltage at point 2N should vary from 0-13V with the setting of the colour control. If there is no variation or intermittent variation, replace VR905 (10kΩ). IC201 is mounted in a holder. If the pins of the chip or the holder are dirty you can get no colour, intermittent loss of colour, colour flaring on red, blue or green, loss of one colour, low contrast or background colouring on lowlights.

The 4·43MHz crystal X261 can also be responsible for loss of colour. Check it by replacement. The associated trimmer VC261 may be misadjusted. Other possible causes of loss of colour are failure of the pulse shaper transistor Q231 (2SC536); R225 (2·2kΩ) going open-circuit; the chroma delay line L242 being open-circuit or dry-jointed; and VR240 (3kΩ) going open-circuit or having a defective track. If still in trouble check that the line hold control VR901 is set correctly and if necessary check IC401 (LA7800) by replacement.

No digit Display

For no digit display, first check LD1751 (E1581L) by replacement. Check whether IC701 (AN5011) has 6V at pin 11. If this voltage is missing, check D708 (EQB01-06) and R718 (68Ω). If nęcessary check IC701 by replacement.

The 80P Chassis

The 80P is a compact chassis with much of the circuitry incorporated in a small group of i.c.s, IC101 i.f., IC201 colour decoder, IC171 audio amplifier and IC401 sync/timebase generator. It's used in 14, 20, 22 and 26in. models. The 20in. models CTP6130, CTP6131 and CTP6132 are similar to the 7130/1/2 covered in this article but there are important differences. For example the chopper transformer has two output windings providing 110V and 18V lines. In the power supply R302 is 330kΩ, R313 is 2·2Ω, C308 if 100μF and F301 0·8A. The scan correction panel is omitted and the line output transistor is type 2SD869. There are numerous other component differences, so when working on these sets it's important to have the correct circuit diagram to hand.

