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SEPTEMBER 1987

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TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS

Extra inside –

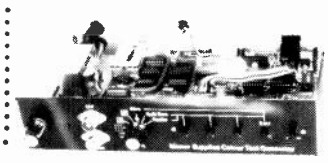
HRS Video Head Chart

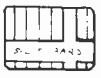
VM6101 Teletext Decoder Interface
Field Servicing Kit • Vintage TV
Coaxial Cable TV Techniques
Mains Supply Checker • DX-TV
Salora's Satellite TV Receivers
TV Fault Finding • VCR Clinic

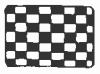
MANOR SUPPLIES

MKV PAL COLOUR TEST GENERATOR FOR DOMESTIC TV & VCR.

TEST DEMONSTRATIONS AT 172 WEST END LANE







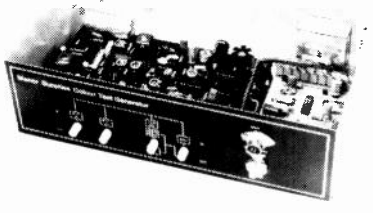
- ★ 40 different patterns and variations.
- ★ Broadcast transmission accuracy (fully interlaced sync pulses with correct picture blanking).
- ★ EBU colour bars, BBC colour bars, whole rasters & split bars (specially useful for VCR service), white, yellow, cyan, green, magenta, red, blue and black.
-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

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

SPECIAL TEST REPORT 'TELEVISION' DEC. 1982

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

PAL COLOUR BAR GENERATOR (Mk4)



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

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

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

ADD VAT 15%

TELETEXT DECODER PANELS (TESTED)
Mullard VM6101 **£30.00**, Philips KT3, K30 **£30.00**, Texas XMH (TIFAX) **£28.00** (untested £5.00) p.p. £1.80

THORN TX9 MK2/3, TX10, teletext
Mullard Decorder panel + Interface **£35.00** p.p. £1.80
THORN TX10, PHILIPS G11 PRESTEL, TELETEXT
Mullard Units VM 6230, 6330 plus Line Coupler & Interface **£38.00** p.p. £2.50

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LOPTs, TRIPLERS, PANELS, TUNERS, SELECTORS ETC.

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PHILIPS G11 6 position touch tune channel selector units **£16.00** p.p. £1.80 (can replace earlier mechanical selector unit).
PHILIPS G11 PANELS (tested).
Frame, IF, decoder **£18.00** each p.p. £2.00. Scan **£28.00** p.p. £2.80.
PHILIPS G11 PANELS ex rental (untested).
Scan **£10.00**, Frame, Decoder **£5.00** p.p. £2.00.
PHILIPS HANDSETS (New Replacements) p.p. £1.50.
G11 Ultrasonic Nontext **£22.50**, Infra red Text **£22.50**. Others available.
KT3 Non text (RC4001) **£20.00, KT3, K30 etc.** Text **£26.50.**
PHILIPS HANDSETS Ex rental, text, Untested. KT3, K30, **£3.50** p.p. £1.00.
COLOUR MANUALS p.p. 50p.
PHILIPS G11 **£3.50**, KT3 **£3.50**, CTX-E **£1.50**, CTX-S **£1.50.**
THORN REMOTE CONTROL HANDSETS
TX9 ULTRASONIC (3-button) **£15.00; TX9, TX10** Infra red (type 725) **£18.00; TX9, TX10** Infra red Teletext **£20.00**, p.p. £1.20. Others available.
TX9 Ultrasonic remote handset transducer **£2.00**, switches 3 for **£1.50** p.p. 50p.
TX9/TX10 Tele ext interface panel (1524) **£5.00** p.p. 80p.

THORN TX9 Ultrasonic Remote/Control/Receiver panels. **£8.50** p.p. £1.50.
TX9, TX10 Facia control panel incl. infra-red remote receiver **£8.50** p.p. £1.80.
THORN TX9, TX10 Saw Filter IF Panel. **£5.00** p.p. 80p.
TX9, TX10 Remote & tuning control panel (1515) **£10.50** p.p. £1.80.
SAW FILTER IF AMPLIFIER PLUS TUNER complete and tested for T.V. Sound & Vision. **£28.50** p.p. £1.20.
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. **£12.00** p.p. 80p. (Alum. Case **£2.90** p.p. £1.40.) **ADDITIONAL GREY SCALE** Kit **£2.90** p.p. 45p.
UHF SIGNAL STRENGTH METER KIT £22.00 Alum. Case **£2.90**, De Luxe Case **£8.60** (Built & Tested **£48.00**) p.p. £2.30.
CRT TESTER & REACTIVATOR KIT For Colour & Mono complete with Case, Panel Meter Indicator – can be adapted for latest CRTs **£29.50** p.p. £2.80.
BUSH A823 Convergence, Time Base Panels **£5.00** each p.p. £1.80
GEC 20AX Line Time Base **£18.00** p.p. £2.00.
ITT CVC30 SERIES. Convergence & Purity Control Panels. **£5.00** p.p. £1.50.
ITT CVC30 SERIES PANELS SURPLUS (untested) **£5.00 each.** CMP31, CME31, CMA30, CM532, p.p. 80p; CMD33, p.p. £1.80.
THORN TX9 Panels ex factory for small spares. Includes I.C's & Semiconductors etc. **£3.00** p.p. £1.80.
THORN TX9 Panels salvaged ex factory for spares incl. Electrolytic & Mains Transformers. **£8.50** p.p. £3.00.
THORN 8000, 8500, 8800 IF Decoder Panels Tested **£10.00** p.p. £2.30.
THORN 8000/8500 IF/Decoder Panels salvaged **£3.20** p.p. £1.80
THORN 9000 IF/Decoder Panels Salvaged For spares **£2.50** p.p. £1.80.
PHILIPS G8/G9 F/Decoder Panels for small spares incl IC's **£2.50** p.p. £1.60
PHILIPS G8 Line Driver Panel incl. Equalizing Coil. **£1.00** p.p. 60p.
GRUNDIG 8630 Series Varicap Tuners **£5.00** p.p. £1.00.
VARICAP TUNERS U321, U322 204, ELC1043/05 **£7.80** p.p. £1.00.
VHF Philips, NSF **£6.80** p.p. £1.00.
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FERGUSON 3787 (Normende)	£9.80	R.B.M. 120, 122 Bobbin	£5.60
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RBM A823	£4.80	**PHILIPS** K13	£9.80
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PYE 691-7 chassis type only	£5.00	**PHILIPS** CTN E	£21.00
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SPECIAL OFFER TRIPLERS
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THORN 1500 5 Stick **£1.50**, 1500 3 Stick **£1.50** p.p. 80p
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PYE 713, 731 IF Module **£3.50** p.p. 80p.

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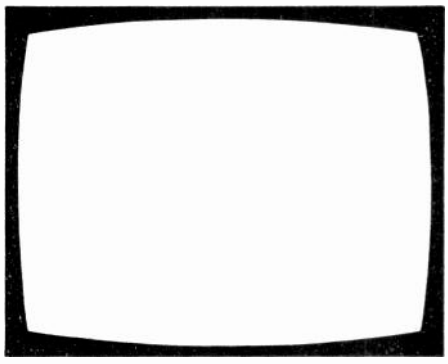

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this month

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M293	7.10	TA7172P	8.90	TDA1870	6.46	UPC1447H	58
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M54544L	3.80	TA7176P	2.50	TDA2523	3.40	UPC577H	2.46
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MN1219	11.43	TA7205AP	3.72	TDA2530	2.70	UPD553C164	20.76
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MC1310P	1.84	TA7222	2.42	TDA2541	3.84	UPD546C107	22.28
MC1327	1.70	TA7223P	3.74	TDA2560	3.50	UPD547C049	11.18
MC1330P	1.84	TA7227P	5.98	TDA2576A	3.75	U05G	1.27
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ML923	2.90	TBA120T	1.47	TDA3190	2.00		
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MS1515L	3.28	TBA396	1.75	TDA3561	6.66		
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SAA1250	4.99	TBA480Q	1.82	TDA3651A	4.50		
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SAA5012	6.60	TBA530(Q)	1.38	TDA3950	4.37		
SAA5020	5.90	TBA540	1.76	TDA4420	5.55		
SAA5030	8.25	TBA560(Q)	1.93	TDA4500	5.84		
SAA5050	8.50	TBA570	1.79	TDA4503	5.68		
SAF1032	6.30	TBA690	1.50	TDA4600	2.95		
SAF1039	7.77	TBA700	2.12	TDA4600-2D	2.95		
SAS560S	2.07	TBA720	2.64	TDA8180	4.00		
SAS570S	2.07	TBA750	2.98	TDA9503	4.21		
SAS660	3.25	TBA800	1.62	TEA1009	1.86		
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SAS590	2.90	TBA820M	1.25	UPC566H	2.95		
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SL1327Q	1.20			UPC1028H	2.52		
				UPC1032H	94		
				UPC1042C	1.56		
				UPC1156H	4.26		
				UPC1158H	3.50		
				UPC1163H	2.48		

COMPUTER ICs

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2764	3.20
27128	4.95
27256	4.75
4116	1.10
4164	1.60
6264	2.75
6522	4.09
Z80A CPU	1.70
8271	60.00
ZTX213	17
ZTX313	27
ZTX650/1	35
LM1889	2.00
74LS260	0.55