ECONOMIC DEVICES PO BOX 15, WOLVERHAMPTON, WV2 4AZ

15/80H	3.30
15/85R	3.30
17052	5.61
17053	5.61
17074	9.30
17089	3.45
17127	2.50
17376	1.58
1N4001	0.04
1N4002	0.06
1N4003	0.06
1N4004	0.05
1N4005	0.05
1N4006	0.08
1N4007	0.07
1N4148	0.03
1N4448	0.05
1N5401	0.14
1N5402	0.15
1N5403	0.16
1N5404	0.15
1N5408	0.35
1N914	0.04
1S1555	0.31
1S44	0.10
1S921	0.10
2N2219A	0.33
2N3053	0.35
2N3054	0.99
2N3055	0.61
2N3442	1.56
2N3702	0.14
2N3703	0.18
2N3705	0.16
2N3706	0.14
2N3707	0.16
2N3711	0.13
2N3771	0.70
2N3772	1.71
2N3773	2.00
2N3819	0.54
2N3823	1.17
2N3904	0.62
2N3906	0.62
2N4101	1.73
2N4240	3.30
2N4444	0.99
2N5293	0.50
2N5294	0.50
2N5296	0.49
2N5297	0.50
2N5298	0.61
2N6109	1.58
2N6130	0.80
2N6133	1.25
2N6180	0.95
2N6292	1.65
2SA1006	1.50
2SA1011	1.65
2SA1015	0.49
2SA1012	1.25
2SA1020Y	0.89
2SA1027R	0.45
2SA473	0.75
2SA766S	4.95
2SC1173Y	1.25
2SC1474	1.25
2SC1509	1.35
2SA1095	3.00
2SA1103	6.55
2SA329	0.40
2SA489	1.17
2SA490	2.25
2SA493	2.25
2SA562	0.57
2SA564	0.75
2SA614	4.88
2SA628	1.14
2SA639S	1.75
2SA659	0.49
2SA673	1.50
2SA684	1.61
2SA697	1.05
2SA699	1.75
2SA715	0.95
2SA748	1.95
2SA817	0.65
2SA835	2.50
2SA836	0.89
2SA844	0.65
2SA872	0.80
2SA884	2.15
2SA937R	0.97
2SA940	1.32
2SA940-2	2.14
2SA950	0.72
2SA951	1.75
2SA966-Y	1.16
2SA999	1.36
2SB774	1.15
2SB185	1.13
2SB375	3.87
2SB400	0.40
2SB405	1.03
2SB511	2.50
2SB54	1.39
2SB546	0.56
2SB56	2.80
2SB618A	2.22
2SB631	1.45
2SB643	0.50
2SB669	3.67
2SB681	3.96
2SB695	1.98
2SB774	0.65
2SB819	1.13
2SC1096	1.16
2SC1104	3.98
2SC1106	4.54
2SC1114	3.25
2SC1116	4.95
2SC1124	1.28
2SC1129	1.65
2SC1131	0.64
2SC1158	3.33
2SC1162	0.55
2SC1172	2.22
2SC1195	3.26
2SC1213	0.89
2SC1226	1.46
2SC1293	0.90
2SC1306	1.98
2SC1317	0.50
2SC1364	0.49
2SC1383	1.20
2SC1391	2.45
2SC1398	0.75
2SC1413A	3.05
2SC1446	1.25
2SC1447	2.07
2SC1475	0.60
2SC1505	1.08
2SC1514	1.69
2SC1573D	1.25
2SC1583	0.58
2SC1617	3.89
2SC1678	1.98
2SC1741	1.25
2SC1810	1.70
2SC1815	0.45
2SC1826	0.67
2SC1829	2.22
2SC1875	4.50
2SC1893	3.02
2SC1906	0.98
2SC1921	1.37
2SC1923	0.30
2SC1929	2.25
2SC1942	1.65
2SC1959	0.26
2SC1957	1.09
2SC1953	1.93
2SC1962	1.93
2SC1969	2.04
2SC1983	2.21
2SC1985	1.55
2SC2009	0.34
2SC2029	2.33
2SC2028	2.11
2SC2063	0.99
2SC2078	3.11
2SC2073	2.25
2SC2085-Q	1.65
2SC2091	1.30
2SC2141	2.44
2SC2166	1.98
2SC2216	0.69
2SC2233	1.80
2SC2236	1.65
2SC2278	1.69
2SC2314	2.17
2SC2335+Kit	12.95
2SC2551	1.26
2SC2565	3.92
2SC2570	2.88
2SC2577	1.60
2SC2578	6.75
2SC2671	1.99
2SC288A	1.85
2SC3153	6.84
2SC372	1.40
2SC373	1.16
2SC383	1.33
2SC388	0.50
2SC394V	0.81
2SC403C	0.60
2SC458	0.15
2SC495	0.92
2SC515A	2.85
2SC535	0.79
2SC536	0.45
2SC537	0.54
2SC605L	1.16
2SC620	0.95
2SC643A	1.54
2SC668	0.67
2SC681	4.40
2SC682	1.88
2SC684	1.65
2SC693	0.63
2SC710	0.69
2SC711A	0.50
2SC717	1.28
2SC734	1.40
2SC781-Y	0.95
2SC783	3.98
2SC790Y	1.85
2SC828	0.28
2SC867A	3.84
2SC876	0.96
2SC930	0.54
2SC935	4.13
2SC940	4.68
2SD1128	2.90
2SD1138	0.94
2SD1273	1.56
2SD1453	1.40
2SD152K	2.64
2SD198	4.20
2SD234	0.49
2SD235	0.60
2SD24	2.29
2SD257	1.98
2SD292	2.58
2SD313	2.65
2SD325D	2.26
2SD350	5.20
2SD353	7.50
2SD389	2.41
2SD401	1.40
2SD414	1.98
2SD471	2.13
2SD560	2.95
2SD600	2.98
2SD601R	0.65
2SD613	1.03
2SD636	0.55
2SD639-R	0.72
2SD655	0.98
2SD657	3.50
2SD661A	0.80
2SD731	1.05
2SD773	0.60
2SD811	3.30
2SD823	1.98
2SD837	1.56
2SD841	2.60
2SD856	1.25
2SD857Q	1.84
2SD882	1.15
2SD894	1.75
2SD898	1.85
2SK105H	2.15
7805-T022	0.63
7808	0.85
7812-T022	0.35
7815	0.64
7905	0.80
AC133	0.12
AC127	0.27
AC128	0.34
AC138	0.24
AC141	0.29
AC142K	0.35
AC176	0.30
AC179	0.28
AC183	0.72
AC187	0.39
AC188	0.37
AC188K	0.43
AD140	1.06
AD143	1.93
AD145	1.60
AD161	0.30
AD162	0.30
AF114	2.47
AF115	0.79
AF118	1.20
AF127	0.79
AF139	0.40
AF178	1.45
AF179	0.55
AF180	0.56
AF181	0.53
AF186	0.53
AF239	0.43
AF279	0.88
AN115	3.98
AN155	1.89
AN206	2.58
AN208	3.55
AN210	2.28
AN211	3.25
AN214Q	2.40
AN234	5.92
AN236	3.78
AN240P	1.25
AN241	1.71
AN245	4.50
AN253	1.80
AN260	3.85
AN272	8.25
AN295	5.52
AN301	2.00
AN302	1.93
AN305	3.20
AN315	1.29
AN316	3.50
AN318	4.41
AN320	5.47
AN321	2.25
AN322	5.85
AN337	5.37
AN340P	1.17
AN355	5.98
AN362	1.32
AN370	3.95
AN5111	3.43
AN5120N	4.50
AN5132	5.39
AN5250	4.40
AN5610	5.50
AN5612	2.30
AN5613	4.20
AN5630	3.95
AN5701N	1.66
AN6250	0.33
AN6300	4.40
AN6310	4.54
AN6340	10.14
AN6341	1.43
AN6363	16.00
AN6531	1.95
AN6551	1.35
AN6552	0.68
AN6610	2.40
AN7111	1.25
AN7115	3.38
AN7145	1.68
AN7146	2.05
AN7151	2.37
AN7156	2.85
AN7158	2.34
AN7218	1.64
AN7223	4.25
AU107	3.50
AU110	2.25
AU113	6.40
AY105K	2.08
AY106	1.09
BA524	8.21
BA310	0.14
BA1310	1.98
BA1320	1.38
BA1322	3.95
BA1330	2.75
BA145	0.19
BA148	0.25
BA154	0.40
BA155	0.12
BA156	0.05
BA159	0.08
BA182	0.24
BA222	1.66
BA302	1.24
BA311	1.32
BA312	1.45
BA313	0.76
BA317	0.08
BA318	0.02
BA328	1.65
BA333	1.37
BA335	6.27
BA5102A	2.86
BA511	1.95
BA514	2.20
BA521	2.52
BA524	8.94
BA526	7.98
BA527	2.98
BA532	1.50
BA536	2.05
BA6209	4.55
BA656	1.00
BA7100	11.35
BA841A	28.98
BA843	3.96
BA854	5.76
BAV18	0.21
BAV19	0.11
BAV20	0.35
BAV21	0.12
BAW62	0.11
BAX12	0.48
BAX13	0.11
BAX16	0.11
BC107B	0.18
BC108B	0.15
BC109B	0.15
BC113	0.14
BC119	0.36
BC126	0.23
BC132	0.14
BC135	0.14
BC137	0.18
BC138	0.34
BC139	0.28
BC140	0.45
BC141	0.34
BC142	0.23
BC143	0.19
BC147	0.13
BC148B	0.13
BC148C	0.11
BC149B	0.13
BC153	0.14
BC154	0.14
BC159	0.36
BC160	0.40
BC161	0.28
BC168	0.36
BC169C	0.16
BC170	0.16
BC171	0.11
BC172B	0.27
BC173	0.17
BC174B	0.27
BC177	0.35
BC178	0.26
BC179	0.26
BC182	0.05
BC182LB	0.07
BC183LB	0.26
BC184	0.13
BC184LB	0.26
BC186	0.25
BC187	0.28
BC204	0.16
BC207	0.14
BC212B	0.26
BC213L	0.10
BC214	0.10
BC225	0.40
BC237	0.10
BC238	0.10
BC238B	0.08
BC239B	0.25
BC251A	0.31
BC294	0.50
BC300	0.35
BC301	0.45
BC302	0.53
BC303	1.04
BC307A	0.08
BC308A	0.11
BC309	0.17
BC317A	0.13
BC327	0.15
BC328	0.10
BC337	0.09
BC338	0.10
BC368	0.24
BC440	0.69
BC441	0.44
BC454	0.36
BC460	0.42
BC461	0.35
BC462	1.15
BC463	0.64
BC478	0.22
BC479	0.41
BC532	0.28
BC546	0.08
BC547	0.10
BC548	0.12
BC549	0.10
BC550	0.10
BC556	0.10
BC557	0.10
BC558	0.10
BC559	0.10
BC560C	0.14
BC635	0.36
BC636	0.28
BC637	0.24
BC639	0.20
BC640	0.24
BCX34	0.18
BD115	0.34
BD116	0.70
BD124	1.31
BD131	0.57
BD132	0.20
BD133	0.53
BD135	0.36
BD136	0.26
BD137	0.26
BD138	0.33
BD139	0.28
BD140	0.29
BD144	1.70
BD150	1.25
BD157	0.67
BD160	1.60
BD163	0.71
BD166	0.42
BD175	0.20
BD179	0.45
BD181	0.99
BD182	0.99
BD183	0.99
BD184	1.21
BD187	0.53
BD189	0.69
BD190	0.72
BD201	0.65
BD202	0.60
BD203	0.50
BD204	0.41
BD207	1.79
BD208	0.34
BD222	0.50
BD225	0.49
BD228	0.63
BD229	1.05
BD232	0.50
BD234	0.42
BD237	0.47
BD238	0.39
BD239	0.45
BD240	0.57
BD241	0.39
BD242	0.39
BD243A	0.35
BD243C	0.29
BD244	0.45
BD244C	0.79
BD245C	0.99
BD246C	0.77
BD253	1.05
BD278A	0.60
BD317	2.60
BD318	2.00
BD375	0.42
BD380	0.76
BD410	0.52
BD433	0.47
BD434	0.56
BD435	0.49
BD436	0.60
BD437	0.49
BD438	0.40
BD441	1.42
BD442	1.41
BD509	1.65
BD510	0.62
BD519	0.98
BD529	0.80
BD530	1.18
BD533	0.67
BD534	0.52
BD535	0.45
BD536	0.61
BD537	0.80
BD538	0.80
BD544B	0.83
BD677	0.69
BD679	0.57
BD680	0.76
BD681	1.48
BD696	2.47
BD699	3.49
BD700	3.70
BD707	0.98
BD709	1.05
BD710	0.80
BD809	0.80
BD810	0.69
BD879	0.74
BD895	2.31
BD901	0.99
BD902	0.84
BDW83C	1.45
BDW84C	1.56
BDX32	1.75
BDX53A	1.25
BDX53B	1.85
BDX54B	2.16
BDX62A	2.15
BDX63A	1.96
BDY20	1.21
BDY81	1.05
BF115	0.40
BF117	0.66
BF118	0.67
BF121	0.25
BF123	0.21
BF127	0.13
BF137	0.29
BF153	0.58
BF154	0.26
BF157	0.33
BF158	0.18
BF159	0.18
BF160	0.31
BF167	0.38
BF173	0.34
BF177	0.35
BF178	0.40
BF179	0.36
BF180	0.36
BF181	0.32
BF182	0.34
BF183	0.39
BF184	0.43
BF185	0.39
BF194	0.14
BF195	0.14
BF196	0.17
BF197	0.18
BF198	0.17
BF199	0.17
BF200	0.37
BF218	0.36
BF224	0.17
BF237	0.65
BF240	0.17
BF241	0.15
BF245	0.50
BF245B	0.49
BF246A	2.52
BF255	0.20
BF256	0.38
BF257	0.34
BF258	0.36
BF259	0.34
BF262	0.28
BF263	0.57
BF271	0.34
BF273	0.20
BF274	0.20
BF324	0.35
BF336	0.33
BF337	0.45
BF338	0.33
BF355	0.49
BF362	0.62
BF363	0.50
BF371	0.50
BF391	0.25
BF417	0.84
BF418	1.87
BF422	0.30
BF423	0.52
BF450	0.35
BF451	0.29
BF457	0.41
BF458	0.33
BF459	0.52
BF460	1.45
BF469	0.22
BF470	0.55
BF471	0.33
BF472	0.33
BF479	0.35
BF480	1.38
BF491	2.20
BF506	0.43
BF532	0.45
BF596	0.18
BF597	0.27
BF694	0.22
BF757	0.59
BF759	0.47
BF761	1.05
BF762	0.50
BF869	0.47
BF870	0.30
BF959	0.42
BF960	0.49
BF970	0.50
BFR39	0.44
BFR61	0.92
BFR62	0.50
BFR79	0.29
BFR81	1.65
BFR86	1.08
BFR89	1.63
BFR90A	0.90
BFX29	0.34
BFX84	0.37
BFX85	0.41
BFX86	0.36
BFX87	0.55
BFX88	0.34
BFX89	0.44
BFY50	0.30
BFY51	0.25
BFY52	0.27
BFY79	0.49
BFY90	0.61
BLY49	2.20
BR100	0.29
BR101	0.65
BR103	0.55
BR303	1.15
BRC84	2.08
BRX44	0.60
BRX49	0.67
BRY39	0.69
BSS38	0.87
BSTBO140G	5.25
BSTC0246	6.99
BSTC0233	7.25
BSTCC0143	3.07
BSTD1043	2.85
BSV57B	3.49
BSW68	0.60
BSX19	1.29
BSX20	0.30
BSY52	0.50
BSY79	0.51
BT108	1.45
BT119	1.76
BT120	2.17
BT121	2.48
BT123	1.98
BT151-800R	0.89
BTT6018	2.42
BU106	2.48
BU108	1.50
BU109	2.65
BU110	5.68
BU125	2.48
BU126	1.45
BU137	6.53
BU205	1.15
BU206	1.27
BU207	1.65
BU208	1.20
BU208/02	1.97
BU208A	1.12
BU208D	1.95
BU209	1.50
BU226	2.45
BU326	2.00
BU326A	2.20
BU406	1.49
BU406D	1.79
BU407	0.82
BU412	5.29
BU426A	1.13
BU500	1.45
BU508A	1.25
BU536	1.65
BU608	1.80
BU705	2.95
BU806	1.79
BU807	0.80
BU826A	1.95
BUW84	1.39
BUX84	1.00
BUX85	1.10
BY126	0.13
BY127	0.08
BY133	0.12
BY164	0.44
BY176	0.52
BY179	1.08
BY182	0.95
BY187	0.77
BY189	1.79
BY198	1.62
BY207	0.22
BY208	0.46
BY210-400	0.19
BY210-600	0.27
BY210-800	0.30
BY218	1.64
BY223	1.23
BY224-600	1.88
BY226	0.25
BY227	0.20
BY228	0.60
BY229-1000	1.12
BY229-600	0.92
BY255	0.66
BY295-600	1.03
BY298	0.36
BY299	0.45
BY407	0.90
BY409	1.49
BY448	1.35
BY713	0.65
BYW56	0.14
BYX55-600	0.23
BYX71-600	0.85
BYX71-350	0.72
BYY56	1.20
BZY83C30	1.86
BZY88 RANGE	0.10
BZX61 RANGE	0.18
BZX79 RANGE	0.10
C106D	0.46
C106M	0.76
CA3046	1.55
CA3089	0.83
CA3090AQ	3.25
CA3094	2.20
CA3131EM	2.95
CD4001	0.34
CD4002	0.27
CD4008	1.35
CD4011	0.29
CD4012	0.24
CD4013	0.33
CD4016	0.46
CD4017	0.82
CD4020	1.23
CD4021	0.39
CD4023	0.28
CD4025	0.64
CD4028	0.84
CD4040B	0.85
CD4047	1.06
CD4049	0.24
CD4052	0.75
CD4066	0.20
CD4069	0.29
CD4070	0.66
CD4081	0.35
CD4093	0.72
CD4511	1.10
CD4528	2.04
CD4556	1.47
CR02AM-8	1.70
CV12E	4.09
CX095D	3.14
CX104	9.64
CX108	12.48
CX109	7.86
CX130	8.76
CX134	12.32
CX136	11.49
CX139	11.83
CX157	5.52
CX158	5.50
CX177	6.46
CX187	6.84
CX755	12.95
CX885A	6.85
E1222	0.40
E5024	0.28
E5386	0.25
GD243	4.34
GF758	0.84
HA11215	1.75
HA11211	2.53
HA11225	1.12
HA11229	1.96
HA11235	1.47
HA11124	5.25
HA1125	1.17
HA1137W	1.26
HA1138	5.03
HA11414	5.65
HA1156	0.80
HA1160	4.78
HA1166X	6.43
HA1167	6.45
HA11706	3.61
HA11705	5.00
HA11703	3.84
HA11701	2.98
HA11710	3.13
HA11713	9.75
HA11711	7.50
HA11715	3.25
HA11714	9.75
HA11716	13.10
HA11725	18.26
HA11725MP	16.00
HA117555P	6.23
HA11781	19.90
HA1180	5.15
HA1196	7.43
HA13001	1.73
HA1306	2.26
HA13402	7.87
HA13342	2.65
HA13365	4.02
HA1366WR	1.51
HA1367	2.75
HA1368R	2.45
HA1368	1.76
HA1370	3.30
HA1374	4.80
AA117	9
HA1377	1.75
HA1389R	2.05
HA1389	2.39
HA1392	2.17
HA1394	1.95
HA1397	2.17
HA1398	2.29
HA1406	1.30
HA1452	0.85
HD14538	2.07
HD38702-A2	7.95
HD38750A53	10.44
HD38750A-7	7.25
HD38800A50	14.09
HD44801A05	19.98
HISH1010	8.59
HISH1004	6.00
HISH1002	9.50
HM6231	9.81
HM6232	5.25
HM6251	5.25
HM7103	4.85
HM9032	9.98
HM9012	3.22
HM9015	3.24
HT4207	17.16
HT4208	20.65
KA2101	2.92
KC581C	7.60
KC582C	3.97
L200CV	1.69
LA1201	0.75
LA1210	1.33
LA1230	1.05
LA1320	2.87
LA1357N	11.07
LA1363	1.05
LA1364	3.02
LA1365J	2.08
LA1385	1.53
LA1387	5.95
LA3350	1.00
LA3361	0.91
LA3390	5.52
LA4032P	1.40
LA4100	0.87
LA4101	0.94
LA4102	0.75
LA4112	0.56
LA4125	1.88
LA4138	4.55
LA4140	0.70
LA4192	1.55
LA4220	1.04
LA4420	1.35
LA4422	1.72
LA4430	1.29
LA4440	1.81
LA4445	3.95
LA4460	1.47
LA4461	2.95
LA5112N	1.16
LA7020	13.86
LA7025	11.97
LA7027	10.92
LA7040	9.20
LA7042	3.90
LA7800	1.00
LA7801	1.30
LB1274	3.61
LC7800	9.20
LD3120	1.13
LD3150	2.75
LM1017N	1.75
LM1877	13.43
LM2808	6.25
LM2877	7.45
LM317CKC	1.08
LM324N	0.98
LM339N	0.35
LM340K	11.85
LM348N	2.15
LM380N	2.80
LM384N01	3.25
LM567CN	1.71
LM6402/011	10.23
LM6402A093	10.15
LM748	0.69
LM8360	3.87
LM8361	3.57
LR3419	9.37
LR3471	9.37
LU1141	7.27
LU52012	5.95
LU52011	14.95
LU03112	12.37
M193	6.83
M21C	1.13
M23C	1.98
M293	6.95
M51102L	1.86
M5115P	5.24
M51203L	3.15
M51231P	0.95
M5134-9341	4.13
M51353P	5.25
M51381P	5.45
M51393AP	9.35
M51394P	14.05
M5142P	6.85
M5144P	2.97
M51513L	1.56
M51515BL	2.15
M51517L	1.61
M5192	2.20
M5194AP	5.74
M5231L	1.95
M53274P	1.33
M54532P	1.88
M54544L	3.45
M58478P	8.77
M58485P	14.25
MA06	1.07
MA8001	0.82
MA8003	1.16
MB3705	1.44
MB3712	1.00
MB3713	1.69
MB3730	2.09
MC13002	3.60
MC1310P	0.58
MC1327P	0.40
MC1330P	1.91
MC1350P	1.66
MC1351P	2.96
MC1352P	2.50
MC1357P	2.15
MC1358P	1.35
MC14001	2.40
MC14013	0.41
MC14493P	7.65
MC14494P	2.15
MC14497	3.46
MC14510BAL	3.75
MC14511BCP	1.10
MC14528BCP	2.15
MC1712	3.88
MC5192	19.50
MC7724CP	3.49
MC7818C	2.18
MCR106-5/6	0.95
MCR220/7	2.28
ME0411	0.28
ME6002	0.26
ME6102	0.28
ME8001	0.34
ME0411	0.75
MJ2501	3.30
MJ3001	1.76
MJ481	1.53
MJ802	4.90
MJE2955	1.89
MJE3055	1.25
MJE340	0.49
MJE520	0.49
ML231	3.33
ML232B	3.01
ML237B	2.51
ML238	5.77
ML923	3.00
ML926	3.98
MM5314N	8.99
MM5316N	9.16
MM5318N	3.11
MM5369N	2.01
MM5387AA/N	6.20
MM5841N	6.64
MN1400VL	13.65
MN1405	12.50
MN1435VX	12.40
MP1192	5.07
MP2794	4.00
MP2812	5.07
MP8512	1.57
MPC596	2.13
MPF256C	0.60
MPS6570	0.48
MPSA42	0.65
MPSA56	0.27
MPSA92	0.72
MPSU05	0.86
MPSU10	1.45
MPSU56	0.78
MPSU60	1.98
MR818	0.33
MR854	0.85
MR914	1.20
MSM5816RS	17.35
MSM5840H	15.15
MVS460-02	0.61
NE542	2.65
NE555	0.16
NE556	0.65
NP1106	7.25
OA202	0.11
OA47	0.16
OA91	0.14
OA95	0.13
OC28	2.95
OC29	2.15
OC36	1.28
OC44	0.35
OC45	0.18
OC72	0.44
OC75	0.44
ON236	1.06
ON782	1.98
OT121	1.45
PT6042	2.45
PT8504	4.98
R1038	2.19
R1039	2.19
R2008B	1.33
R2009	1.98
R2010B	1.33
R2029	1.33
R2030	1.33
R2257	3.71
R2265	1.49
R2305	1.18
R2322	0.59
R2323	0.76
R2354A	2.01
R2354B	2.01
R2443	0.88
R2461	1.50
R2540	1.91
R2540X	3.30
R2615	0.67
RCA2060	2.00
RGP01-15	1.65
RGP10	0.30
RGP30M	0.28
RT402	1.58
RT905A	2.38
S1299	5.34
S2800D	5.54
S2802	3.47
S2818	0.85
S3702S	6.15
S40W	18.64
S6080B	8.80
SA8063	5.17
SAA1006	1.85
SAA1020	4.76
SAA1025	4.40
SAA1024	2.81
SAA1075	4.25
SAA1121	7.44
SAA1124	3.30
SAA1130	4.99
SAA1174	7.77
SAA1250	4.15
SAA1251	3.20
SAA1351	8.11
SAA3027P	2.55
SAA5000	2.50
SAA5010	4.40
SAA5012	5.50
SAA5020	5.78
SAA5030	8.25
SAA5050	7.74
SAB1009B	5.98
SAB3011	7.34
SAB3013	3.76
SAB3021	7.90
SAB3024	6.36
SAB3209	5.82
SAB3210	3.10
SAF1032P	3.58
SAF1039	2.95
SAS5010	8.39
SAS560S	1.86
SAS560T	5.42
SAS570T	5.42
SAS570S	2.61
SAS580	2.25
SAS6600	1.33
SAS660	2.97
SAS6700	1.33
SAS670	3.96
SAS6710	2.21
SBA750	1.61
SC84203	19.35
SC9504P	1.46
SDA2006	17.95
SDA2112/2	12.85
SG264A	6.45
SG613	10.75
SG629	8.27
SG6533	11.96
SI1125H	7.50
SI1225HD	18.35
SI1630HD	20.50
SKE2F1/04	1.39
SKE2G3/04	0.85
SKE4F1/06	0.35
SKE4F2/08	1.07
SKE4F2/06	0.44
SKE4F2/10	1.24
SKE4G2/02	0.96
SKE5F3/10	1.60
SKS1/10	2.15
SL1310	3.14
SL1430T	0.89
SL414	3.69
SL432A	3.44
SL439	2.48
SL471	2.50
SL480	3.98
SL490	1.25
SL901B	6.95
SL918A	9.07
SN16861AN0	1.95
SN16862AN	2.98
SN16966N	10.25
SN29717N	7.19
SN29716N	3.66
SN29715N	6.04
SN29722	11.95
SN29723AN	8.77
SN29764AN	1.65
SN29767	4.90
SN29770BN	1.95
SN29772BN	4.91
SN29771BN	1.65
SN29791	2.98
SN29798N	5.56
SN2709	0.44
SN7400N	0.34
SN7401N	0.36
SN7402N	0.65
SN7404N	0.52
SN7408N	0.27
SN7410N	0.27
SN74121	1.60
SN7413N	0.74
SN74141N	2.65
SN74151AN	1.51
SN74154N	1.27
SN74190	1.35
SN7420N	0.55
SN7430	0.49
SN7440N	0.27
SN7472	1.54
SN7474N	0.44
SN7490AN	0.93
SN74LS26N	1.45
SN76001N	1.65
SN76013ND	3.50
SN76023N	2.75
SN76023ND	3.96
SN76033N	3.65
SN76110N	1.13
SN76115AN	1.61
SN76131	1.92
SN76227N	0.85
SN76226DN	2.00
SN76228N	3.27
SN76242	8.96
SN76243	8.50
SN76396	2.90
SN76533N	2.47
SN76532N	0.95
SN76545	1.95
SN76546N	3.30
SN76549	2.59
SN76570	3.08
SN76611	2.59
SN76620	2.59
SN76660N	2.48
SN76666N	1.20
SN76708	4.86
SN76709N	3.30
SN76707N	5.11
SN76705N	6.60
SN76730	6.00
SN76810N	0.60
SN76832N	1.35
SN94041	5.54
SN94042	5.54
SP8385	0.55
SPS5384	1.98
ST1702L	0.99
STA401	6.76
STA441C	3.00
STA471C	7.95
STK0029	3.33
STK0050	5.63
STK016	8.45
STK022	5.25
STK031	12.95
STK040	13.34
STK054	7.13
STK058	27.50
STK077	5.96
STK1039	5.10
STK2110	7.33
STK2145	16.95
STK2240	16.65
STK2250	18.95
STK3042	4.95
STK3044	5.75
STK4019	4.50
STK433	6.25
STK4332	4.30
STK435	4.93
STK4352	1.95
STK436	3.95
STK437	5.62
STK4372	11.15
STK460	7.02
STK466	11.77
STK4833	10.95
STK501	5.28
STK502	7.25
STK5314	12.40
STK5730	2.99
STK7216	14.50
STK772	6.95
STR1096	4.98
STR4090	10.55
STR440	4.78
STR451	5.36
STR453	8.16
STR454	4.95
STR6020	5.25
T6029V	5.75
T6035V	0.73
T6036	0.67
T6037	2.11
T6044V	0.97
T6045	1.20
T6049	1.45
T6052V	0.87
T6058	3.08
T6059	2.77
T9003V	1.25
T9005V	2.38
T9011V	1.40
T9013V	4.95
T9014V	2.42
T9016	1.02
T9019W	1.98
T9034V	1.45
T9035V	1.95
T9051	6.95
T9054V	5.34
T9057V	0.70
T9062V	0.49
T9064	1.25
TA7027	4.80
TA7050	1.74
TA7051	1.74
TA7054	0.80
TA7060AP	0.71
TA7061AP	1.27
TA7069	3.13
TA7070P	1.83
TA7072P	2.57
TA7074P	1.98
TA7076P	7.80
TA7089P	2.82
TA7092P	8.65
TA7093P	3.99
TA7102P	5.88
TA7108P	1.61
TA7109	3.71
TA7122B/P	0.92
TA7124P	2.34
TA7129P	1.50
TA7130P	0.63
TA7136AP	1.89
TA7137P	0.73
TA7141AP	3.87
TA7146	2.50
TA7146P	4.23
TA7148P	1.67
TA7149P	3.26
TA7152P	2.72
TA7161P	4.50
TA7162P	3.61
TA7172P	1.41
TA7176P	1.54
TA7193P	3.84
TA7204P	2.16
TA7206P	12.49
TA7207P	2.34
TA7208P	1.12
TA7210P	1.45
TA7214P	3.63
TA7215P	2.07
TA7217AP	1.45
TA7222	1.12
TA7226	3.57
TA7229P	2.13
TA7230P	1.30
TA7233P	1.67
TA7240AP	3.55
TA7245P	3.55
TA7310P	0.94
TA7313AP	1.36
TA7314	1.90
TA7323P	3.15
TA7325P	0.61
TA7339P	1.85
TA7340P	5.95
TA7607AP	2.10
TA7609	2.65
TA7611AP	2.32
TA7616P	5.25
TA7622AP	8.94
TA7628P	2.50
TA7629P	7.50
TA7630P	0.95
TA7640AP	1.08
TA7672P	2.55
TA7676P	2.81
TA7726P	12.50
TAA320A	1.27
TAA350A	6.45
TAA570	1.85
TAA621AX1	4.85
TAA621A12	2.14
TAA661B	2.62
TAA691	8.58
TAA700	2.37
TAA930	4.87
TAA970	2.83
TAG626-600	1.20
TBA120AS	0.68
TBA120SB	1.05
TBA120T	0.97
TBA120U	0.62
TBA120A	1.05
TBA1440	1.78
TBA1441	1.62
TBA240A	2.65
TBA395	1.10
TBA395Q	1.10
TBA396	1.20
TBA400	2.39
TBA440C	2.34
TBA480Q	1.30
TBA510	2.11
TBA520	1.15
TBA520Q	1.68
TBA530	1.30
TBA530	1.30
TBA540	1.15
TBA540Q	1.15
TBA560C	1.40
TBA560CQ	1.60
TBA570Q	1.35
TBA570A	1.71
TBA651	0.87
TBA673	2.60
TBA700	1.85
TBA720	3.50
TBA730	3.55
TBA750Q	2.90
TBA760	1.71
TBA800	0.92
TBA810S	1.61
TBA810T	1.50
TBA810AS	1.00
TBA820	1.52
TBA820M	0.82
TBA890	2.50
TBA920	1.53
TBA920Q	2.31
TBA940	1.87
TBA950	1.84
TBA970	3.56
TBA990	1.98
TBA990Q	1.68
TCA270Q	1.86
TCA270S	0.95
TCA270SQ	1.05
TCA290A	2.39
TCA420A	2.16
TCA440	2.25
TCA530	2.24
TCA640	2.25
TCA650	3.05
TCA660B	2.60
TCA730	3.81
TCA750	2.25
TCA800Q	6.95
TCA830S	2.38
TCA890	5.44
TCA900	2.04
TCA910	2.04
TCA940	2.47
TCA940E	2.93
TD3F800R	3.66
TD3F900H	4.16
TD62706P	4.50
TDA1001B	2.31
TDA1003A	2.25
TDA1005A	2.38
TDA1006A	2.11
TDA1010AF	4.25
TDA1011	0.95
TDA1010	1.28
TDA1011A	1.03
TDA1028	2.45
TDA1034B	2.42
TDA1035S	2.95
TDA1035T	1.85
TDA1037	1.95
TDA1037D	2.05
TDA1044	1.95
TDA1047	3.25
TDA1059B	0.98
TDA1054M	1.35
TDA1060	2.60
TDA1082	3.25
TDA1151	1.22
TDA1190	2.11
TDA1190Z	3.96
TDA1200	1.51
TDA1235	3.88
TDA1236	4.30
TDA1270	3.55
TDA1327A	1.33
TDA1412	0.92
TDA1420	2.55
TDA1440	3.45
TDA1470	2.90
TDA1470P	4.25
TDA1506	7.85
TDA1510	4.60
TDA1512	3.88
TDA1515	2.60
TDA1559	3.15
TDA1670	4.48
TDA1770	6.85
TDA1905	1.27
TDA1908	2.98
TDA1940	1.95
TDA1950	2.95
TDA2005	1.45
TDA2006	1.32
TDA2004	1.48
TDA2002	0.69
TDA2003	1.00
TDA2030	1.45
TDA2140	1.68
TDA2150	6.20
TDA2151	2.07
TDA2160	4.01
TDA2161	1.85
TDA2170	2.88
TDA2270	2.25
TDA2520	2.37
TDA2522	3.46
TDA2524	4.50
TDA2521	3.71
TDA2525	3.80
TDA2532	0.82
TDA2530	2.55
TDA2541	1.88
TDA2540	0.66
TDA2545Q	5.94
TDA2560	0.76
TDA2575A	0.50
TDA2578A	2.57
TDA2576A+Kit	12.35
TDA2581	1.60
TDA2582	1.80
TDA2591	2.50
TDA2594	3.40
TDA2593	2.47
TDA2595	1.69
TDA2600	5.60
TDA2611AQ	2.98
TDA2612Q	4.68
TDA2611A	1.05
TDA2610	3.08
TDA2620	2.15
TDA2630	1.96
TDA2631	2.73
TDA2640	2.95
TDA2652	13.45
TDA2653	2.95
TDA2654	6.18
TDA2670	2.54
TDA2680	3.20
TDA2740	6.00
TDA2780AQ	5.14
TDA2795	2.78
TDA2791	25
TDA2910	13.25
TDA3300B	6.98
TDA3330	2.95
TDA3506	4.40
TDA3501	7.25
TDA3500	4.25
TDA3510	5.95
TDA3520	9.71
TDA3540	6.99
TDA3541	2.22
TDA3560	4.25
TDA3571Q	2.83
TDA3576	7.48
TDA3590	5.79
TDA3591	6.45
TDA3650	5.90
TDA3652	2.60
TDA3651AQ	3.96
TDA3651	2.95
TDA3651A	2.96
TDA3950	4.50
TDA4050B	3.95
TDA4280	5.95
TDA4290	4.47
TDA4400	2.27
TDA4420	2.55
TDA4422	3.65
TDA4427S	9.00
TDA4431	2.27
TDA4440	3.26
TDA4442	4.15
TDA4500	4.75
TDA4600-2	2.10
TDA4610	6.88
TDA4620	4.78
TDA5500	6.20
TDA5700	2.75
TDA7270S	2.25
TDA8190	2.75
TDA9403	3.15
TDA9503	1.95
TDA9513	3.15
TDB1033	2.68
TDE1081	7.05
TEA1002	2.30
TEA1009	1.50
TEA1014	2.50
TEA1020SP	8.21
TIC106C	0.61
TIC106M	0.77
TIC44	0.72
TIC45	0.50
TIC47	0.35
TIP120	1.06
TIP110	0.45
TIP112	0.54
TIP117	0.50
TIP121	0.50
TIP126	0.73
TIP132	0.99
TIP137	1.50
TIP29	0.84
TIP2955	0.95
TIP29A	0.46
TIP29B	0.63
TIP29C	0.40
TIP29D	0.75
TIP3055	0.75
TIP30A	0.41
TIP30C	0.16
TIP31A	0.34
TIP31B	0.38
TIP31C	0.50
TIP32A	0.35
TIP32B	0.69
TIP32C	0.40
TIP33	0.85
TIP33A	1.05
TIP33C	0.80
TIP34	0.50
TIP41A	0.49
TIP41B	0.65
TIP41C	0.25
TIP42A	0.49
TIP42B	0.53
TIP42C	0.25
TIP47	0.37
TIS43	1.43
TIS90	0.28
TL011CP	0.95
TL494CN	8.95
TL072CP	2.56
TMP4320	15.00
TMS1024NLL	13.75
TMS1025N	16.95
TMS3720ANS	5.25
TMS3748NS	14.95
TMS3755	13.65
TMS3894NL	19.25
TMS5102NLL	6.25
TUA2000	8.98
TY6010B	2.97
ULN2204	8.50
UPA53C	4.94
UPC1003	5.95
UPC1009C	8.95
UPC1025H	2.20
UPC1028H	0.86
UPC1032H	0.62
UPC1042C	8.95
UPC1156H	1.45
UPC1161C	4.98
UPC1182H	1.50
UPC1186H	0.79
UPC1181H	1.03
UPC1185H	2.10
UPC1188	7.40
UPC1212C	1.72
UPC1225H	3.25
UPC1230	1.78
UPC1238	1.15
UPC1278H	2.15
UPC1351C	1.81
UPC1350C	1.00
UPC1353	1.40
UPC1355C	2.13
UPC1363	1.00
UPC1362	2.64
UPC1365C	1.65
UPC1366	2.25
UPC1360C	4.51
UPC1378H	1.25
UPC141C	4.95
UPC1458	3.34
UPC151C	2.95
UPC2002	1.48
UPC30C	2.51
UPC324C	4.17
UPC32C	5.25
UPC339C	4.35
UPC41C	4.10
UPC4558C	2.15
UPC474	5.11
UPC554C	1.21
UPC575C2	0.77
UPC580C	2.85
UPC587C2	1.34
UPC592H	2.15
UPC595	1.15
UPC596	1.80
UPD1514C	4.76
UPD2819C	4.98
UPD4013B	4.00
UPD4066B	4.95
UPD553-164	19.52
UPD8049C-1	11.50
X0022CE	5.75
X0029CE	7.09
X0031CE	4.95
X0035TA	5.98
X0040TA	4.50
X0042CE	4.35
X0043CE	2.75
X0056CE	6.25
X0057GE	6.00
X0062CE	8.35
X0065CE	4.60
X0074GE	10.80
X0077GE	15.96
X0079CE	4.95
X0092CE	4.95
X0096CE	5.95
X0109CE	11.25
X0113CE	2.07
X0195CE	7.50
X0204CE	8.74
X0261CE	8.75
ZPY120	3.25