COMMODORE ICs

6510 CPU	5.66
6526 CIA	Keyboard
Int.	5.11
6561	7.74
6569 Col. Cont.	Vid. 20.77
6581 Sound Gen.	7.79
901225 ROM	Char. 3.37
901226 ROM	Basic 6.45
901227 ROM	Kernel 3.52
906114 PLA	4.51
4164 RAM	1.60
Timer 555	46
8701 Clock Chip	5.46

THYRISTORS

DEC1	2.20
DEC2	2.20
THY15/80	2.40
THY15/85	2.40
Transistor mounting kit TO66, TO3, TO220AB	30

LARGE RANGE OF ICs/SEMIS FOR SINCLAIR/AMSTRAD PRODUCTS AVAILABLE

SEMICONDUCTORS

AC107	35	BC558	9	BF273	24	MR475	4.85
AC126	34	BC635	19	BF274	24	MR479	4.85
AC127	34	BC637	39	BF336	40	MR477	4.90
AC128	34	BC638	33	BF337	41	OT121	1.91
AC128K	40	BC639	30	BF338	41	R2008B	1.90
AC141	62	BC640	32	BF355	56	R2010B	1.92
AC141K	39	BCY72	13	BF362	68	R2265	1.50
AC176	35	BC372S	85	BF363	72	R2322	84
AC176K	35	BD115	45	BF371	30	R2323	67
AC186	41	BD116A	90	BF392	35	R2461	1.60
AC187	38	BD124P	84	BF422	34	R2540	3.20
AC187K	46	BD131	50	BF423	46	RC4558	2.20
AC188	35	BD132	49	BF457	35	RCA16334	90
AC188K	46	BD133	60	BF458	43	RCA16029	1.18
AD143=OC28	82	BD135	38	BF459	58	RCA16039	1.18
AD145	85	BD136	38	BF460 = BF462	86	RCA16092	1.18
AD161	64	BD137	38	BF469	63	RCA16040	96
AD162	54	BD138	35	BF470	66	RCA16041	84
AD161/62 MP	1.15	BD139	35	BF597	16	RCA16334 =ON447	90
AF106	49	BD140	44	BF757	54	RCA16335 =ON448	90
AF114	89	BD144	1.70	BF758	54	RCA16957	2.88
AF121	75	BO150	60	BFR39	27	TIC45	1.18
AF124	48	BD159	65	BFR40	30	TIC46	60
AF125	53	BD160	1.50	BFR79	85	TIC47	72
AF126	53	BD166	52	BFR90	1.74	TIL32	65
AF127	53	BD179	70	BFT42	42	TIL78	48
AF139	63	BD182	1.20	BFT43	42	TIP29C	43
AF178	1.54	BD183	1.18	BFW10	60	TIP30A	47
AF239	60	BD201	85	BFX29	40	TIP30C	43
AF279	1.56	BD202	91	BFX84	42	TIP31C	55
AL102	4.90	BD203	80	BFX85	30	TIP32C	42
AU110	3.01	BD204	99	BFX86	30	TIP33B	75
BC107	20	BD222	46	BFX88	46	TIP34B	1.06
BC108	20	BD223	56	BFY50	32	TIP41C	47
BC109	20	BD225	47	BFY51	32	TIP42C	50
BC114	12	BD232	82	BFY52	32	TIP47	93
BC115	17	BD233	66	BFY90	95	TIP11211	69
BC116A	35	BD234	63	BR100	34	TIP120	65
BC117	30	BD235	60	BR101	95	TIP161	2.15
BC118	24	BD236	65	BR103	83	TIP2955	90
BC119	36	BD237	57	BR303	1.46	TIP3055	63
BC139	32	BD238	65	BRC4443	1.94	TIS91	32
BC140	32	BD243	85	BRC4444	1.98	TU106/02	1.80
BC141	30	BD244	85	BRY39	56	15051V	3.43
BC142	30	BD410	79	BRY55	45	T6069V	38
BC143	31	BD434	74	BRY56	57	T6071	5.95
BC147	13	BD437	86	BSV57B	89	T9063V	4.70
BC148	13	BD438	94	BT100	1.65	T9064V	1.14
BC149	12	BD507	69	BT101	1.20	T9022W	43
BC157	16	BD508	80	BT106	1.60	T9053/4	4.50
BC158=BC558	16	BD509	86	BT108	1.69	2N696	21
BC159	15	BD510	86	BT109	1.31	2N918	82
BC160	52	BD278A	81	BT116	1.87	2N2904	51
BC161	32	BD517	60	BT119	3.66	2N2905	28
BC170B	15	BD519	1.08	BT120	3.66	2N3055	79
BC171	15	BD520	75	BT151/800	2.07	2N3702	16
BC172	15	BD535	82	BU104	2.00	2N3703	16
BC173	16	BD536	91	BU126	1.75	2N3705	10
BC174	10	BD696A	1.49	BU204	1.50	2N3706	10
BC177	27	BD697=701	1.63	BU205	1.87	2N3708	17
BC178	26	BD698=702	1.50	BU206	1.80	2N5294	48
BC182L	15	BD701	1.63	BU208	1.60	2N5296	48
BC183L	15	BD707	1.50	BU208A	1.65	2N5298	69
BC184L	15	BDX32	2.10	BU208D =BU800	2.20	2SB337	1.86
BC186	35	BF115	38	BUW81A	3.84	2SA715	1.98
BC187	25	BF117	36	BU208/02	2.10	2SA771	3.04
BC204	10	BF125	26	BU326A	2.00	2SA835	1.82
BC208	13	BF127	47	BU407	1.70	2SA1027R	1.27
BC209	10	BF154	15	BU426	3.07	2SA1175	89
BC212	15	BF158	18	BU500	2.50	2SB733	1.18
BC212L	15	BF160	27	BU526	2.46	2SB740C	1.24
BC213	15	BF167	24	BU508	3.20	2SB856	1.84
BC214	15	BF173	37	BU508D	2.77	2SC403C	32
BC237	14	BF177	52	BU806	1.40	2SC867A	3.07
BC238	14	BF178	46	BU807	2.94	2SC1034	6.57
BC251A	18	BF179	42	BU826	4.95	2SC1061 = 2SC1986	3.07
BC252	12	BF180	39	BUT1L	2.58	2SC1114	6.57
BC261	33	BF181	39	BUW84	1.45	2SC1124	1.27
BC262	30	BF182	36	BUX84	1.50	2SC1316	8.05
BC300	50	BF183	29	E1222	40	2SC1362-7	43
BC301	51	BF184	42	BX342	5.12	2SC1364	43
BC303	33	BF185	36	CX104A	6.57	2SC1413A	9.23
BC307	20	BF194/394	16	CX136A	9.23	2SC1475	43
BC308	25	BF195	16	CX143A	9.23	2SC1962	1.84
BC323	99	BF196	16	CX186	6.57	2SC2009	32
BC327	22	BF197	16	BUT11	2.58	2SC2278	1.24
BC328	18	BF198	18	GL4850	14	2SC2335 Kit	11.18
BC337	18	BF199	21	ME0411	20	2SC2369	4.14
BC338	18	BF200	35	MJE340	68	2SC2551	1.27
BC461	42	BF224	40	MJE520	50	2SC2785	43
BC527	35	BF241	38	MJ3000	1.98	2SC3153	5.12
BC547	13	BF256	60	MPSA92	35	2SC495	1.10
BC548	13	BF257	34	MR814	45	2SC496	1.31
BCX32 = BC637	39	BF258	34	MR854	55	2SC643A	1.82
BC549	10	BF259	34			2SC1096	1.72
BC550	10	BF262	84			2SC1172Y	5.50
BC557	10	BF263	81			2SC1173Y	1.69
		BF271	24			2SC1306	2.73
						2SC1307	3.00
						2SC1449	1.67
						2SC1520	68
						2SC1678	2.67
						2SC1909	2.90
						2SC1953	1.44
						2SC1986 =2SC1061	2.94
						2SC2028	1.82
						2SC2029	2.50
						2SC2078	2.90
						2SC2091	1.34
						2SC2166	2.73
						2SD870 (Sony)	8.05
						2SD257	3.04
						2SD725	11.18
						2SD773	32
						2SD774	1.24
						2SD1164	1.27
						2SD1497-02	5.12
						2SD1497-06	5.12
						2SD1453	2.20
						1CPS10	98
						1CPN25	98

VALVES

30FL2	1.70	EF80	95
DY802	98	EF86	2.20
DY86/7	66	EF183	99
ECC81	1.08	EF184	1.09
ECC82	98	EL90	1.75
ECC83	1.07	EL34	3.50
ECC84	80	EL84	1.05
ECC85	98	EY86/7	68
ECC88	1.35	EY500A	2.25
ECF80	1.30	EZ80/81	56
ECF82	88	GY501	1.45
ECH81	1.60	GZ34	3.50
ECH84	1.66	KT66	9.75
ECL80	84	KT77	8.50
ECL82	1.30	KT88 (alt type)	12.00
ECL86	1.99	PC92	4.50

PC97	1.65
PCC85	85
PCC805	1.40
PCF80	1.00
PCF200	1.35
PCF800	1.38
PCF801	1.13
PCF802	1.12
PCF805	1.80
PCF808	1.63
PCH200	1.45
PCL82	1.20
PCL84	1.20
PCL805	1.09
PCL86	92
PFL200	1.86
PL36	1.87
PL81	94
PL95	2.25
6L6GT	2.30
12HG7	3.20
12BH7A	2.75
PL504	1.65
PL508	2.90
PL509/19	5.30
PY88	81
PY500A	2.30
PY800/1	69
UCH81	2.25
UCL83	1.82
UY85	1.35
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SONY	C7/J7/SL17	4.35
JVC	TCE3V00/01/06/16/23/24	4.35
JVC	HR2200/3320/3330 3660/1100/7700	4.35
AKAI	VS9700	4.35
HITACHI	VT5000	4.35
SHARP	VC6300/6500	4.35
SONY	TC6 GEN	4.35