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AMSTRAD
Machine Nos.: VCR4500 VCR5200 — VHS T
Machine Nos.: VCR7000 — VHS R
VCR4600 VCR9000 — VHS T

FERGUSON/JVC
Machine Nos.: 3292 8903 3V00 3V01 3V06 3V16 3V22 3V23 3V24 3V29 3V30 3V31 3V35 3V36 3V38 3V39 3V49 — VHS A

FISHER
Machine Nos.: FVH — D520 D530 D620 D720 P420 P510 P520 P530 P615 P620 P622 P710 P720 P721 P722 — VHS U

GEC
Head Part Nos.: 5458161 5458165
Machine Nos.: 4000H 4001H 4002H — VHS I
Head Part Nos.: 5458282 5458413 5458415 5458992
Machine Nos.: 4001H 4004H — VHS K

HITACHI
Machine Nos.: VT3000 — VHS A
Head Part Nos.: 5458104
Machine Nos.: VT4000 VT4200 VT5000 VT5500 — VHS H
Head Part Nos.: 5458161 5458165
Machine Nos.: VT6500 VT7000 VT8000 VT8040 VT8100 VT8500 VT8700 VT9000 VT9300 VT9500 VT9700 VT9900 — VHS I

Head Part Nos.: 5458282 5458413 5458415 5458992
Machine Nos.: VT11 V14 VT33 VT34 VT330 VT340 VT5030 VTP10 VTP30 — VHS K

ITT
Machine Nos.: VR3605 VR3033 VR3905 VR3913 VR3914 VR3935 VR3943 VR3963 VR3993 VR3975 VR3985 VR3986 VR3833 — VHS A

JVC (see also Ferguson)
Machine Nos.: HP4000 HR2200 HR3300 HR3320 HR3330 HR3350 HR3360 HR3660 HR3750 HR3860 HR4100 HR7200 HR7600 HR7610 HRD110 HRD111 HRD120 HRD121 HRD140 HRD150 HRD220 HRD225 — VHS A

MITSUBISHI
Machine No.: HS200 — VHS A
HS7008 — VH700

NATIONAL PANASONIC
Head Part Nos.: VEH0099 0103 0115 0121 0131
Machine Nos.: NV300 NV322 NV332 NV333 NV340 NV390 NV2000 NV3000 NV7000 NV7200 NV7500 NV7800 NV7850 NV8170 NV8200 NV8400 NV8600 NV8610 NV8620 — VHS B
Head Part Nos.: VEH0171 VEH0218
Machine No.: NV370 NV3708 — VHS M
Head Part Nos.: VEH0171
Machine No.: NV330 NV777 — VHS N
Head Part Nos.: VEH0286
Machine No.: NV430 — VHS W
Head Part Nos.: VEH0174
Machine No.: NV366 — VHS X

SHARP
Head Part Nos.: DDRMU 0002 HE17/21/27
Machine No.: VC581/2/3 651 681/2/3/5 659 699 — VHS S
Head Part Nos.: DDRMU 0001 HE00 0002 HE02 04 05 06
Machine No.: 2C9 VC110 VC200 VC220 VC300 VC381 VC384 VC386 VC387 VC388 VC477 VC481 VC482 VC930 VC970 VC3300 VC9100 VC9300 VC9400 VC9500 VC9600 VC9700 — VHS C
Head Part Nos.: DDRMU 0001 HE09
Machine No.: VC7300 VC7700 VC7750 — VHS D
Head Part Nos.: DDRMU 0001 HE10
Machine No.: VC6300 — VHS E
Head Part Nos.: DDRMU 0001 HE12
Machine No.: VC8300 — VHS L
Head Part Nos.: DDRMU 0001 HE14
Machine No.: VC2300 — VHS F

SANYO
Head Part Nos.: 1430242 T01700 1430242 T22300
Machine No.: VTC5000 VTC5150 VTC5300 VTC5400 — BETA D
Head Part Nos.: 1430242 T02200
Machine No.: VTC5350 VTC5500 — BETA D
Head Part Nos.: 1430762 T02000
Machine No.: VTC9300 VTC9455 VTC9500 — BETA X
Head Part Nos.: 143072 T02100
Machine No.: VTC9300PS VTC9350 — BETA X

SONY
Head Part Nos.: A6762 044A, 044B, 054A, 147A
Machine No.: SL3000, 8000, 8080, SLT 6Me, 7, 7E, 7ME — BETA A
Head Part Nos.: A6762 012A, 038A, 055A, 129A
Machine No.: SL5W, 5000 5100 SLC5, C6, C7 — BETA B
Head Part Nos.: A6762 072A, 122A, 136A, 139A, 213A
Machine No.: SLC20, C30, C33, C40, C44 SLF1, F30, HF72, HF100, T20, T30 — BETA W

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VHS N	£35.99
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VHS S	£26.95
VHS T	£25.99
VHS U	£26.95
VHS V	£35.99
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01X0 027 085	£46.02
01X0 033 825	£47.05
01X0 040 002	£48.32
01X0 056 013	£61.55
01X0 057 002	£31.36
01X0 082 001	£46.02
01X0 083 063	£66.03
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310 274 44	POA
691 200 54	£49.68
691 200 98	£62.02
691 201 12	£61.66
691 201 66	£61.93
691 201 78	£49.96
691 202 87	£55.37

FERGUSON/JVC

VID1	01X0-003-381	Tension band T3292/PU545904A	2.55
VID2	01X0-018-024	Take up idler T3292/PU47752	5.00
VID3	01X0-018-025	Rewind idler assembly T3V16/PU49282	6.20
VID4	01X0-018-729	Take up idler T3V00/PU49280	6.95
VID5	01X0-040-006	Loading belt T3V29/30/PU48941-2	0.50
VID6	01X0-033-454	Roller Assy. (cass. Housing) T3V23/PU49042	4.50
VID7	01X0-040-007	Take up idler 3V29/30/PU48967B	2.90
VID8	01X0-040-017	Reel motor assembly 3V29/30/PU51381V	27.95
VID9	01X0-065-009	Capston motor 3V35/36/38/39/PU55371V	27.00
VID10	01X0-065-016	Cass. housing Assy. 3V35/36/38/39/PU29825	27.00

GEC/HITACHI

VID11	V5577355	GEC 4100/Hitachi VT11E capston motor	21.90
VID12	V6413663	GEC 4000/Hitachi VT33 f/f rewind arm	2.10
VID13	V6861471	GEC 4001/2/Hitachi 93/9500 f/f rewind arm	1.70
VID14	V6861482	GEC 4001/2/Hitachi 93/9500 play Idler assy.	4.75
VID15	V6886971	GEC 4004/Hitachi VT33 f/f rewind arm	1.80
VID16	V2423461	ET541 Tuner Unit	21.90

NATIONAL PANASONIC

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VID18	VXP0344	Idler NV7000/7200	0.85
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VID20	VXP0521	Idler NV370	2.50
VID21	VXP0463	Reel Idler NV777	3.25
VID22	VXP0432	Pinch Roller NV333	8.50
VID23	VXP0401	Idler wheel NV333	0.90

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SANYO/FISHER

VID24	4529V10800	Reel motor VTC5000/5150	8.00
VID25	1430662T01201	Reel drive pulley	5.00
VID26	PR2758	Pinch roller VTC5000/5150	3.85
VID27	1430490400900	Gear idler Fisher FVH-P615	6.50
VID28	1430420400300	Heart idler Fisher FVH-P615	6.05

SHARP

VID29	RMOTP1029	Capston motor 73/9300	33.55
VID30	RMOTV1008	Reel motor VC9700	16.85
VID31	NIDL0006	Idler VC387H etc	1.95
VID32	NIDL0005	Reel idler VC9300 etc	1.85
VID33	NIDL0004	Idler wheel VC2300	1.60

VIDEO LAMPS/BULBS

VID34	LA9292	Universal lamp without socket 290mm	0.45
VID35	LA9210S	Universal lamp with socket 310mm	0.75
VID36	NAT/PAN.	P.C. MTG. leadless lamp	0.50
VID37	SHARP 9300	Etc. lamp plus plastic shroud	2.53

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VP 68	2	DBK135	£0.95
VP 7100	1	DBK103	£1.95
VS 1	2	DBK134	£1.20
VS 2 EG	5	DBK101	£1.95
VS 3	2	DBK134	£1.20
VS 5 EG	6	DBK101	£1.95
VS 10	2	DBK136	£0.75
VS 9300	7	DBK103	£1.95
VS 9500	7	DBK103	£1.95
VS 9700	6	DBK102	£2.20
VS 9600	7	DBK103	£1.95

FERGUSON

3292	7	DBK103	£1.95
3 V 00	7	DBK103	£1.95
3 V 01	7	DBK103	£1.95
3 V 16	7	DBK103	£1.95
3 V 22	7	DBK103	£1.95
3 V 23	3	DBK106	£1.95
3 V 24	2	DBK137	£0.75

FISHER

VBS 7000	4	DBK146	£2.95
VBS 7600	5	DBK105	£2.60
VBS 7000	6	DBK105	£2.60
VBS 9000	3	DBK108	£1.95

GEC

V 4000 H	3	DBK129	£0.75
V 4001 H	3	DBK129	£0.75
V 4002 H	3	DBK129	£0.75
V 4100 H	5	DBK125	£1.80

HITACHI

VT 11	5	DBK126	£1.50
VT 3000	7	DBK103	£1.95
VT 6000	7	DBK126	£2.60
VT 6500	4	DBK142	£0.75
VT 7000	3	DBK143	£0.75
VT 8000	3	DBK129	£0.75
VT 8500	3	DBK144	£0.75
VT 9300	3	DBK129	£0.75
VT 9500	3	DBK129	£0.75

SANYO

VTC 5300	5	DBK106	£2.60
VTC 5400	5	DBK106	£2.60
VTC 5500	3	DBK106	£1.95
VTC 9300	4	DBK104	£2.95
VTC 9350	4	DBK145	£2.95

JVC

HR 2200	2	DBK137	£0.75
HR 3300	9	DBK107	£2.95
HR 3330	7	DBK126	£2.50
HR 3360	7	DBK103	£1.95
HR 3600	7	DBK107	£2.95
HR 3660	7	DBK103	£1.95
HR 4100	7	DBK127	£2.50
HR 7200	3	DBK139	£0.95
HR 7600	3	DBK138	£0.95
HR 7650	3	DBK132	£0.95
HR 7700	3	DBK108	£1.95

NATIONAL PANASONIC

NV 300	5	DBK110	£1.95
NV 330	5	DBK110	£1.95
NV 777	4	DBK131	£1.20
NV 2000	5	DBK109	£1.95
NV 3000	6	DBK113	£1.95
NV 7000	5	DBK111	£1.95
NV 7200	5	DBK140	£1.50
NV 8600	7	DBK112	£1.95

SHARP

VC 381	4	DBK116	£2.95
VC 383	4	DBK116	£2.95
VC 385	4	DBK116	£2.95
VC 388	4	DBK116	£2.95
VC 6000	5	DBK117	£1.95
VC 6300	5	DBK117	£1.95
VC 6500	5	DBK117	£1.95
VC 7300	5	DBK117	£1.95
VC 7700	5	DBK118	£1.95
VC 7750	5	DBK118	£1.95
VC 8300	5	DBK119	£1.95
VC 9300	5	DBK120	£1.95
VC 9500	5	DBK120	£1.95
VC 9700	3	DBK121	£3.30

SONY

SL 8000	6	DBK115	£2.95
SL 8080	6	DBK115	£2.95
SL 8500	6	DBK115	£2.95
SL 8600	6	DBK115	£2.95
SLC 6	6	DBK100	£1.95
SLC 7	6	DBK100	£1.95
SLC 9	6	DBK130	£1.95
SLJ 7	6	DBK100	£1.95
SLT 7 ME	6	DBK100	£1.95
SLT 7 MER	6	DBK100	£1.95

TOSHIBA

V 7540	5	DBK123	£1.95
V 8600	6	DBK124	£1.95

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VCR Clinic

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

Philips VR2340

For intermittent noisy playback pictures – it looks just like the effect of dirty heads – clean the earth screw connection on head preamplifier module A420. **P.B.**

Philips VR6660

This machine was almost dead – the only sign of life was the head drum which was rotating much too fast. All the supply lines were present and disconnecting various plugs and sockets as instructed in the I2C bus fault-finding chart proved to be inconclusive. Whilst carrying out scope checks we discovered that the power-on reset signal was high all the time. Transistor 7151 was open-circuit. **P.B.**

Mitsubishi HS318

The fault here was a very intermittent one: the drum motor would stop at random intervals during play or record. The deck would then shut down to produce the stop mode. Monitoring the drum speed control voltage was inconclusive because as soon as a probe (or a finger!) was touched on the collector of Q4A1 (drum control line) the motor's operation would revert to normal. The trouble was being caused by the motor control chip. This is part of the quite inexpensive stator assembly whose part no., 409-B-051-03, is not given in the manual. Replacing it is a rather fiddly job however. **E.T.**

JVC HRD225/Ferguson 3V36

"Sound deteriorates when hot" was the complaint with this machine. We found that when the machine had been running for an hour or two the E-E sound became distorted and threatened to disappear altogether. The playback sound remained o.k.

A scope check showed that the audio signal coming from the receiver section was "strangled" at TP4 on the tuner/timer panel because the interstation mute circuit was coming into operation. This is based on the action of the 15·625kHz tuned circuit T5. Careful adjustment of T5 to peak up the line-rate waveform at the collector of Q11 overcame the problem. **E.T.**

Panasonic NV788

The fault with this machine was complete loss of both the playback and E-E sound. There was no switched, regulated 12V supply to the audio panel. Tracing it to source via the video panel finally brought us to the syscon board, where regulator transistor Q6062 had 12V at its base but nothing at its emitter — the base-emitter junction was open-circuit. We replaced this 2SC1847 transistor with a BD137. Restoration of power to the audio section also brought up the back-light in the LCD counter display. Had we known about this we'd maybe have found the culprit sooner. **E.T.**

Finlux 2030/Tatung VR8495/B & O VHS82 etc

The Philips deck used in these machines is also used in many others. We've had several cases of failure to enter the rewind search (review) mode. What happens is that when review is keyed the machine shuts down and often ejects the tape. The culprit is the reel drive clutch (called the coupler, part no. 4822 528 20428) which binds – in one direction only! – and effectively jams the mechanism.

Apparent failure to complete the loading with these machines, with the mode motor running against a slipping belt, can easily be mistaken for failure of the load-end switch. Replacement of the switch seldom cures the trouble however. Most often the cause of the problem is broken teeth on the rack slider – the original part number was 4822 403 20202 but this has been changed to 4822 403 53377. You can see the broken teeth, at just the right position of the loading process, by peering through a hole in the deck under-surface. Replacing this assembly is no joke, but gets easier with practice – and we're getting plenty of that! **E.T.**

JVC GRC7

A fairly common fault with this and similar camcorders is the cassette lid's securing screw working loose and falling into the mechanism. In most cases no harm is done and the machine works once the screw has been retrieved. Sometimes damage can occur however. In a recent case the screw jammed under the right-hand side (exit) guide and bent the spring, slide washer and slide plate that keep it on the curved and narrow. The sliding base of the guide then jammed at the entrance to its V notch, bringing up the emergency display of simultaneously flashing stop, play and fast forward indicator LEDs. These emergency mode indications are invaluable and are becoming more common, even on domestic machines. **E.T.**

Toshiba V83

We've recently had three of these machines that would intermittently shut down in the record or playback mode. Observation of the deck at the moment of failure showed that the take-up reel had stopped, allowing slack tape to spill on to the deck. The problem was in each case cured by replacing the reel motor, part no. 70326539. **E.T.**

Sony CCD-V200

The shop mentioned that the auto focus on this top of the range "professional" camcorder didn't seem to be too hot. When we checked with the Siemens star we found that the manual focus was sharp but the auto-focus system produced defocusing. The focus calibration was also off: when focused at 2 metres the reading on the focus ring was about 3 metres. The machine worked well when the plane back and auto focus had been adjusted. **N.B.**

Grundig VS200

This VCR wouldn't accept a cassette, though the customer's complaint was that it wouldn't record! In this machine there's a safety system in the syscon circuit to prevent activation of the mechanism if the brake release solenoid hasn't been energised. After removing a diode to override this safety arrangement a cassette could be inserted. Then, intermittently but gradually becoming permanent, the brakes wouldn't release, causing a terrible noise when the machine tried to lace, and stopping rewind and fast forward dead. The cause of the trouble was soon traced to the BC876 solenoid coil driver transistor, which is a Darlington type. **N.B.**

Panasonic NV-M5

This camcorder's auto-focus system didn't work. It was a fairly simple problem to deal with as we soon found that there was no oscillator signal across pins 53/4 of IC603, due to X601 being faulty. The part no. is VSX0196. **N.B.**

Sony SLF1

This one was brought in by a merchant seaman who used it on board ship. This explained the rusty aerial socket! The symptoms were as follows: the drum and take-up reel were spinning at high speed in the forward direction while the supply reel rotated in the reverse direction. The syscon in these machines is fairly complex, but when you get to know it and apply a logical fault-finding procedure you find that it rarely causes difficulty. Not long after delving into the syscon I found myself heading towards the reel servo where the switching transistor Q204 was short-circuit. **N.B.**

Salora SV9300/Mitsubishi HS330

In playback the tape laced up but the sound and vision wouldn't switch from the E-E mode. We soon found that the switched 9V line was missing as the 2·5A fuse F901 in the mains transformer's 14V a.c. winding had gone open-circuit. It had died rather than blown, and a replacement held. A long soak test produced no further problems. **N.B.**

Panasonic NV-MS1

The garbled message I received about this camcorder, which had been bought the day before, mentioned frame jitter in the electronic viewfinder and on the monitor. It transpired that the customer had been filming in the early morning when it was misty with hazy sunshine: on bright white scenes there was a barely perceptible 50Hz flicker. We convinced him that there was nothing to worry about and suggested the use of a filter. He then mentioned noise in fast forward and rewind. These machines — the latest S-VHS ones — are a bit noisy but this one was excessively so because of a scraping reel drive pulley. A replacement put that right. **N.B.**

Panasonic NV8610

The complaint with this old tank was of intermittent overloaded vision. It was o.k. on direct video, a clue that narrowed down the fault-finding process. We soon found that the track of the 10kΩ level preset VR2 in the r.f. modulator was noisy. **N.B.**

Mitsubishi HS349

On playback this VCR produced either a rolling picture or a picture with the top part blanked out. When the machine was dismantled the picture returned to normal. Tapping the servo board made the fault come and go and a check on the drum flip-flop waveform showed that when the fault was present it was not a true 1:1 squarewave. At this point the machine decided to work correctly and no amount of tapping and banging would provoke the fault. We inspected the servo board under a powerful magnifier but couldn't find any dry-joints. So to do the utmost to prevent a comeback we resoldered all the components and wire links connected with generation of the drum flip-flop signal, from the drum pick-up pulse on CA1 through Q4B0 and Q4B1 to pin 24 of I4A0 and then from pin 11 of I4A0 to plug CE. **A.D.**

Panasonic NV688

Sometimes this machine wouldn't switch from LP operation in the record mode, while in playback it would select LP by itself with an SP recording and what can only be described as LLP with an LP recording. After a lot of tapping, prodding and flexing of boards we found that the supply to the SL/LP discriminator IC2005 was varying and at times non-existent. There was a dry-joint on a wire jumper that's part of the supply. **A.D.**

Ferguson 3V54

The job card said intermittent play and record and chewing tapes. When the fault was seen tape movement ceased, the tape being left in the fully laced position. The capstan motor had stopped due to a dry-joint at the emitter of Q603. I've often resoldered the connections to this transistor and Q604 when servicing these machines as the joints have always looked suspect. **A.D.**

Telefunken VR2931

This VCR is similar to the Ferguson 3V65. The cause of a hum bar on the monitor screen was really quite obvious — C3 (2,200μF, 16V) in the supply to the 5V regulator was bulging and leaking electrolyte down the rectifier panel. **A.D.**

Some Quickies

Ferguson 3V29: We've had several cases of no clock display due to the i.c. being faulty.

Sharp VC651: This machine would run for hours, days or weeks before the fault showed — there were then very wild speed variations. My first thought was a duff capstan motor, which in the circuit diagram is shown as a black box. Ordering and fitting a complete unit seems to have proved successful, touch wood! **J.O.**

Panasonic NV-G25

We've recently had two of these machines with the same problems. Both were about a year old, the complaint being of a poor picture and intermittently low sound. When the video heads in these machines start to wear out you get a slight increase in overall picture noise and bands of noise in only the top third of the picture in the review mode, particularly near the beginning of a tape. The only cure as far as I know is to replace the heads. I did find that by adjusting the inlet guide by approximately a quarter of a turn the noise disappeared with a Panasonic tape, but the noise returned when a different type of tape was used. If more adjustment was tried the noise could still be cleared, but then the guide adjustment was wrong for normal playback. The low sound problem was due to audio head wear, so again replacement was necessary. The audio/control head assembly is now supplied as part no. VBR0125 instead of the original VBR0116 — perhaps the new type will last longer. **I.B.**

Long-distance Television

Roger Bunney

November was a relatively quiet month for DX-TV reception. There was some activity on several days and there were two periods of enhanced tropospheric conditions, on the 4th/5th and 14th. The 4th produced signals from Ireland, Luxembourg, France and the Benelux countries. There was an improvement on the 5th with numerous French signals, West German Band III/u.h.f. signals and Swiss ch. E12/u.h.f. reception. The 14th again produced reception from Ireland, West Germany, France and the Benelux countries in central/southern England.

F2 layer reception was noted on several days early in the month. The 6th produced two ch. E2 signals, one with the familiar EBU test pattern (thought to be from the Gulf area) and the other unidentified. There was further weak F2 reception on the 7th, again during the morning. Two further days with F2 reception during the morning occurred on the 12th/13th, when an EBU pattern and a blank raster were seen together on ch. E2.

Excellent signals were produced by the Leonids meteor shower during the 14th-19th, with a particularly active period during the morning of the 18th. There were no reports of Band III MS. Further MS activity occurred on the 30th.

There were only a few SpE signals of any consequence, as follows:

7/11/88	TVP (Poland) ch. R2.
11/11/88	TVE (Spain) E3.
12/11/88	TVE E2; ARD (W. Germany) E2.
14/11/88	TVE E2, 3.
17/11/88	Intense signals from TVE chs. E2, 3, 4 and RTP (Portugal) chs. E2, 3 were received mid-morning.
18/11/88	TVE E2, 3, 4.
19/11/88	DR (Denmark) E3.
23/11/88	TVE E3.
25/11/88	TVE E3.
28/11/88	TVE E3.
29/11/88	CST (Czechoslovakia) R1; TVE E2, 3.

My thanks to Cyril Willis (Kings Lynn), Iain Menzies (Aberdeen), David Oliver (Birmingham), Simon Hamer (Powys), Roger Fussell (Torpoint) and Tim Anderson (St. Leonards) for sending in reports.

Suitable Tuner for DX-TV

Bill Cotterill (Tipton) who builds a lot of equipment for DX-TV reception tells us that he is now using the recently released NSF 240-039-ET001 tuner. Its performance is similar to the classic ET021 in terms of gain, noise, overload capability and frequency coverage. Fig. 1 shows the pin connections.

SpE Research

A report from the RSGB on work being carried out at Southampton University suggests that the cause of SpE propagation is shear winds in the upper atmosphere. When two adjacent clouds with charged gas particles (ions) move in opposite directions there's a concentration of ions, giving rise to a thin but very dense reflecting layer.

DX Down Under

Meanwhile the SpE season is in full swing in Australia. Robert Copeman (Victoria) reports reception from several Australian states with the bonus of China Ch. C1 on the 16th and 27th, the 27th producing much stronger signals. Robert comments that the most likely ch. 0 F2 reception from Australia would be from DDQ Darling Downs (identification "Vision TV"), ABMN Wagga Wagga ("ABC-TV" or "000") or NEN Tamworth ("NEN9/ECN8" or "9 + 8").

Miscellaneous Points

A new 50MHz amateur beacon, G3BUX, has come into operation in Sheffield. Tim Anderson reports that a 10kW transmitter in West Kentucky is beaming digital information towards New York city – and hence us – on a 24-hour basis at 49·596MHz. This is a good pointer for transatlantic F2-DX. Incidentally in the November issue I mentioned an odd-looking FUBK test pattern in use by BRT, with a hole in the middle. This was not a fault condition as suggested but part of the design. Kevin Phillips (Bexhill) mentions that the Bush Model 2114T 14in. colour portable available from retail outlets, Argus etc. is a good-value DX-TV receiver at £190. It features remote control, teletext, a v.h.f./u.h:f. tuner with a 55 channel memory and is very sensitive.

News Items

France: The Canal Plus service is to be made available via W. German cable systems within the next year or two. A multi-mode decoder with PAL, SECAM and MAC-D2 capability is envisaged to give cross-frontier coverage. It's suggested that around half a million pirate decoders are in use in the Mulhouse region. To counter the problem Canal Plus is considering the use of a different scrambling address system, using a new keyboard and a new card reader. The timescale of such a change would be long however in view of the three million "official" decoders now in use. Health Television, a scrambled service for the medical profession, is now being carried by the FR3 network between 0700-0800. The appropriate 8-digit code

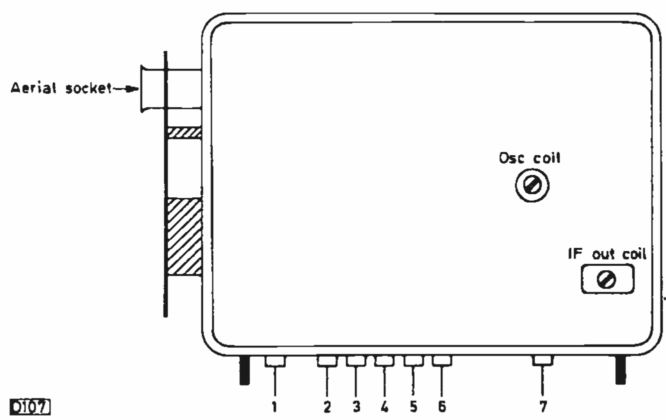


Fig. 1: Physical appearance of the NSF type 240-039-ET001 tuner. Pin connections are as follows: 1 Band I 12V; 2 tuning 0-28V; 3 u.h.f. 12V; 4 12V supply; 5 0-8V a.g.c.; 6 Band III; 7 i.f. output. Details from Bill Cotterill.

has to be used to unlock the signal, which uses Canal Plus type scrambling. A new unscrambled programme, "Canal + Famille", is to be distributed via Telecom 1C.

Switzerland: It will soon be legal to receive the French La 5 and M6 channels, RTL and any satellite downlinked material intended for domestic entertainment.

Finland: The MTV commercial channel hopes to establish its own transmission network. Currently it leases facilities from the Finnish Broadcasting Company YLE for morning TV with news/information/general entertainment.

Hungary: From January MTV is to operate on a seven days a week basis. The MTV-2 broadcasting hours are also to be extended.

Modifications to the D100 Converter

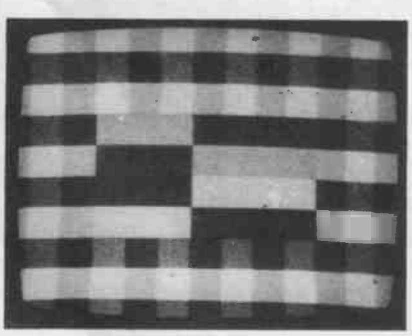
The HS D100 De Luxe DX-TV converter was reviewed in the December issue. Excellent though the unit is, a few simple modifications will improve the operation of the system at little cost.

First I suggest fitting a mains on/off switch on the front panel. A miniature double-pole toggle switch will serve the purpose, matching the general size of the other switches. Drill a hole of appropriate diameter, carefully and slowly, on the right-hand side of the front panel in line with the selectivity switches and the on LED, between the latter and the D100 lettering. If the drill should move and scratch the panel lightly, the mark can be removed by carefully rubbing with a cotton bud and Vim/Ajax powder! Once the switch has been fitted, cut the mains input wiring at the heatshrink sleeved joint. There's sufficient cable within the unit to connect the mains input to the switch and the latter to the mains transformer. When clipping the box together take care not to trap wires between the two halves. Carry out this operation with the unit isolated from the mains supply! A matching Letraset "on" can be applied and clear varnished.