VIDEO BELT KITS

VEKIT 1	AKAI VS9300/VS9500/VS9800 JVC HR3300/HR3320/HR3330/HR3360 TCE	8903/3V00/3V16/3V22	3.50
VEKIT 2	PANASONIC	NV7000B/NV7200B	3.00
VEKIT 3	SONY	SLC5/7	3.75
VEKIT 4	SONY	SL8000/8500/8600	4.50
VEKIT 5	SONY	SL3000UB	4.00
VEKIT 6	PANASONIC	NV3000B	3.00
VEKIT 7	SANYO	9300P	4.25
VEKIT 8	PANASONIC	NV2000B	3.75
VEKIT 9	PANASONIC	NV8600B/8610/V011	4.42
VEKIT 10	TOSHIBA	V8600	3.00
VEKIT 11	SHARP	VC7300	3.50
VEKIT 12	SHARP	VC6300/6600	4.00
VEKIT 13	SANYO	VTC5000	1.95
VEKIT 14	SANYO	VTC5300	2.50
VEKIT 15	JVC	HR7650	2.50
VEKIT 17	SHARP	8300	1.76
VEKIT 18	SHARP	9300	1.47
VEKIT 19	HITACHI	VT8000	1.12
VEKIT 20	HITACHI	VT11/33	2.15
VEKIT 21	HITACHI	9500	1.12
VEKIT 22	SONY	SLC6	3.75
VEKIT 25	TOSHIBA	V7540	1.90
VEKIT 26	JVC	HR7000	96p
VEKIT 27	THORN	3V29	1.95

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	27	3.9	52p
AKAI	26	20	3.9	50p
JVC	32.8	3.4	3.9	56p
JVC	23.9	4.8	4	56p
NATPAN	31.2		56p	

VIDEO HEADS

Thorn New Life (Nat Pan)*	25.95
Thorn New Life Heads (exchange)*	22.95
3HSSV	24.93
4HSS (3HSSN)	24.93
PS3B Sony/Beta	28.12
Philips V2000 and V2023	64.00
Philips 1700	64.00
Sanyo 9300/9455/9500	53.00
Sanyo 5000/5300/5400	53.00
Toshiba 9600 Upper Ass.	12.50
Toshiba 9600 (Rep. type only) PS3BT	37.50
Sony 8000 UB	49.39
Sony SLC9	49.39
Sony SLC5, 6, 7	49.39
Sharp 3300/9700	56.00
Sharp 3HSS (S P.)	40.62
Hitachi HIVI/VT8000E	35.62
Hitachi VT33E/GEC 4004	35.62
Hitachi VT11/GEC 4100	35.62
Hitachi 9300/4001 3HSSH	32.12

* Thorn New Life heads are refurbished heads and we have types to cover most VHS types on an exchange basis

VIDEO TAPE

SKC	E60	2.50	Scotch E30		3.66
	E120	2.88		E60	4.00
	E180	2.80		E120	3.24
	E240	3.78		E180	3.86
	L500	2.90		L750	5.22
	L750	3.40		VCC360	6.33
				VCC480	7.23

VIDEO SUNDRIES

VHS Drum Motor	25.50
VHS Capstan Motor	25.50
Sanyo 5000 Reel Motor	12.95
Sharp Reel Motor	19.50
Take up idler Ass./Clutch Ass.	
VHS (general purpose) Thorn/JVC etc.	5.95
Sharp 381/383/386/9100 9300/9500	2.97
Sanyo	6.95
Hitachi F.F. Idler VT11E/VT33E	3.91
Video Lamps	
Nat. Pan. Bulb VHS	1.30
General Purpose VHS	1.41
3V23 with plug VHS	1.95
Video Care	
Universal Copy Kit	5.50
Head Cleaner	90
Beta Eccentricity Gauge	55.00

VARICAP TUNERS

ELC1043-05	8.40
ELC104305 Mullard	12.50
ELC1043-06	8.40
ELC2003	19.50
Philips G8/G9	10.50
Philips G11 (U321)	9.90
TX90	13.75
U322	7.30
U341	9.50
U342	8.50

PUSH BUTTON ASS.

Hitachi 4 way	12.36
Philips G8 (early)	17.82
Philips G8 (late)	18.97
Philips G11 Tip Switch unit	26.50
Philips KT3	16.67
Philips KT30	13.22
Thorn 9000 6 way	20.70
Pye 697 repair kit	10.35
Pye 725-735 (also Red Mk.1)	12.60
Pye 725-735 tuning head with PCB	12.50
Decca 4 way	7.93
Decca 6 way	9.17
Decca 4/6 way conversion kit	17.50
Decca 7 way piano key rep. kit	15.62
GEC 2110 6 way	10.92
GEC 6 way slim	10.29
GEC/ITT/PYE 7 way	16.67
GEC Conversion kit	16.50
Rank A823	12.36
Rank T20A	11.21
ITT CVC 8/9 (mod)	13.80
ITT 6 way with VCR	8.90
Thorn 8500	6.50
GEC 7 B/P c neons	10.50

LINE OUTPUT TRANS.

Philips 210/300 Mono	10.00
Philips G8	8.75
Philips G9	9.50
Philips KT3	15.95
Philips K30	17.94
Philips TX2	13.39
Philips TX3	14.41
Philips G11	15.58
Pye 713/715	10.00
Pye 725 90°	10.50
Pye 169	10.00
Pye 741	9.90
Bang & Olufson (2000,3000)	14.69
DECCA 80	8.58
Decca 100	8.58
Decca 1700	9.00
Decca 1730	8.58
Decca 2230	8.58
GEC 2110	16.75
GEC 2040	9.50
ITT CVC 1/9	10.85
ITT CVC 25/30/32	8.65
ITT CVC 20	8.60
ITT CVC 45	8.60
R.B.M. T20	13.95
R.B.M. BUSHRANGER T16A	10.00
R.B.M. BUSHRANGER T18A	10.00
Thorn 3000 EHT	9.95
Thorn 3000 SCAN	7.95
Thorn 8500	17.50
Thorn 3000/3500 Mains	10.00
Thorn 1615	12.50
Thorn 1691	9.68
Thorn TX9	23.85
Thorn 9600 (Gen Thorn)	21.79
Thorn 9000	25.53

RECTIFIER TRAYS

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Thorn 1500 5 Stick	5.99
Thorn 3500	7.98
Thorn 8000	6.95
Thorn 8500/8800	7.15
Thorn 9000	8.70
Decca 1730/1830	5.48
Decca 30	6.76
Decca 80	7.12
Decca 100	7.50
Decca/Tatung 120/130	6.50
GEC 2100	7.40
GEC 2200 (20AX)	6.50
GEC 2040/2028	6.60
GEC 2110 (pre Jan '77)	7.00
Philips G8 Short Focus Lead	7.12
Philips G8 Long Focus 550	7.12
Philips G9	6.37
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Pye 691/3	7.58
Pye 713 4 Lead	8.79
Pye 713 5 Lead	8.79
Pye 731/25	8.75
R.B.M. A823 plug in	8.75
Rank T20/22	7.12
ITT CVC5/9	7.50
ITT CVC20/25/30 (Mullard)	7.12
ITT CVC45	8.65
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No. 5	9.09	No. 18	10.83
No. 6	11.08	No. 19	10.83
No. 7	9.09	No. 21	14.40
No. 8	10.08	No. 23	13.86
No. 9	9.09	No. 24	27.07
No. 13	11.11	No. 25	12.57

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Solda Mop Stnd.	77
For sold. irons see Antex/Weller Under Specific Spares	
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Battery Press Studs std.	15
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14SWG 100 Amp	1.86
17SWG 60 Amp	1.86
19SWG 45 Amp	1.86
20SWG	2.75
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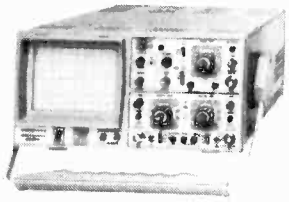

SPECIFICATION
- Bandwidth DC-20MHz
- Sens. Ch1, Ch2. 2mV/cm
- Time Base 0·2s/cm – 20ns/cm
- Trigger DC-40MHz AC, DC, HF, LF, (TV Frame) Active TV Sinc. Sep.
- Invert both channels
- Variable hold-off 10:1
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Including two probes

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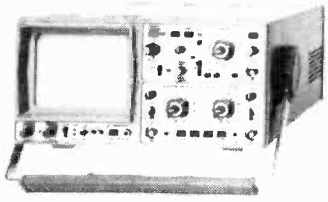

SPECIFICATION
- Bandwidth DC-20MHz
- Sens. Ch1, Ch2. 1mV/cm
- Delay Line
- Time Base 1·2Ss/cm – 10ns/cm
- Delayed Sweep 100ns – 0·1s
- Trigger DC-50MHz AC, DC, HF, LF, (TV Frame)
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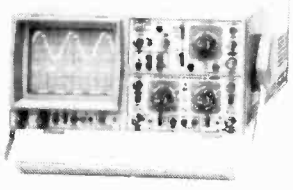

SPECIFICATION
- Digital Storage
- Analogue Real Time (Same as 203-6)
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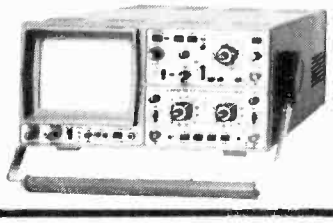

SPECIFICATION
- Bandwidth DC-60MHz
- Sens. Ch1, Ch2. 1mV/cm
- Delay Line
- Delayed Sweep 100ns – 0·1s
- Trigger DC-80MHz AC, DC, HF, LF, (TV Frame)
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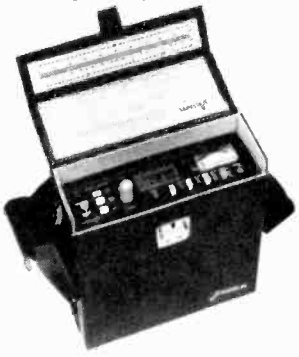

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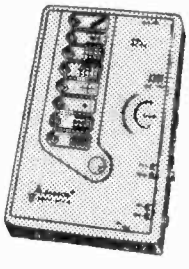

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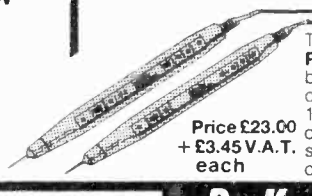

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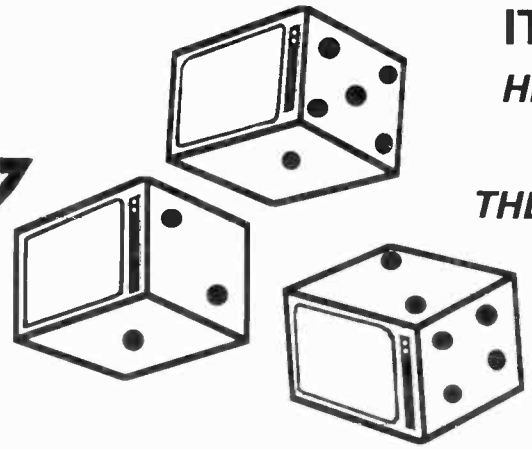

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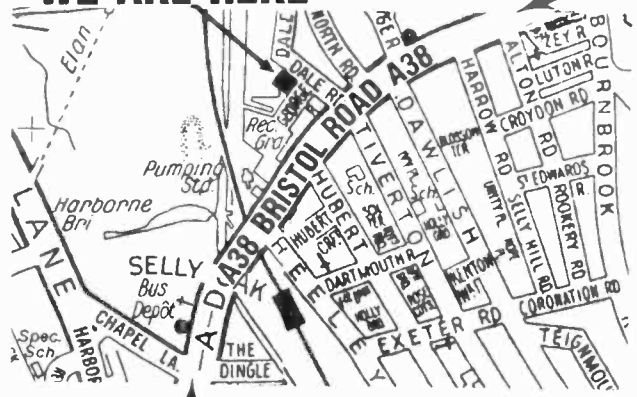

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F/F Idler	1.60
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Rewind Idler	6.25
Take-up Idler (LG)	6.95
Take-up Idler (SM)	5.80

3V29/30

Booster	24.95
Capstan Motor	38.60
Full Erase Head	9.75
Loading Motor	8.95
Pinch Roller	4.95
Pilot Bulb	.95
Reel Motor	31.90
Take-up Clutch	2.35
Take-up Idler	1.40
Take-up Spool	3.95

3V35/36

Capstan Motor	25.95
Cass. Housing	28.95
Cass. Motor	6.70
Erase Head	9.60
Guide Roller	.30
Leaf Switch	1.45
Reel Idler	2.85
RF Converter	24.95
Take-up Clutch	2.45
UHF Tuner	36.50

GEC/HITACHI TV SPARES

HM6232	5.95
HM6251	4.70
HM9032	5.70
STR4211	3.95
STR441	5.50
STR451	5.50
STR454	4.95
STR6020 (Kit)	5.95
ET548 Tuner	14.20
ET556A Tuner	9.95

GEC/HITACHI VIDEO SPARES

V4000H/VT8000

Audio Head	18.95
Capstan Motor	31.90
Idler F.F./Rew	1.85
Pilot Lamp	.65
Pinch Roller	4.95
Play Idler	3.95
Pulley F.F./Rew	.65
Video Head	28.95

V4001H/V4002H
9300E/9500E

Capstan Motor	30.95
Idler F.F./Rew	1.80
Play Idler	4.30
Pilot Bulb	.95
Pinch Roller	4.95
Pulley F.F./Rew	.75
Relay	2.25
R.F. Converter	28.95
Video Head	28.95

V4100H/VT11E

Audio Head	19.95
Capstan Motor	21.95
Clutch Assy	9.40
F.F./Rew Arm	2.90
Pinch Roller	5.50
Relay	2.95
Video Head	27.95

V4004H/VT33E

Capstan Motor	29.95
Clutch Assy	8.95
F.F./Rew Arm	2.90
Video Head	29.95

V4005H/VT63E

Capstan Motor	15.95
Video Head	49.95

NAT. PAN. VIDEO SPARES

NV333 Idler	1.10
NV2000 Idler	1.30
NV3000 Idler	1.25
NV7000 Idler	1.20
NV333 Play Idler	1.20
NV370 Play Idler	3.95
NV333 Load. Gear	2.50
NV2000 Load. Gear	1.60
NV7000 Load. Gear	1.60
NV333 Pinch Roller	4.95
NV2000 Pinch Roller	4.95
NV7000 Pinch Roller	4.95

REMOTE CONTROLS

PHILIPS KT3/30
Repair Kits
Buttons & Foils
Text or Non Text
£6.50

PHILIPS RC5 HANDSET
Suitable for:
KT3/K30/K35/KT40
Text & Non Text
£21.95

SANYO VIDEO SPARES

5000/5300

Capstan Motor	32.95
Gear Idler	6.95
Load. Roller	1.95
Pinch Roller	6.85
Reel Motor	9.95
Reel Pulley	6.95

SERVICE MANUALS

TELEVISION

Ferguson TX9	28.50
Ferguson TX10	39.95
Ferguson TX90	10.95
Ferguson TX100	10.95
Ferguson 1790/1	1.95
Fidelity AVS1600	2.50
Fidelity CTV14R	2.50
Fidelity CTV14S/20R	2.50
Fidelity CTV20	2.50
Fidelity ZX (text)	2.50
GEC C1403H	2.75
GEC C1405H	2.95
GEC C1407H	3.50
GEC C2095H/C2295H	3.50
GEC C2096H/C2296H	3.50
Philips CTX-E	1.00
Philips CTX-S	1.00
Philips G11	3.50
Philips KT3	3.50
Philips K30	3.50
Philips K35	3.50
Philips K40/KT4	3.50
Sony KV2212UB	8.50
Sony KV2252UB	8.50
Sony KV2705UB	8.50

VIDEO RECORDERS

Ferguson 3V29	24.95
Ferguson 3V35/36	26.95
Ferguson 3V44/45	9.35
Ferguson 3V46/47	9.20
GEC V4005H	6.95
GEC V4100H	6.50
Philips 6460/00/05	6.50
Philips 6520/00/05	6.50
Sony C5	9.40
Sony C6	9.40
Sony C6 MkII	9.40
Sony C7	9.40
Sony C9	9.40

SHARP VIDEO SPARES

9300/381/383

Capstan Motor	27.50
Loading Motor	8.85
Pinch Roller	5.95
Reel Idler	3.30
Reel Motor	17.50
Unlock Assy	.75

481/483

Reel Idler	3.25
Reel Motor	16.95

SONY SPARES

C5/C7

Ace Head Assy	33.95
Brake Assy	1.80
Capstan Motor	28.70
Limiter Assy	3.15
Pinch Roller	1.30
Remote Control (C7)	46.95
Rewind Kit	5.25
Timer Lid	1.25

C6

Ace Head Assy	42.20
DC Motor	14.35
Forward Assy	3.55
Pulley Assy	1.25
Reel Motor	14.95
Reel Motor (C6MKII)	19.90
Rewind Kit	4.20

C9

DC-DC Conv.	22.70
Door Assy	4.95
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Gear Kit	6.70
Guide Pin Kit	4.95
Video Head (genuine)	49.95

V.C.R. PILOT BULBS

Amstrad 7000	2.65
Hitachi 8000	.65
Hitachi 9300	.95
National NV2000	1.00
Sharp 8300	1.00
Sharp 9300	2.65
Thorn (Plugged)	.95
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VIDEO BELT KITS

AKAI 9300/9700	2.50
Amstrad 7000	1.50
Ferguson 3V00/16/22	2.50
Ferguson 3V29/30	1.80
Hitachi 8000	1.95
Hitachi 9300/9500	1.80
Hitachi VT11E	1.95
JVC HR7200	1.80
Nat. Pan. NV333	2.20
Nat. Pan. 2000	2.25
Nat. Pan. NV3000	1.95
Nat. Pan. NV7000	1.95
Sanyo VTC5000	1.00
Sanyo VTC5300	1.95
Sanyo VTC5500	1.95
Sanyo VTC9300	2.95
Sharp 8300	2.40
Sharp 9300	2.40
Sony C5/C7	2.50
Sony C6	1.95

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Amstrad 4600/7000/9000	28.95
Ferguson 3V00/22/29/35	25.95
Hitachi 8000 (genuine)	28.95
Hitachi 9300 (genuine)	28.95
Hitachi VT11E (genuine)	27.95
Hitachi VT33E (genuine)	29.95
JVC HR2200/7700	25.95
Nat. Pan NV333	25.95
Nat. Pan NV366	47.25
Nat. Pan NV370/380	28.50
Nat. Pan NV2000/7000	25.95
Philips VCR6460	28.50
Philips VCR6462 (genuine)	43.95
Sanyo VTC5000 (genuine)	47.50
Sharp 9300/9700	29.70
Sony C5/6/7	28.90
Sony C5/6/7 (genuine)	45.00
Toshiba 9600/V31B	33.95

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Please add 75p for p/p U.K. Add 15% VAT to this total. Service Manuals p/p 90p each. Export Orders p/p charged at cost Delivery by return on all stock items.