I found that when progressively switching to reduced bandwidth it was necessary to adjust the tuning. This problem can be overcome by repeaking the two selectivity stages slightly. Switch to wideband operation and, with a weak signal, adjust for optimum picture. Then switch to medium selectivity (right-hand switch down). If you find that the tuning needs adjustment, make a slight adjustment to the right-hand selectivity stage (farthest from the modulator). Retune for optimum wideband reception then switch back to medium and repeak the right-hand selectivity coil. With the fine tune position retained, switch to narrow selectivity by depressing the left-hand switch. If retuning is needed, return to the medium position and set for optimum then return to the narrow setting and peak the selectivity coil nearest the modulator. Once this operation has been completed, switching progressively from wide to narrow will require no retuning.

Fit an additional earthing solder tag between one of the 4BA aerial input retaining bolts and the aerial input (phone) socket on the tuner case.

The u.h.f. calibration was good but v.h.f. left something to be desired. Switch to Band I and locate a ch. E4 signal. You may find it impossible to obtain accurate indication with the arrowed main tuning knob relative to ch. E4 irrespective of the fine-tune setting. The shaft of the tuning knob is bevelled, so the knob cannot be moved round and secured. The solution is to rebolt the main



Somebody's tablecloth! Seen recently and photographed by Garry Smith (Derby) on ch. E36. Thought to be from a local W. German transmitter. Can anyone assist with identification?

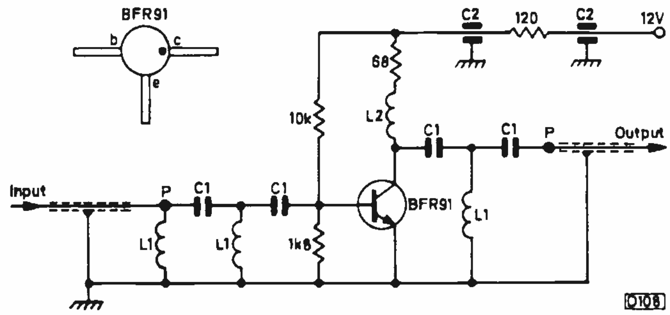


Fig. 2: Circuit of the u.h.f. amplifier to boost the output from the HS D100 converter. C1 = 5·6pF sub-miniature ceramic; C2 = 1kpF feedthrough; P = stand-off insulator, RS type 433-876; resistors should be low-noise types, 0·25 or 0·2W; L1 = 2¼ turns, ⅛in. diameter close-spaced; L2 = 2 turns ⅛in. diameter wound on from the leadout wire of the series 68Ω resistor.

tuning potentiometer 90° clockwise. This will mean lengthening one wire that passes from a band select tag to the potentiometer. Now locate ch. E4 with the main tuning control. The fine-tune setting will perhaps be at mid-point (on the u.h.f. scale). Once located, mark the fine-tune setting with a small coloured paint dot (a pin head covered with paint will give you a neat, circular dot). Make a similar coloured mark adjacent to the "1" on the band select switch. Thus when switching to Band I (say red dot) the fine tuning potentiometer is rotated quickly to the Band I red dot. Next find ch. E8 or E9, tuning with the fine-tune knob. Once the channel is found another paint mark is made for the Band III fine-tune position and a similar dot is applied next to the "3" on the band select switch – obviously a different colour should be used. You should now find that channel location is very accurate when band switching at v.h.f., provided the fine tune setting procedure is adhered to. Though the u.h.f. calibration is generally accurate it may be worth checking on ch. 39/40 and if necessary creating yet a third colour dot with, this time, the main v.h.f. tuning control which doubles as the u.h.f. fine tuner. The third colour dot is then added against the "U" on the band select switch. All very simple to do and if care is taken accurate tuning will be obtained – essential for those weak Band III MS signals. Remember that the Band I setting includes Band II TV.

Although the D100 will resolve a very strong System L video signal (positive-going) this is done by a dodge. I'm looking into whether positive-going video capability could be added and if successful will provide details later.

The most complicated modification involves adding a small amplifier stage after the output from the modulator to give a further lift of 10dB or so to the signal before it's fed to the main receiver. The circuit is shown in Fig. 2 and consists of a grounded-emitter BFR91. It can be built on a small piece of single-sided copper laminate, approximately 1·5 × 1in., using feedthrough capacitors and stand-off insulators as anchoring points. You can mount it via two soldered-on solder tags to the lid of the modulator stage.

All work within the D100 should of course be done with the unit isolated from the a.c. mains supply.

Satellite TV News

A 24-hour Spanish-language news service called Televisa, not unlike the CNN operation, came into operation at the beginning of December. This free channel is being carried via an ECS-4 downlink initially but may go to Astra at a later date. It originates in Mexico and is supported by advertising.

A news service from Visnews, called Good Morning Europe, is operational on a three-month trial basis. It consists of ten-minute news packages which are uplinked from London starting at 0230 GMT each day. Late US material is included, but the use of sound in syncs will make domestic reception difficult – the service is intended for European broadcasters, five of whom have already taken on the service.

Delegations from Yugoslavia, Algeria and China recently visited SES in Luxembourg (Astra) to discuss the possibility of starting a Third World Channel.

A new experimental service called Qamarsat (Moonsat) is using three C Band (4GHz) channels for several hours daily with downlinking from the Arabsat bird. The service consists of general entertainment etc. plus educational programming and covers over eighty per cent of the Arab world from the Gulf to Morocco and down to Equatorial Africa. If successful, the London-based Arab Spacescene Corporation hopes to start a daily 12-hour service. A further plan is to provide a scrambled S Band (2·6GHz) TV service via Arabsat covering much of Europe and Africa. This would be one of the largest satellite coverages when in operation.

As mentioned last month, TDF-1, the first DBS craft, is now in operation providing massive MAC signals on two channels. Ian Waller (Lincoln) noted signals on chs. 1, 5 and 9 (11·72, 11·8 and 11·88GHz), with D2-MAC. The very high level signals seem to spread everywhere. With a 1·8m dish evidence of the signals can be seen at ±8° off the 19°W orbital position. It's reported that one engineer resolved signals simply by pointing an LNB at the satellite. The quoted power is 64dBW.

Gorizont at 14°W has been seen carrying the Moscow first programme (without sound) on 11·541GHz. The transponder provides the UK with about 39dBW. With a 1·5m dish the signals have varied from noisy to sparklie-free – Gorizont is unstable in its slot, hence a cyclic variation in signal strength. The polarisation is circular, but a linear feed worked – a Teflon strip for insertion in the feed tube is being prepared to give correct reception of circularly polarised signals.

During early November several enthusiasts received PanAmSat (PAS-1) carrying system M signals with coverage of the US elections. Two transponders were being used, at 11·5 and 11·58GHz. The path here at Romsey is over two-thirds obscured by nearby housing but the signals were locked with only half-bandwidth filtering in circuit. Mexican programming was noted on the 30th, on test, at 11·5GHz.

John Standon (North East Aerial Systems) has been in touch recently. His company now deals solely with business satellite activities. He mentioned that C Band signals from BrazilSat craft at 65°W and 70°W have been received in Yorkshire via their spot beams despite the fact that the estimated e.i.r.p. is only 4dBW. A new patented system called Starcatcher is in use, extending a receiver's threshold down to virtually zero. It seems that the new system employs a selective video processing operation – we hope to be able to provide further details in due course. Examples of the possibilities with this remarkable unit include Ku Band reception from Intelsat at 27·5°W with a six-inch dish and C Band reception of AFRTS with entertainment quality using a patio-mounted 90cm dish. This system could lead to a rethink about aerial requirements in the TVRO field.

A new downlink via ECS-4 at 13°E and approximately 11·56GHz was seen at the end of November, with the identification Galavision. The polarisation is horizontal.

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £2 cheque or postal order (made out to IPC Magazines Ltd.), the query coupon and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.

SONY SLC9

This machine has a fault on playback. With prerecorded tapes and tapes recorded up to about three months ago playback seems to be o.k. With more recent recordings however a picture is obtained for about three-five seconds after which the picture breaks up two or three times then disappears, leaving a blank, unmodulated raster. On selecting cue and review or pause then playback the picture reappears until these keys are released, then the blank raster returns. The fault seems to show up at the same point of the tape — checked by rewinding and playing back again — suggesting a possible record fault.

This symptom is produced by the mute circuit which comes into operation when the control track head is not producing strong enough pulses. Cleaning this head (part of the audio head assembly) is usually all that's required. If this doesn't work the head could be worn and in need of replacement.

GRUNDIG CUC220 CHASSIS WITH REMOTE CONTROL

When the set is switched on it works for only about two-four minutes then switches off. If one of the buttons, say number 8, on the remote control unit is pressed the set comes on and remains on all evening.

Check that pin 14 of IC2365 remains high when the set should be on. If it does, suspect the BC337 transistor T2378 if, when the fault occurs, its collector voltage goes high. If the voltage at pin 14 goes low when the set switches off IC2315 and IC2365 are suspect.

FERGUSON 3V31

The problem with this machine is that the full erase head is on in the play mode though not in double speed, fast forward/rewind search and pause, when the oscillator is turned off — same in audio dub, though full dubbing doesn't take place. The relays have been checked. The original fault was no capstan drive as Q10 was open-circuit.

The key to this problem lies in the interface between the mechacon and audio boards, connectors 51-56. Check that during playback 55 is low, 51 and 52 are high and 56 is low. If not pursue the fault on the mechacon board. If these switching voltages are correct, find out why pin 7 of T1 on the audio board is being held low — this is the only way in which the oscillator can run.

SHARP VC381H

This VCR won't work in the video search mode. In the playback mode everything is all right until the fast forward or rewind button is pressed to put the machine into video search. The tape then unloads and the machine goes into fast forward or rewind as though video search doesn't exist. IC801 and D7758 have been replaced. The three inverter chips, IC805 and IC806 have all been checked with a logic probe. The mode switch also appears to be working correctly. Pin 59 of IC801 is low and doesn't change at all. The print is also fine.

Check that pins 1, 4 and 5 of I7754 go high in the search mode and that pins 12, 13 and 16 go correspondingly low. If D7753's cathode doesn't go high at this time, suspect Q7751. If pin 59 of IC801 doesn't go high for video search, isolate it and check again. If it now goes high something is loading it down. If it doesn't go high the trouble remains around IC801. Check the smoothness and level of the supply voltage at pin 32 (9·9V) and the oscillator components R882 and C802.

PHILIPS CTX-E CHASSIS WITH VST

Every time this set is switched on the channels have to be retuned. The set is then all right until switched off. When it's switched on again, even after only a few minutes, retuning is necessary.

The most likely culprit would seem to be the CCAM memory chip IC7800, type SAB3013. Before condemning it, check that the 5·5V supply at pin 9 is correct and that its clock oscillator produces a 4V peak-peak waveform at pin 2. This is governed by the timing components R3800 and C3800.

SAISHO VR805

When record is selected the machine holds on pause, the pause indicator lights and won't disengage. After two-three minutes the machine returns to the stop mode. Recording is normal when the timer is used. All other functions work correctly.

First check thoroughly that there's no corrosion or leakage in the operation PCB or input control (syscon, prefix 10) PCB due to liquid spillage. Next confirm that pin 48 of the syscon chip IC1001 always remains high at about 10V. If so suspect IC1001. If not check Q1014 and R1036.

PANASONIC U2 CHASSIS

This set has an intermittent power supply fault. Occasionally R832 (150Ω) will glow like a firework, then the set will shut down with 340V at the collector of the chopper transistor Q801 and nothing at its other electrodes. To make fault diagnosis difficult, the set will work normally for hours on end day after day. The 160V h.t. is correct and a scrap chassis is to hand.

There's a reasonably sure way of curing this one, but it involves replacing several components as follows: D812, D809, Q802, Q803, D808, D814, R832 and R803. We would advise new components rather than salvaged ones – the latter may also be suspect.

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TELEVISION FEBRUARY 1989

HITACHI VT8000

There's an intermittent fault in the record mode. The playback picture is fine but the sound level drops approximately every four seconds then comes straight back up again.

Relay RL401 on the audio panel could be to blame but it's more likely that the cause of the trouble is on the deck. Check the tape's back-tension and the condition of the pinch roller. If these are o.k., clean the audio head and check its tilt – follow the instructions given on page 2-17 of the manual, then give the top of the head a very slight tilt outwards towards the tape. If these steps produce no improvement the audio head is suspect.

TEST CASE

314

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.

The workshop was its normal chaotic self on this winter afternoon. Techno-Supersleuth was in his corner puffing on his fag and, for some obscure reason, drawing arcs from a Sanyo line output transformer; in his corner Hubo was doing wonderful things with a CD player while dreaming of a 60MHz scope and a function generator; in another corner Television Ted was triumphing over dry-joints in a Philips G11 between eating bacon crisps. And in the fourth corner of the workshop a strange drama was developing . . .

The patient was a Panasonic NV7200 VCR. Its owner had complained of "no playback signals", which was so. Apart from an occasional short burst of picture and sound when the play button was first pressed, all that the machine would produce was a snowstorm on the screen and a hiss on sound – just as if a blank tape had been fed in. The E-E signals were o.k. once a local station had been tuned in, which exonerated the tuner and much of the electronics.

A good tape was inserted and the play mode was selected. A finger on the audio head lead-out then produced a healthy buzz from the monitor set's loudspeaker – strange! A finger on the leads and connections from the video heads to the signals PCB brought up noise and instability on the screen. So it certainly seemed that the playback signal chains were working. Most logical avenues of thought finished at dead-ends after these test results. The tape path past the audio head looked to be o.k.

We had this situation once before when it turned out that the video tape was back-to-front. You can't get signals from the back surface of a tape! There was no sign of this here, and the customer said that he'd had the problem with all the tapes he'd tried, including library ones. Another known good tape was loaded, and we carefully watched the tape as it emerged from the cassette. No, it wasn't being twisted over.

The next test, really somewhat irrelevant in the absence of playback sound, was an ohmmeter check on the windings of the rotary transformers and the video heads themselves. All proved to be in order, but since we had another video head drum for this model in stock we fitted it. This made no difference of course. Another thought was that the head switching was incorrect, so that each head was being switched out as it started to scan the tape. The head wiring and the SW25 flip-flop waveform were correct however, and since the sound is recorded longitudinally in this machine no drum or head problem could account for the loss of sound.