AN1270	£2.20	AN7146M	£2.20	HA1199	£1.85	LA1111P	£0.95	M5106P	£2.75	STK5451	£6.75	TA7628P	£2.95	2SA101	£0.60
AN203	£2.20	AN7154	£1.90	HA1319	£2.50	LA1140	£2.20	M5134P	£3.25	STK5720	£6.80	TA7640AP	£1.75	2SA103	£0.60
AN210	£1.75	AN7156N	£2.50	HA1339A	£1.85	LA1201	£0.85	M5155P	£1.85	STK5730	£4.25	TA7641BP	£1.95	2SA329	£0.40
AN211A	£2.30	AN7158N	£3.25	HA1366W	£1.80	LA1222	£1.00	M51102L	£3.95	STK7308	£5.95	TA7658P	£1.75	2SA350	£0.60
AN214Q	£1.80	AN7160	£3.75	HA1366WR	£1.85	LA1230	£1.50	M51513L	£1.80	STK8250II	£10.75	TA7668BP	£1.98	2SA495	£0.40
AN217B	£2.20	AN7161	£3.75	HA1367	£3.25	LA1231	£2.35	M51514AL	£1.95	STR440	£5.80	TA7688P	£2.95	2SA539	£0.40
AN228W	£2.90	AN7168	£2.75	HA1368	£1.90	LA1240	£1.95	M51515BL	£2.70	STR441	£5.80	UPC16C	£1.95	2SA562	£0.40
AN234	£5.95	AN7178	£2.95	HA1368R	£1.95	LA1365	£1.50	M51516L	£2.80	STR2012	£7.20	UPC20C	£2.50	2SA643	£0.70
AN236	£2.50	AN7213	£2.20	HA1372	£3.50	LA1368	£2.50	M51517L	£2.80	STR4211	£7.20	UPC30C	£2.20	2SA733	£0.35
AN239Q	£4.20	AN7223	£3.95	HA1374	£2.50	LA1387	£3.60	M51518L	£2.20	STR6020	£7.20	UPC41C	£2.30	2SA768	£0.95
AN240P	£1.50	AN7273	£3.95	HA1377	£2.20	LA1460	£2.50	M51521AL	£1.90	TA7050P	£1.80	UPC561C	£2.50	2SA899	£0.75
AN241P	£1.50	AN7310	£1.20	HA1388	£3.50	LA2100	£2.95	MB3705	£1.80	TA7051P	£1.80	UPC566H	£0.75	2SA952	£0.40
AN247P	£2.50	AN7311	£1.20	HA1389	£2.20	LA3160	£1.50	MB3712	£1.50	TA7054P	£2.20	UPC573C	£2.50	2SA1015	£0.35
AN259	£2.75	BA301	£0.80	HA1389R	£2.20	LA3161	£2.50	MB3713	£1.60	TA7066P	£1.50	UPC574J	£0.65	2SA1102	£2.20
AN260P	£2.20	BA311	£0.95	HA1392	£2.50	LA3201	£0.95	MB3722	£3.50	TA7070P	£1.75	UPC575C	£1.00	2SA1103	£2.20
AN262	£1.60	BA313	£0.80	HA1394	£2.95	LA3210	£0.75	MB3730	£2.50	TA7074P	£1.95	UPC576H	£2.20	2SA1104	£2.50
AN271A	£2.50	BA318	£1.50	HA1397	£2.75	LA3300	£1.65	MB3731	£3.50	TA7104P	£2.50	UPC587C	£1.30	2SA1105	£2.75
AN274	£2.75	BA401	£0.80	HA1398	£2.75	LA3301	£1.30	MB3756	£2.60	TA7108P	£1.50	UPC592H	£0.95	2SA1106	£2.75
AN295	£3.60	BA402	£0.80	HA1457W	£1.75	LA3350	£1.30	MB8719	£3.65	TA7109AP	£2.50	UPC595C	£2.20	2SB54	£0.70
AN301	£3.50	BA403	£1.95	HA1112W	£3.75	LA3361	£1.20	SI-1125H	£7.50	TA7120P	£0.75	UPC1001H	£2.20	2SB75	£0.60
AN302	£3.30	BA511A	£1.80	HA11211	£2.30	LA3370	£2.80	STK011	£3.95	TA7122AP	£0.90	UPC1009C	£2.20	2SB341V	£2.75
AN303	£2.75	BA514	£1.90	HA11215A	£4.35	LA4030P	£2.00	STK013	£7.25	TA7130P	£1.00	UPC1018C	£1.95	2SB405	£0.80
AN305	£3.50	BA521	£1.80	HA11219	£3.25	LA4031P	£1.95	STK014	£7.25	TA7136P	£1.00	UPC1025H	£2.30	2SB426	£2.95
AN313U	£2.95	BA526	£3.50	HA11221	£2.75	LA4032P	£1.90	STK015	£5.20	TA7137P	£1.00	UPC1026C	£1.90	2SB471	£3.50
AN315	£2.30	BA527	£1.60	HA11223W	£3.80	LA4051P	£2.20	STK020	£5.75	TA7139P	£2.50	UPC1028H	£0.90	2SB492	£0.75
AN316	£3.75	BA532	£1.60	HA11225	£1.95	LA4100	£1.20	STK022	£5.30	TA7140P	£1.75	UPC1031H	£1.95	2SB509D	£1.95
AN318	£4.95	BA536	£2.40	HA11226	£4.50	LA4101	£1.00	STK025	£7.50	TA7142P	£2.95	UPC1032H	£0.60	2SB536	£0.95
AN331	£2.95	BA547	£2.50	HA11227	£2.20	LA4102	£1.40	STK026	£7.50	TA7145P	£2.50	UPC1035C	£1.95	2SB546	£1.50
AN340P	£1.50	BA612	£1.80	HA11235	£2.30	LA4110	£1.75	STK040	£8.70	TA7150P	£2.75	UPC1037H	£1.25	2SB561	£0.35
AN360	£1.30	BA631	£5.75	HA11244	£4.60	LA4112	£2.95	STK043	£10.50	TA7152P	£2.50	UPC1037II	£1.25	2SB698	£0.40
AN362L	£1.60	BA656	£4.50	HA11401	£2.80	LA4120	£2.20	STK077	£6.50	TA7157P	£1.65	UPC1156H	£2.95	2SB755	£3.50
AN366P	£1.70	BA843	£4.50	HA11423	£4.75	LA4125	£2.20	STK078	£6.75	TA7176P	£2.75	UPC1158H	£0.95	2SB772	£0.35
AN374P	£2.20	BA847	£3.75	HA11440A	£3.95	LA4126	£2.60	STK080	£7.50	TA7193P	£4.00	UPC1165C	£1.30	2SC380	£0.35
AN377	£2.00	BA853	£7.50	HA11701	£3.50	LA4140	£0.80	STK082G	£7.75	TA7202P	£4.50	UPC1168C	£1.30	2SC458	£0.30
AN610P	£1.80	BA1310F	£1.75	HA11703	£4.50	LA4160	£2.40	STK086	£9.50	TA7203P	£1.90	UPC1170H	£1.60	2SC460	£0.35
AN612	£1.80	BA1320	£1.25	HA11704	£5.20	LA4170	£3.50	STK430	£5.50	TA7204P	£1.75	UPC1171C	£1.50	2SC461	£0.35
AN5033	£5.25	BA1330	£1.75	HA11705	£6.95	LA4182	£2.10	STK431	£5.95	TA7205AP	£1.00	UPC1176C	£1.75	2SC503Y	£0.70
AN5265	£3.20	BA1360	£1.80	HA11706	£4.75	LA4192	£1.95	STK433	£5.25	TA7207P	£1.75	UPC1177H	£1.60	2SC536	£0.35
AN5510	£2.75	BA5102A	£2.75	HA11710	£3.75	LA4200	£1.50	STK435	£5.50	TA7208P	£1.75	UPC1181H	£1.10	2SC537	£0.35
AN5620X	£3.50	BA5406	£3.20	HA11711	£9.50	LA4201	£1.60	STK436	£5.25	TA7210P	£2.50	UPC1182H	£1.10	2SC710	£0.35
AN5701	£1.80	BA6137	£2.75	HA11713	£6.50	LA4220	£1.50	STK437	£6.50	TA7214P	£2.60	UPC1183H	£2.20	2SC732	£0.35
AN5722	£1.60	BA6209	£3.75	HA11714	£5.95	LA4230	£2.25	STK439	£5.95	TA7215P	£2.30	UPC1185H	£2.50	2SC733	£0.35
AN5730	£1.85	BA6304	£2.20	HA11715	£6.25	LA4250	£2.75	STK441	£7.95	TA7217AP	£1.60	UPC1186H	£0.90	2SC828	£0.30
AN5732	£1.85	CX0642	£8.50	HA11716	£4.75	LA4420	£1.60	STK443	£7.95	TA7220P	£2.50	UPC1187V	£1.75	2SC840	£1.50
AN5753	£1.95	CX065B	£2.95	HA11717	£5.75	LA4422	£1.40	STK457	£6.50	TA7222AP	£1.30	UPC1215V	£1.35	2SC900	£0.35
AN6250	£2.30	CX075B	£2.75	HA11718	£4.75	LA4430	£1.40	STK459	£6.75	TA7223P	£2.30	UPC1223C	£2.20	2SC929D	£0.35
AN6310	£6.25	CX095C	£2.85	HA11727	£9.50	LA4440	£2.50	STK461	£7.50	TA7225P	£3.25	UPC1225H	£2.00	2SC930D	£0.35
AN6341N	£4.00	CX100D	£6.75	HA11745	£9.00	LA4445	£2.75	STK463	£8.40	TA7226P	£3.20	UPC1236H	£2.50	2SC1034	£4.75
AN6344	£4.75	CX101G	£7.75	HA11747ANT	£9.50	LA4460	£1.80	STK465	£8.50	TA7227P	£2.20	UPC1263C	£2.50	2SC1061	£1.20
AN6350	£7.50	CX130	£4.75	HA11749	£4.75	LA4461	£1.80	STK501	£6.25	TA7229P	£3.25	UPC1277H	£2.75	2SC1096	£0.70
AN6356N	£3.85	CX136A	£7.50	HA11750	£5.00	LA4500	£2.60	STK0025	£4.95	TA7230P	£1.95	UPC1278H	£2.75	2SC1364	£0.35
AN6360	£4.50	CX143A	£7.50	HA11753NT	£8.50	LA4505	£2.80	STK0029	£4.75	TA7232P	£2.95	UPC1350C	£1.20	2SC1815Y	£0.45
AN6362	£5.50	CX157	£4.25	HA11756NT	£8.50	LA4507	£4.25	STK0039	£4.75	TA7240AP	£2.95	UPC1353C	£1.95	2SC1875	£2.95
AN6363	£7.50	CX158	£3.75	HA11768	£4.50	LA4520	£2.50	STK0040	£6.25	TA7241AP	£2.95	UPC1356C	£2.00	2SC1942	£3.25
AN6387	£5.95	CX160	£3.50	HA11788	£4.50	LA5112	£1.85	STK0049	£5.50	TA7270P	£2.75	UPC1363C	£2.20	2SC1957	£0.80
AN6610	£1.80	CX161A	£3.50	HA11816NT	£6.50	LA6458D	£1.20	STK0059	£7.00	TA7310P	£1.85	UPC1378H	£2.40	2SC1969	£1.75
AN6677	£6.30	CX162	£3.95	HA11828NT	£9.50	LA7016	£2.75	STK0060	£7.75	TA7312P	£1.50	UPC1382C	£1.10	2SC2078	£0.95
AN6811	£1.60	CX170	£6.75	HA12001W	£6.50	LA7215	£2.75	STK0080	£7.75	TA7313AP	£1.50	UPC1384C	£2.85	2SC2166	£0.95
AN6873	£4.50	CX181	£8.75	HA12002	£2.95	LA7751	£4.75	STK2028	£7.50	TA7314P	£2.50	UPC1387C	£2.50	2SC2335	£1.50
AN6884	£2.75	CX1129	£6.75	HA12017	£2.75	LA7755	£3.20	STK2029	£5.75	TA7315AP	£2.35	UPC1391H	£1.50	2SC2577	£1.95
AN7105	£2.30	HA1124A	£2.75	HA12035	£9.50	LA7800	£1.95	STK2129	£6.75	TA7317P	£2.75	UPC1403CA	£5.75	2SC2578	£2.75
AN7110	£1.50	HA1125	£1.75	HA12038	£6.75	LA7801	£2.95	STK2230	£6.50	TA7324P	£2.50	UPC1420CA	£6.50	2SC2579	£2.75
AN7111	£1.50	HA1137W	£1.75	HA12413	£2.75	LA7806	£2.75	STK3042	£6.50	TA7325P	£1.00	UPC1458C	£0.95	2SC2580	£2.75
AN7114E	£1.75	HA1144	£4.25	HA13001	£2.95	LA7808	£2.95	STK4060	£6.50	TA7328AP	£2.20	UPC1533HA	£2.75	TDA1515	£4.50
AN7115E	£1.60	HA1151	£2.50	HA13402	£4.95	LB1287	£2.75	STK4141II	£7.50	TA7331P	£2.20	UPC4557C	£1.50	TDA2002	£0.80
AN7116	£1.50	HA1156W	£1.20	HA13403	£7.50	LB1405	£2.20	STK4191II	£8.95	TA7343P	£2.95	UPC4558C	£0.90	TDA2003	£0.90
AN7120	£1.50	HA1167	£3.75	HA13430A	£4.50	LC4066B	£2.95	STK4332	£5.75	TA7607AP	£2.95	UPD1514C	£5.75	TDA2004	£2.20
AN7130	£1.30	HA1196	£1.75			LC7120	£3.50	STK4392	£7.50	TA7608CP	£3.95	UPD4514BC	£3.50	TDA2005	£2.75
AN7145M	£1.95					LC7130	£3.50	STK5211	£6.75	TA7609P	£2.70	X0042CE	£2.20	TDA2006	£1.50
						LC7131	£3.75	STK5421	£6.50	TA7611AP	£3.20	X0077CE	£9.95	TDA2020	£1.40
						LC7136	£2.75	STK5422	£6.75	TA7614AP	£2.75	X0092CE	£5.60	TDA2030	£1.40
						LC7137	£2.75			TA7617AP	£2.50			TDA3562A	£6.00

T. POWELL

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HITACHI VT5000 (7)	£2.20
JVC HR3300/3600 (9)	£2.50
JVC HR3360/3660 (7)	£2.50
JVC HR7700 (3)	£1.70
PANASONIC NV333 (5)	£1.90
PANASONIC NV2000 (5)	£1.90
PANASONIC NV7000 (5)	£1.75
PANASONIC NV8600 (7)	£2.25
SANYO VTC5500 (3)	£1.50
SANYO VTC9300 (4)	£2.75
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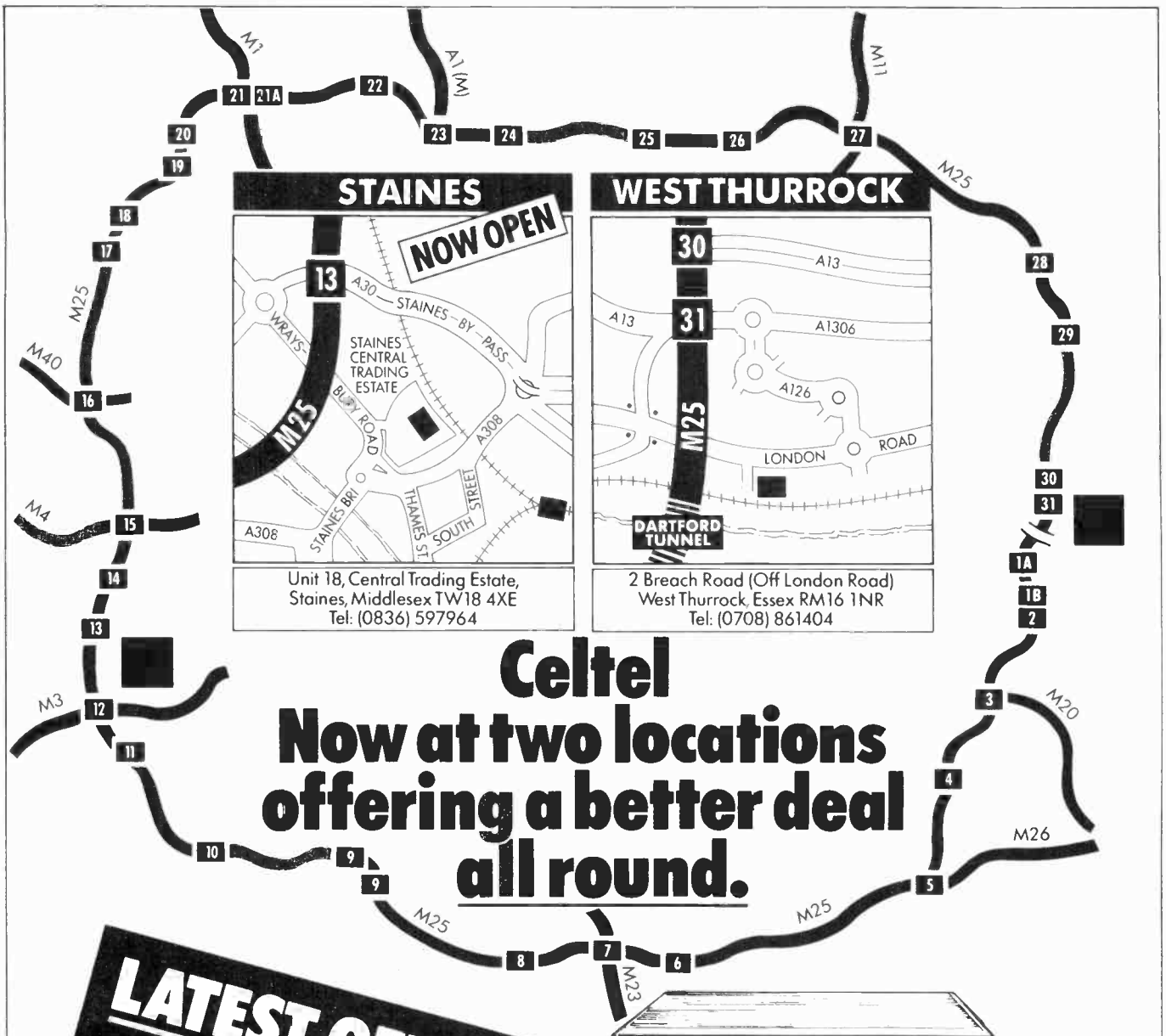