Next came a check that should have been done earlier – try to make a recording. A minute or so of off-air programme was recorded, rewound then played back on another machine. There was perfect recording of both vision and sound! This cleared the heads, tape path and many other things of suspicion.

Testing in the playback mode commenced again, with a half-wound prerecorded tape. While playing with the operating keys we discovered that the machine would produce playback pictures in the review (search backwards) mode. Resisting the temptation to scream, we pondered on this additional absurdity. Of course! As we watched the tape whizzing backwards light dawned. Which item was the culprit? See next month's issue.

ANSWER TO TEST CASE 313
– page 210 last month –

Last month's puzzle was not really a difficult one, though it did show how a bit of thought on the theoretical aspect can provide a quick solution. The low scan amplitude problem described was due to low input and output signals to and from the field output chip, but the primary cause of the lack of height was in fact too much signal!

As with all field timebases, this one has a feedback loop to ensure height stability with time and temperature and to help with linearity correction. In this design the field scan coils are themselves within the feedback loop. The coils are returned to chassis via a small-value resistor, R3420 (1·3Ω), which is used to sample the sawtooth current flowing. This resistor develops a feedback signal which is potted down to a suitable level by the parallel-connected height control and then fed back to the sawtooth generator section of the timebase.

What had happened was that the value of the sampling resistor had increased slightly, so that the amplitude of the sawtooth voltage developed across it had also increased. The excessive feedback suggested to IC7375 that the height was too great. Doing its job correctly, this chip reduced its output in order to restore approximately correct conditions at its negative feedback input pin 2. The width was affected (bowed out sides) because the feedback signal is also used by the EW raster correction circuit. Fitting a new 1·3Ω resistor put matters right.

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AA117	9p
AA119	9p
AAY32	9p
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AC128	21p
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MV209	48p
MV2209	48p
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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
78HO5KC	800p
78H12KC	700p
78GU1C	190p
79GU1C	215p
79HGKC	800p

VALVES

DAF96	60p
DF96	50p
DL92	60p
DY86	50p
DY87	60p
DY802	75p
EABC80	60p
EB91	44p
EBF80	45p
EBF89	50p
ECC81	80p
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-239Q	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	280p
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-3089Q	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	280p
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	160p
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-1469	290p
MC-1488	65p
MC-1489	65p
MC-1494	672p
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-024	700p
STK-025	700p
STK-031	820p
STK-041	700p
STK-043	980p
STK-050	1450p
STK-056	820p
STK-077	800p
STK-078	620p
STK-080	710p
STK-082	720p
STK-084	740p
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-583	600p
STK-732	850p
STK-734B	510p
STK-772B	480p
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-2120	820p
STK-2125	650p
STK-2110	680p
STK-2155	1000p
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-3083	550p
STK-4021	425p
STK-4025	600p
STK-4026	800p
STK-4036	500p
STK-4038	680p
STK-4048	1280p
STK-4060	580p
STK-4111	650p
STK-4122	560p
STK-4121	800p
STK-4131	650p
STK-4141	700p
STK-4151	720p
STK-4161	820p
STK-4162	820p
STK-4171	1000p
STK-4181	820p
STK-4191	1100p
STK-4311	800p
STK-4332	500p
STK-4352	700p
STK-4362	625p
STK-4372	600p
STK-4392	720p
STK-4773	1000p
STK-4793	1180p
STK-4803	820p
STK-4813	950p
STK-4833	920p
STK-4843	865p
STK-4853	950p
STK-4893	1400p
STK-4913	1220p
STK-5314	625p
STK-5315	650p
STK-5322	620p
STK-5324	550p
STK-5325	650p
STK-5332	300p
STK-5372	300p
STK-5421	625p
STK-5422	600p
STK-5441	500p
STK-5471	500p
STK-5476	600p
STK-5481	520p
STK-6922	600p
STK-6962	320p
STK-6972	630p
STK-7216	610p
STK-7308	800p
STK-7309	650p
STK-7402	660p
STK-7404	580p
STK-7406	800p
STK-7408	880p
STK-7410	1200p
STK-7563	1000p
STR-8250	700p
STR-8050	880p
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	210p
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-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-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-1031H2	180p
UPC-1032	60p
UPC-1155	200p
UPC-1156	250p
UPC-1158H2	70p
UPC-1167C2	170p
UPC-1168	105p
UPC-1181	110p
UPC-1182	110p
UPC-1183	200p
UPC-1185H2	230p
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
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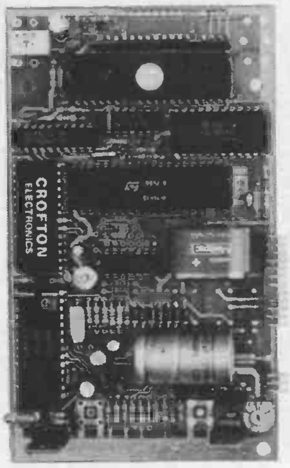

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VP180	25	Tantalum Bead Capacitors, assorted values	£1.00
VP182	4	1000uf 50v Electrolytics	£1.00
VP192	30	Min. Electrolytics, mixed values, .47mf-1000mf, 6/16v	£1.00
VP193	6	Sub Min. Electrolytics, 2 × 1000/2200/3300mf 10/16v	£1.00
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VP531	10	High Voltage Electrolytics 100-330mf, 100-350 volts	£2.00
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VP533	8	Electrolytics, 2 × 1000/2200/3300/4700mf, 10-16 volts	£2.00
VP534	5	Axial Electrolytics 1000mf 16 volts	£1.00
VP535	4	Radial Electrolytics 2200mf 16 volts	£1.00
VP536	3	Axial Electrolytics 4700mf 10 volts	£1.00
VP537	4	Axial Electrolytics 10000mf 6.3 volts	£1.50

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VP27	15	Large .2″ red LEDs	£1.00
VP28	10	Rectangular .2″ red LEDs	£1.00
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VP130	6	RED 7 Seg. CC 14mm × 7.5mm RDP FND353 LED Display	£2.00
VP131	4	GREEN 7 Seg. CA .6″ LDP XAN6520 LED Display	£2.00
VP133	6	RED Overflow .6″ 3 × CA 3 × CC 6630/50 LED Display	£2.00
VP134	5	GREEN Overflow .6″ CA XAN6530 LED Display	£2.00
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Pak No.	Qty	Description	Price
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VP199	4	DL707R LED Display, CA	£1.00
VP203	15	Triangular shape LEDs, mixed colours	£1.00
VP204	10	Large 5mm green LEDs	£1.00
VP205	10	Small 3mm green LEDs	£1.00
VP206	10	Large 5mm yellow LEDs	£1.00
VP207	10	Small 3mm yellow LEDs	£1.00
VP208	10	Large .2″ LEDs clear showing red	£1.00

Pak No.	Qty	Description	Price
VP241	2	ORP12 Light Dependant Resistors	£1.50
VP242	4	Tri-colour LEDs, 5mm diameter, 5mA 2v, red, green, yellow	£1.00
VP243	3	Tri-colour LEDs, rectangular, 5mm, red, green, yellow	£1.00
VP266	10	Large 5mm orange LEDs	£1.00
VP267	8	Stackable LEDs, rectangular, mixed colours, r.g.y	£1.00
VP268	15	LED panel mounting clips. Metal & plastic, 3-5mm	£1.00
VP269	2	Large 5mm red Flashing LEDs	£1.00
VP267	8	Stackable LEDs, rectangular, mixed colours, r.g.y	£1.00
VP268	15	LED panel mounting clips. Metal & plastic, 3-5mm	£1.00
VP269	2	Large 5mm red Flashing LEDs	£1.00
VP279	10	OCP71 Photo Germanium Transistor, PNP	£1.00
VP284	2	Opto-Isolator IL74-4N27, single	£1.00
VP285	1	Dual Opto-Isolator ILD74	£1.00

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VP39	100	Silicon Transistors, PNP plastic, coded, with data	£3.00
VP45	40	NPN Transistors like BC107/0, all good, TO18	£1.00
VP46	40	PNP Transistors like BC177/8, all good, TO18	£1.00
VP47	10	Sil. Power Transistors, similar 2N3055, uncoded	£1.00
VP48	5	Pairs NPN/PNP plastic Power Transistors, 4A, with data	£1.00
VP50	60	NPN Sil. Switching Trans. TO18 and TO92	£1.00
VP51	60	PNP Sil. Switching Trans. TO18 and TO92	£1.00
VP60	100	Assorted Transistors, NPN/PNP	£1.00
VP150	20	BC183B Sil. Trans, NPN 30v 200mA Hfe240+ TO92	£1.00
VP151	25	BC171B Sil. Trans, NPN 45v 200mA Hfe240+ TO92	£1.00
VP152	15	TIS90 Sil. Trans, NPN 40v 400mA Hfe100+ TO92	£1.00
VP153	15	TIS91 Sil. Trans, PNP 40v 400mA Hfe100+ TO92	£1.00
VP154	15	MPSA56 Sil. Trans, PNP 80v 800mA Hfe50+ TO92	£1.00
VP155	20	BF595 Sil. Trans, NPN eqvt BF184 H.F. TO92	£1.00
VP156	20	BF495 Sil. Trans, NPN eqvt BF173 H.F. TO92	£1.00
VP157	15	ZTX500 series Sil. Trans. PNP plastic	£1.00
VP158	15	ZTX107 Sil. Trans. NPN eqvt BC107 plastic	£1.00
VP159	15	ZTX108 Sil. Trans. NPN eqvt BC108 plastic	£1.00
VP161	25	BC183L Sil. Trans. NPN 30v 200mA TO92	£1.00
VP162	5	SJE5451 Sil. Power Trans. NPN 80v 4A Hfe20+	£1.00
VP163	2	NPN/PNP pairs Sil. Power Trans. like SJE5451	£1.00
VP164	4	2N6289 Sil. Power Trans. NPN 40v 40w 7A Hfe30+	£1.00
VP165	6	BFT33 NPN Sil. Trans. 80v 5A Hfe50-2000 TO39	£1.00
VP166	5	BFT34 NPN Sil. Trans. 100v 5A Hfe50-200 TO39	£1.00
VP167	1	BUY69C NPN Trans. TO3 VCB 500, 10A, 100w, Hfe15+	£1.00
VP168	10	BC478 eqvt BCY71 PNP Sil. Trans. TO18	£1.00
VP169	10	BXS21 eqvt BC394 NPN Sil. Trans. 80v 50mA TO18	£1.00
VP170	10	Assorted Power Trans. NPN/PNP coded and data	£1.00
VP171	10	BF355 NPN TO39 Sil. Trans. eqvt BF258 225v 100mA	£1.00
VP172	10	SM1502 PNP TO39 Sil. Trans, 100v 100mA Hfe100+	£1.00
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VP201	25	OC45 germanium RF Transistors	£1.00
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VP290	15	MPSA06 Sil. Transistors, NPN 80v 500mA Hfe50+ TO92	£1.00
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VP429	10	AC176K PNP germanium Transistors, 1A 32v	£1.00
VP430	4	2N3055 Sil. Power Transistors, full spec	£2.00
VP431	25	PNP Sil. Transistors, TO39 like 2N2905A	£1.00
VP451	20	NPN Transistors, like BFY50/51, all good, TO39	£1.00
VP452	5	PNP Power Transistors, BD244AX eqvt TIP2955	£1.00

Pak No.	Qty	Description	Price
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VP454	10	BC108 Transistors, brand new, NPN TO18	£1.00
VP455	10	BC109 Transistors, brand new, NPN TO18	£1.00
VP456	10	BC107 Assorted gain group Transistors, A, B and C	£1.00
VP457	10	BC108 Assorted gain group Transistors, A, B, and C	£1.00
VP458	10	BC109 Assorted gain group Transistors, B and C	£1.00
VP459	10	BC177/8/9 mixed Transistors, PNP, TO18	£1.00

I.C.S.

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VP210	12	74LS74	£2.00
VP211	10	CD4001B	£2.00
VP212	10	CD4011B	£2.00
VP214	10	CD4069B	£2.00
VP215	10	741P 8 pin	£2.00
VP216	10	555 Timer 8 pin	£2.00
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VP292	1	Z80A P10 Parallel Interface Controller, 40 pin DIL	£2.00
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VP295	1	6821P Peripheral Interface Adaptor (PIA)	£1.50
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VP433	6	CD4017B	£2.00
VP434	10	CD4024B	£2.00
VP435	10	CD4028B	£2.00
VP436	8	CD4081B	£2.00
VP461	1	LM380 Audio Amp. 14 pin, DIL, 2.5w I.C	£1.00
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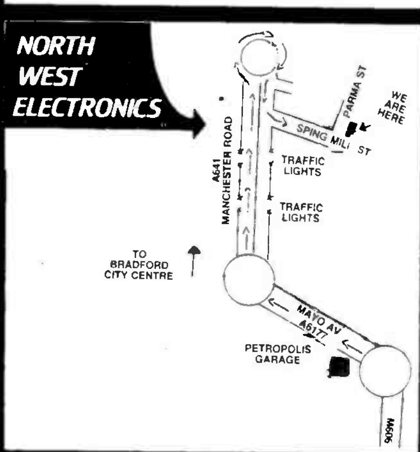

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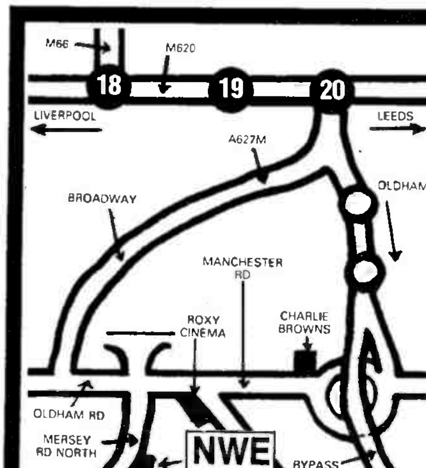

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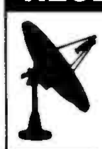

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INDEX TO ADVERTISERS

SENDZ COMPONENTS

TO ORDER SEE BACK PAGE

Matsushita PY34220 Tuner	£7
C. Cam Decoder with TDA3591	£5
Toshiba VHF/UHF EG522F	£6
Mitsumi MEC1-F51	£5