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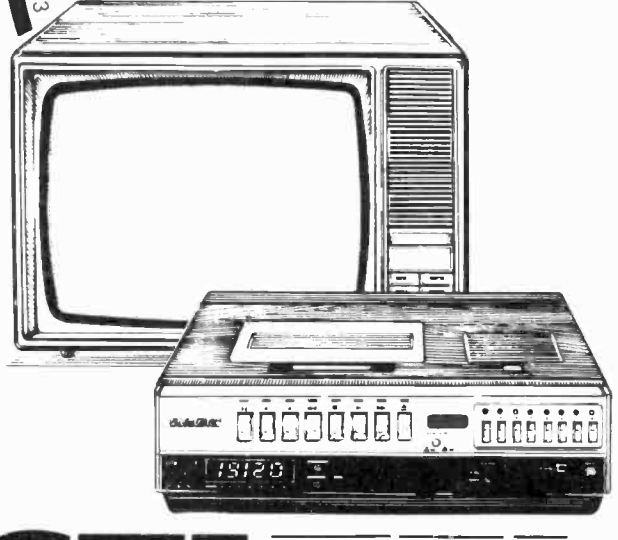

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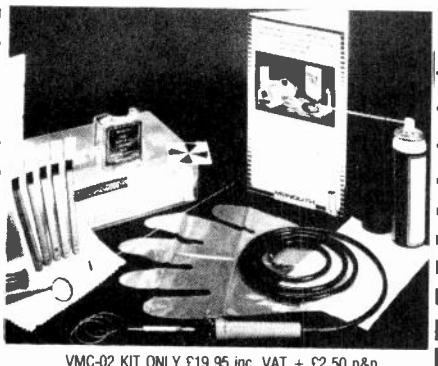

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NV333, NV366 ..... (Replacement) £0.95
NV333, NV366 ..... (Genuine) £2.90
NV370, NV230, NV430 ..... (Genuine) £4.50
NV777, NV788 ..... (Genuine) £3.45
NV730 ..... (Genuine) £4.50

Ferguson/JVC
3V00, 3V16, 3V22 (Large clutch) £5.95
3V00, 3V16, 3V22 (Small clutch) £6.95
3V29, 3V30, HR7200, HR7300 ..... £3.90
3V35, 3V36, 3V38, 3V39, HRD120 ..... £3.90

Sanyo
VTC9100, VTC9300 ..... £1.90
VTC5000 Reel drive pulley £6.50

Sony
SLC5, SLC7 ..... Rewind kit £4.95
SLC8 ..... Rewind kit £4.95

Sharp
VC9100, VC9300, VC9500 ..... £3.90
VC381, VC383, VC386 ..... £3.90
VC482, VC483, VC581 ..... £3.90

Hitachi
VT8000, VT8300, VT8500 ..... £4.72
VT9300, VT9500, VT9700 ..... £4.75
VT11E, VT14E, VT17E, VT19 ..... £3.96
VT33, VT63, VT64, VT65 ..... £3.96

Akai
VS2, VS3, VS4, VS5 ..... £4.50

Fisher
FVHP615, FVHP710, FVHP725, etc. £6.90
We also carry all play idlers and clutches etc. for models listed plus many more.

TELEVIDEO SERVICES

145 STATION RD, BEESTON, NOTTINGHAM NG9 2AZ

TEL: 0602-226070

Please add 50p post & packing and then add 15% VAT to total
OFFICIAL ORDERS ACCEPTED FROM SCHOOLS, COLLEGES, ETC.

£1 BAKERS DOZEN PARCELS

Price per pack is **£1.00.*** Order 12 you get one extra free.
All the parcels listed beloware brand new compenents.
Unless marked s.h.

1. 5 – 13 amp ring main junction boxes
2. 5 – 13 amp ring main spur boxes
5. 3 – flush electrical switches
7. 4 – in flex line switches with neons
8. 2 – 80 watt brass cased elements
9. 2 – mains transformers with 6V 1A secondanes
10. 2 – mains transformers with 12V ½A secondaries
11. 1 – extension speaker cabinet for 6½" speaker
12. 5 – octal bases for relays or valves
13. 12 – glass reed switches
14. 4 – OCP 70 photo transistors
16. 4 – tape heads, 2 record, 2 erase
17. 1 – ultrasonic transmitter and 1 receiver with circuit
18. 2 – 15000 mfd computer grade electrollics
19. 2 – light dependent resistors
20. 5 – different micro switches
21. 2 – mains interference suppressors
22. 2 – 25 wat crossover units 2 way
23. 1 – 40 watt 3 way crossover unit
28. 1 – 6 digit counter mains voltage
30. 2 – Nicad battery chargers
31. 1 – key switch with key
32. 2 – humidity switches
33. 2 – aerosol cans of ICI Dry Lubricant
34. 48 – 2 metre lengths colour-coded connecting wire
36. 2 – air spaced 2 gang tuning condensors
37. 2 – solid diaelectric 2 gang tuning condensors
38. 10 – compression trimmers
41. 8 – rocker switch 10 amp mains SPST
43. 5 – Rocker Switches 10 amp SPDT Centre Off
44. 4 – Rocker Switches 10 amp DPDT
45. 1 – 24 hour time switch mains operated (sh)
46. 1 – 6 hour clock timeswitch
48. 2 – 6v operated reed switch relays
49. 10 – neon valves – make good night lights
50. 2 – 12V DC or 24V AC, 3 CO relays
51. 1 – 12V 2 CO miniature relay very sensitive
52. 1 – 12V 4 CO miniature relay
53. 2 – mains operated relays 3 × 8 amp changeovers
55. 1 – locking mechanism with 2 keys
56. 1 – Miniature Uniselector with circuit for electric jigsaw puzzle
57. 5 – Dolls House switches
60. 5 – ferrite rods 4" × 5/16" diameter aerials
61. 1 – 4 ferrite slab aerials with L&M wave coils
62. 4 – 200 ohm earpiece
63. 1 – Mullard Thysistor trigger module
64. 10 – assorted knobs ¼ spindles
65. 5 – different thermostats, mainly bi-metal
66. 1 – Magnetic brake – stops rotation instantly
67. 1 – low pressure 3 level switch can be mouth operated
69. 2 – 25 watt pots 8 ohm
70. 2 – 25 watt pots 1000 ohm
71. 4 – wire wound pots – 18, 33, 50 and 100 ohm your choice
73. 4 – 3 watt wire would pots 50 ohm
77. 1 – time reminder adjustable 1-60 mins clockwork
78. – 5.5 amp stud rectifiers 400v
85. 1 – mains shaped pole motor ¾" stack – ¼ shaft
86. 2 – 5" ali fan blades fit ¼" shaft
87. 2 – 3"plastic fan blades fit ¼" shaft
88. 1 – mains motor with gear box 1 rev per 24 hours
89. 1 – mains motor with gear box 1 rev per 24 hours
91. 2 – mains motors with gear box 16 rpm
93. 4 – 11 pin moulded bases for relays
94. 5 – B7G valve bases
95. 4 – skirted B9A valve bases
96 1 – thermostat for fridge
98. 1 – motorised stud switch (s h.)
101. 1 – 2½ hours delay switch
103. 1 – 6v mains power supply unit
104. 1 – 4½ mains power supply unit
105. 1 – 5 pin flex plug and panel socket
107. 1 – 5" speaker size radio cabinet with handle
109. 10 – ¼" spindle type volume controls
110. 10 – slider type volume controls
112. 1 – heating pad 200 watts mains
114. 1 – 1W amplifier Mullard 1172
115. 1 – wall mounting thermostat 24V
118 1 – teak effect extension 5" speaker cabinet
120. 2 – p.c. boards with 2 amp full wave and 17 other recs
122. 10 – mtrs twin screened flex white p.v c outer
132. 2 – plastic boxes with windows, ideal for interrupted beam switch
188. 1 – plastic box sloping metal front, 16 × 95mm average depth 45mm
241. 1 – car door speaker (very flat) 6½" 15 ohm made for Radiomobile
243. 2 – speakers 6" × 4" 16 ohm 5 watt made for Radiomobile
266. 2 – mains transformers 9V ½A secondary split primary so ok also for 115V
267. 1 – mains transformers 15V 1A secondary p.c b. mounting
330 2 – 6v 0.6v mains transformer 3A p c.b mounting
350. 40 – double pole leaf switches
365. 1 – 7uf 660v 50hz metal cased condenser
453. 2 – 2¼in. 60ohm loudspeakers
454. 2 – 2¼in. 8ohm loudspeakers
463. 1 – mains operated relay with 2 sets c/o contacts
464. 2 – packets resin filler/sealer with cures
465. 3 – 5A round 3 pin plugs will fit item 193
466. 4 – 7 segment l.e.d. displays
470. 4 – pc boards for stripping, lots of valuable parts
473. 1 – 5" 4ohm speaker with built in tweeter Radio mobil
480. 1 – 3A double pole magnetic tip, saves repairing fuses
498. 4 – 1000uf 25V axial electrolytic cpacitors

TELEPHONE BITS

Master socket (has surge arrestor – ringing condenser etc) and takes B.T plug £3.95
Extension socket £2.95
Dual adaptors (2 from one socket) £3.95
Cord terminating with B.T. plug 3 metres £1
Kit for converting old entry terminal box to new B.T. master socket, complete with 4 core cable, cable clips and 2 BT extension sockets **£11.50**
100 mtrs 4 core telephone cable **£8.50**

COMPACT FLOPPY DISC DRIVE EME-101

The EME-101 drives a 3" disc of the new standard which despite its small size provides a capacity of 500k per disc, which is equivalent to the 5¼" disc We supply the Operators Manual and other information showing how to use this with popular computers BBC, Spectrum, Amstrad etc All a a special snip price of **£27.50** including post and VAT Data available separately **£2**, refundable if you purchase the drive

EVERLASTING BATTERIES!