K35 Decoder	£8.00
K35 Sound OP	£4.00
Thick Film Daughter KT3 3122-127-43891	£3
12 C.H. K30 Tex Rec Front Panel with I.C.	£5
K35 IF	£5.00

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 1vNPN 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 prch unit 0354	£9.50
4 Push button unit prch	£1.00
6 Push button VHF/UHF for v/cap. GEC-Decca type	£7.00
7 Push button for CVC5 ITT	£8.00
KT3 12 Push button unit	£2.00
KT3 (Export) 12 P.B.u	£2
6 Push button Unit Thorn	£1.00
6 Push button GRC	£6.00
6 Push button PYE 731	£6.00
Hearing aid unit	£3
Rank Z718 4 P/B/Unit MECH	£4
7 Button Unit GEC with Lamps	£7
697 Push Button Unit	£6.00
Z916B panel	£5.00
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
270/10/6 for Thorn 4000	50p
18/320/70/39	£1.10
Thorn 50-40R-1K5	50p
Ae Socket & Lead	
GEC, ITT, Philips, Pye	25p
7×3¾ Thorn	£1
Thorn 1600-1700	£1.50
Rank Toshiba Tube Bases	30p

20,000 Per Volt
HT420 Hills Meter
10 Amp AC/DC
1,000 and ohmes range £10
4 ohmes ranges 0-1000 volt AC/DC
AEG KT2000/641-005

Hand Sets
Fidelity All Types
£15 to £35

KT3-K30

OF-425		
OF-550	E.W.	10p
OF-513	correction	10p
OF-557		50p

DIODES

BY 126	10p
BY 127	10p
BY 133	10p
BY 134	10p
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 – BY 407 Eqv.	8p
BY 208/800	8p
BY 210/400	5p
BY 210/800	10p
BY 223	60p
BY 224/600: 4.8A/600v bridge	50p
BY 226	15p
BY 227	15p
BY 228 1500v	20p
Flat BY229 black	15p
BY 299 Red	20p
BY 229/400	30p
BY 299/60p 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 448	10p
BY 527	10p
BY 602	10p
BYV 26C	10p
F 247	10p
GP20G	5p
GRP80G (TX10)	30p
XK 3102	50p
BYV 28/200	20p
Bridge TX10 800/3 amps	30p
KBPC35-02 Bridge	£1.50
Bridge Rec. D35B10	40p

Plug In

K4 Focus Pot	£1.00
Fidelity Tube Base with transitor & 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 T.X. 12"-14" Philips	
27482	£10
4822	£10
10273	£10
Thorn 1690 LOPT	£7.50
2 J/Pots 3.500 1 off each type	£3.00
G8 Trans. Philips	£7.00
G11 Split Diode	£12.00
CVC820 Split Diode ITT	£10.00
Thorn B W AD5308F + 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 T704A	£3.50
Split Diode Trans	£7.00
GEC 20 AX Rank Z522	£3.00
Rank L.O.P.T. Z970	£3.00
CVC32	£6.00
AT2080/15	£5.00
CVC30 ITT	£5.00
CVC32 Line Tran	£7.00
CVC800 Line Trans	£6.00
CVC40 Slip/Diode	£12.00
CVC 45	£5.00
GEC Portable G1OT2041	£3.00
GEC Portable G1OT2046	£3.00
EHT Split Diode Leads ITT	£1.00
3500 L.O.P.T. & ITT Trans	each £2.00
LOPT Rank Z763	£5.00
K35 Split Diode 3122 13835930	£10.00

Universal Tripler

with small focus pot. Green type	£7.00

Black Triplers

KT3 Triplers	£6.00
S.T.C. Universal Tripler	£6.00
11 TJT	£2.50
11 TGA	£2.00
ITT CVC 5-8-9	£3.50
Rank T25LE Tripler	£2.00
Rank 11TCP A823	£3.50
TU 25 30K Rank	£3.00
11 TEZ 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
11TBQ Pye 731	£3.00
11THY	£4.00
D22 for Pye 18" colour portable	£4.00
LP 1193/63	£4.00
BG 100 41	£3.25
ERO Tripler print type with focus PO7 BG2087	£5
T text ultrasonic rec'r panel	£14.00
12-14V. 20 for £5.00 200 for £25.00	
GEC 8 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	£1.00
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 560T/570T	£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 NE511N	£1.20
LM337M Reg.	30p
20 GEC Black Spark Gaps	£1.00
KT3 Front Panel Control Assy.	£2.50
BTW 30/50	50p

International Rectifier EHT Diodes G770/HV34 6KV	3 for 8p
6A/600V Stud Diodes 20p	BTW 92/800R £3
6A/1000V Stud Diodes 20p	25A473 PNP C/P 10p

25% OFF ALL PANELS

G8 LOPT Panel	£12.00
Rank T20 Z136 Panel	£6.00
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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 T/unit	£3.90
Pye 713 IF panel and tuner	£7.00
Pye 713 Chroma	£10.00
Pye/Chelsea Timebase panel with LOPTI	£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 + LOPTI 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

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 1 I.C. SL437F	£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 pb 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
2110 GEC Power Panel	£8.00
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
Universal Focus. Fits Pye. Thorn and Decca Units.	
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
3500 Thorn Focus Unit	£1.00
ITT Small for use with Split	
Z718 Bush Focus	£2.00
Diode	50p
Remo TV12SP	50p
1600 Thorn EHT Rec and Lead	50p
TV14	50p
TV20	£1.00
TV45	50p
Thorn 14-1500 rec stick	5p
TX10 8 Button Unit	£10.00
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

PHILIPS BATTERIES (Small Types) HAND SETS

SR41	25p
SR43	25p
SR44	25p
SR54	25p
LR43	25p
LR44	25p
LR54	25p
CR2032	25p
10 500PF 2KV	20p
.22 1000	20p
.1/250AC	20p
.1/100	5p
1MFD-250AC	25p
TAA7750	£1.00
HA411485	£1.00
UPC1373	50p
M50143	£1.00
M491BB1	£1.00
M58657P	25p
M50441 550	3p
M58658P	£1.00
Delay Line TDK Small	10p

420M 400V	£1.00
470M 380V	£1.00
220/400V	£1.00
1200PF 15KV	10p
.01 2KV	10p
1+1 MFD Mains Filter ITT 3 Pin	15p
1/100 × 10	30p
22/100	10p
4.7M/100	5p
470/100	20p
4700 100	75p
47/160	10p
300 300 300V	80p
800/160	50p
.1 250 Pulse	5p
2.2/250v	10p
7N5 1500V	15p
3n3/250 A.C.	10p
.33 250V	20p
.39/250V	15p
4n7/250 tested 5KV	25p
22 250	15p
47 250	10p
100 250	20p
G11 470 250V	£1.75
GEC600 250	60p
700 250	£1
300+300 MFD 350v	£1.00
800/250	40p
32 300	20p
4 350	5p
8 350	8p
4.7M 350v	10p
33 350	20p
220 350	30p
300 350	40p
400 350	50p
22 375	15p
220/385 (ITT)	75p
330 385 CVC 820HT	60p
0.1 400	15p
KT3 E.W .39/400	15p
.56K 400v	20p
4700pf 400	10p
.22 400	10p
8/400	15p
33 400	20p
400 400	40p
394K 400V	30p
220 450	40p
.47 500	25p
0.1 600	15p
0.1 1200V wire end	20p
0.1 450 A C wire end	20p
.22 1000	20p
.047 600	15p
0 047 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	10p
2n2 1500	15p
.01 1600	10p
G11.8200 2KV	15p
0.1 2KV	20p
3n9 2KV	15p
0.0015 2KV	10p
6n2 2KV	15p
2n0 2KV	15p
2n2 2KV	15p
470pf 4KV	10p
7500pf 2KV	10p
3000PF 3000V	10p
4n7 2KV	15p
6n2 2KV	10p
7n1 1500V	10p
8n2 1500V	10p
9n1 2000V	10p
8n2 2KV	15p
0.0082 2500	15p
150 3500	10p
1800 4KV	5p
4.7nf 5KV	10p
170 8KV	10p
180 8KV	10p
210 8KV	10p
1000 10KV	10p
.47 100V	80p
Tube Thermpath 167	£1.00
Rank Secam Decoder Panel UHF & VHF T115A	£13.00
10 off .91 CAP G11	£2.00
Philips K4 CAP 150M/385V	50p

CVC 20-25-30 Mains Switches	60p
Infra Red and Ultrasonic G11 Teletext Decoder Panel	£30
RANK & ITT Mains Remote On-Off Switch (720R)	£1.50
RANK & ITT Remote Switch 2800 ohm	£1.50
G11 Mains Switch	50p
4 amp Mains Switch	25p
GEC Mains Switch 4 amp	30p
KT3 Mainswitch	£1.00
G8 Mains Switch	75p
G11 Prch Red LED P/Button for C.H. Change	20p
RANK TOSHIBA Transductors TPC-2011	50p
Mains Switch ITT Long Type Print	75p
Mains Switch Philip Long Type TAG	75p
Mains Switch GEC Long Type TAG	75p
2000 Chassis Fidelity Mains Switch (4 TAG)	60p
250V/4A White Lorlin Mains Switch	60p
KT3-K30-K35 Full Remote Mains Switch (6 TAG)	£1
Teletext Adaptor Kit TY-500 Panasonic	£12

Multi-Caps

220 MFD Sprague 385V	50p
350V 300M + 300M	£1.00
400V 400M	60p
350V 400M	60p
Thorn 3500	
175/100/100/350v	£1.00
KT3/200/25/25/385v	£1.00
KT3-K30 220+40+40	75p
200+200+75+25M 325V	£1.00
300+300+150+100+50MFD 350V	£2.00
G11 CAP 470/250	£2.50
47/220/350v	60p
150/150/100/100/100/320v	£2.00
2500/2500/63v	50p
150/200/200/300v	70p
300/100/100/16/275v	£1.50
100/200/325v	40p
150/150/100/375v	£1.50
200/200/75/25M 375V	£1.00
Thorn TX9 Caps 500+500M 175V	£1.00
300/300/100/32/32/300v	2.00
1500/2000/30v	50p
150/150/100/100/320v	£2.00
100/350 + 300/200/100/16/275v	£2.00
225+25/380 GEC	70p
200/100/100/350v	£1.50
500/500/25v	50p
150/150/100/300v	75p
200/150/150/300v	1.00

ITT 8 and 6 Push Button	£1.00
Pye 725 LOPTs	£6.00
Pye 731 LOPTs	£6.00
Thorn 8500-8800 LOPTs	£5.00
CMC 301 front panel	£5.00
CMC 303 front panel	£5.00
CMC 302 Panel with TC mains switch etc	£5.00
CMD 800 Decoder	£8.00
G11 1 I.C. Receiver Panel	£1.50
3 I.C. Power Supply G11 Full Remote Receiver Panel	£3.00
PHILIPS SBC 469 Stereo Microphone	£23.00
Meters Hills 520	£17.00
Meters Hills 420	£10.00
Hills HD5000 Digital Meter 1000V DC 750AC 10 Amp 20 MRG Rangers	£28
HT100 Multimeter	£6.75
HT300 Multimeter	£7.75
HT500 Multimeter	£9.00
HT700	£15.00
HD1000 Digital	£20.00
HD3000 Digital	£25.00
HD5000 Digital	£25.00
HD5500	£29.00
HD6000 Digital	£32.00
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Infra Red Hanset Tester

Works at 24 feet – Sound repeater. Works off 9 volt battery Fits in top pocket.	£8.00
Handset Tester with LED	£4.50

Repaired Handsets

Philips K4-K35. RC5350-RC5300, RC5370, RC5375, repaired same day	£10.00
RC4001 Full Remote KT3 K30 Teletext Handsets exchanged	£15.00
NEW Type RC4001 9 CH not 12	£6.00
GEC Full Remote Infra-red, 1983 models	£15.00
Timers, 60 mins, small	£1.00

TOSHIBA HAND SETS

24 Button CT938 Fulremote	£5.00
32 Button CT983 Videotext	£6.00

THORN

VCR Front Display Panel	£7.00
Large type ITT TV and V C.R. Handset	£15.00
GEC Ultrasonic 8CH Full Remote	£10.00
G11 Full Remote Ultrasonic	£32.00
G11 Ultrasonic Teletext Handset	£20.00
8 C H Ultrasonic GEC Full Remote C2014H/C221911	£15.00
New Replacement for G11 Ultrasonic Full Remote	£12.00
Thorn 4000 insert with 7 buttons	£5.00
Decca RC 11	£14.00
Decca RC 12	£14.00
G11 Infra-red full teletext	£20.00
Dynatron-Full remote CTV 62, 63, 64	£19.00
Hitachi infra red handset	£18.00
Philips full remote KT3, 16CV928/20CV934: 7228/7324: K12 26C 797/1ST 66K 1826	£12.00
G11. Full remote top button assy.	£12.00
G11. Full remote repair service (exchange unit)	£18.00
GEC infra red full remote 8 channel (I.C SAA1250)	£14.00
Philips infra red full remote 9 channel for 60 CP2605	£6.00
Philips infra red full remote 12 channel for 60 CP2605	£12.00
K35	
KT3 K30 T Text	£15.00
KT3 K30 Full remote	£15.00
KT3 Power supply	£4.00
GEC infra-red 2236-2026	£4.00
GEC 8 button full remote	£14.00
GEC push pad handset button blobs each	10p
Pye & Philips handset KT3-K30 chassis. No RC5150-RC5176-RC5171-RC5177. Special Price	£13.00
RC4001 KT3 and Teletex	£14.00
IT CVC 32 handset repaired	£15.00
CVC 32 Hand Set	£15.00
CVC 45 3 and 2 Pin	
TX10 Hand Set Text	£12.50
TX9 with Text	£12.50
TX9 & TX10 button print	£2.00

ITT

TV & Video Processor, 1200 Type	£10.00

PHILIPS
UNIVERSAL HAND SET £12.00 RC5
KT3 – K45

We have all parts for Philips Handsets

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RC5300	£12.00
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TEXT-TYPE

Replace Hand Set for Philips KT3-K30, K4 etc	£12.30

THORN HAND SETS

9000 – 9600 – TX9 - TX10 – TX100 Text and Non-Text	£10.00

PHILIPS

RC5171	£12.00

K35-K4 HAND SET
Repaired for £5.00