Well not quite, but if you don't switch it on, the lithium battery has an almost indefinite shelf life, which makes it suitable for emergency, standby & similar applications, also for quartz clocks and instruments that draw only microscopic currents The lithium battery we have is 3v and about as big and thick as 2p coin Price **2 for £1** ref BD558. Note these plug into Dil socket our ref BD553

3 POLE MODEL MOTOR

Will operate from as low as 1 5v and speed will increase steadily as the voltage is increased, at 9v however a governor takes over and the speed remains constant – and ideal motor for models Size approx 28mm × 40mm easily reversible and with good length spindle **60p each** our ref BM30

CASSETTE STEREO TAPE HEADS

with mounting brackets and with tape guides pairs, one record/playback and the other erase **£1** pair ref BD541.

OPTRO INTERRUPTER

Consists of a IR emitter mounted close to light dependent resistor when light or IR is interrupted the change of resistence can be made to switch or operate a relay – useful for counting, motor stopping etc. Price **2 for £1** ref BD545.

VENNER TIME SWITCH

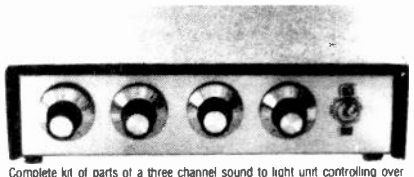
Mains operated with 20 amp switch One on and one off per 24 hrs. repeats daily automatically correcting for the lengthening or shortening day An expensive time switch but you can have it for only **£2.95** without case, metal case – **£2.95**, adaptor kit to convert this into a normal 24hr time switch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

Ex-Electricity Board. Guaranteed 12 months.

12 volt MOTOR BY SMITHS

Made for use in cars, etc. these are very powerful and easily reversible. Size 3½" long by 3" dia. They have a good length of ¼" spindle –
1/10 hp **£3.45** 1/8 hp **£5.75.** 1/6 hp **£7.50**

SOUND TO LIGHT UNIT



Complete kit of parts of a three channel sound to light unit controlling over 2000 watts 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 audio input and output are by ¼" sockets and three panel mounting fuse holders provide thyristor protection A four pin plug and socket facilitate ease of connecting lamps Special price is **£14.95** in kit form.

THIS MONTHS SNIP

9" VDU OR MONITOR ideal to work with computer or video camera uses Philips black and white tube ref M24/306w Which tube is implosion and X-Ray radiation protected. VDU is brand new and has a time bases and EHT circuitry. Requires only a 16v dc supply to set it going Its made up in a laquered metal frame work but has open sides so should be cased (if you are handy with a drill and file you could make a case out of two of our 6½" speaker cabinets) The VDU comes complete with circuit diagram and has been line tested and has our six months guarantee. Offered at a lot less than some firms are asking for the tube alone, only **£16 plus £3 post.** We also have some that failed the line test, again brand new but offered without guarantee at **£8 plus £3 post.** We do a kit for the 16v 2a psu to operate this monitor price is **£3** our ref 3P26

SLIDE SWITCHES Sub miniature size only 10mm × 4mm single pole change over or on/off Price **5 for £1** ref BD553

LOW VOLTAGE RELAY OMRON 3.5v coil, plug in dil sockets. 5a c/o contacts Brand new offered at a silly price **2 for £1** ref BD548

POLARISED RELAY depending upon its direction ac current as low 14 Ma makes this open circuit, so it could be used to protect delicate instruments or as an earth leakage, or reverse voltage trip etc **2 for £1** ref BD549

SLOTTED OPTO SWITCH infra red emitter and sensor mounted in slotted mouulding, so that the emitter beam when broken makes a contactless switch, can be used in electronic ignition, speed sensing etc , etc Price **2 for £1** ref BD545.

24Hr TIME SWITCH. Beautifully made with West German precision Just under 4" square with 15 amp c/o contacts can be set anywhere around 24 hr dial to the nearest 15 mins also with an override switch Ref 8P6 but hurry we have only 300

COMPUTERS

The Acorn "Electron" as used in many schools for games and serious jobs. Works into colour or Black and White TV Proper price was £139, our price, tested and working **£45 + £3 post,** tested but slightly faulty **£36 + £3 post** and lastly tested but not working **£20 + £3 post,** all are new and complete with mains P S U , 300 page handbook, TV lead, and starter cassette Full range of Software also in stock at very low prices

TELEPHONE LEAD

3 mtrs long terminating one end with new BT, flat plug and the other end with 4 correctly coloured coded wires to fit to phone or appliance Replaces the lead on old phone making it suitable for new BT socket Price **£1** ref BD552 or **3 for £2** ref 2P164

POWERFUL IONISER KIT

Generates approx. 10 times more IONS than the ETI and similar circuits. Will refresh your home, office, shop, work room, etc. Makes you feel better and work harder – a complete mains operated kit, case included. **£9.50 + £2.00 P&P.**

J & N BULL ELECTRICAL

DEPT. TV.,250 PORTLAND ROAD, HOVE, BRIGHTON, SUSSEX BN3 5QT

MAIL ORDER TERMS: Cash, P.O. or cheque with order. Orders under £20 add £1 service charge. Monthly account orders (min £20) accepted from schools and public companies. Acces & B/card orders accepted. Brighton 0273 734648. **Bulk orders:** write for quote.

NEW ITEMS

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

£2 POUNDERS

2P120 – 1 combined clockwork switch and thermostat for boiler control
2P122 – 1 30a rotary switch, surface mounting with pointer knob
2P123 – 1 25a rotary switch, surface mounting, cover engraved, high, medium, low and off
2P124 – 1 28kv .001mfd block condensor.
2P127 – 1 30a bridge rectifier assembly on heat sinks.
2P129 – 1 10rpm motor 115v so supplied with adaptor for 230v
2P131 – 1 Crouzet motor 230v fits the Crouzet gearbox
2P132 – 1 ceiling heat-stat for fire warning or protection
2P133 – 1 Circuit breaker 20a, Crabtree ref C50
2P134 – 1 9v 500mA psu, plugs into 13a socket
2P135 – 10m 10 conductor intercom cable
2P136 – 1 2½kw element made for tangential blowers
2P137 – 1 Thermo couple, stainless steel tipped for measuring internal heat.
2P138 – 1 Mains transformer 20v-0-20v 1a upright mounting
2P141 – 1 rechargeable battery D size (4 AH) solder tag ended
2P142 – 10m 4 par intercom cable white PVC outer
2P144 – 1 mains operated relay with 4 × 8a c/o contacts.
2P145 – 1 10,000 uf 70v dc smoothing capacitor
2P146 – 1 7,800 uf 150v dc smoothing capacitor
2P147 – 1 10w 100 ohm line matching transformer
2P148 – 1 Technical information on 3" FDD refundable if you buy fdc
2P149 – 5 diff battery operated model motors.
2P150 – 1 PSU chassis with all components for 24v 2A dc unwired
2P151 – 1 Metal box 14½ × 14 × 4 with lid add £2.00 post
2P152 – 1 Motor start capacitor 80uf 250v.
2P153 – 1 Two station intercom unused but line reject.
2P154a – 1 Nicad charger – plug into 13a socket 5.2v 7UA output
2P154b – 1 Nicad charger – plug into 13a socket 6v 9VA output
2P155 – 1 Mains transformer giving 16, 17, 18 & 20v 60w
2P158 – 1 Oven thermostat with temp. calibrated knob.
2P159 – 1 9v 500ma cased with mains lead and output lead
2P160 – 1 13a plug adaptor fused takes 3 × 13a plugs
2P161 – 1 6" diagonal side cutters.
2P162 – 1 Stereo Matrix PCB mounting de-emphasis K35
2P163 – 1 AC Working capacitor 12uf 660v AC or 1500v dc
2P163a – 1 AC Working capacitor 14uf 350v AC or 800v dc.
2P164 – 3 Phone leads 3 mtrs long tags one end BT plug other end

£3 POUNDERS

3P7 – 1 DC voltage, doubler or halver for 12v to 24v, 12 to 6v, 24 to 12v
3P8 – 1 24hr time switch Sangamo, new condition, guaranteed 1 year
3P9 – 1 12v 500mA psu plugs in 13a socket.
3P10 – 1 Mains transformer 50v 2A with 6.3 pilot light winding, upright mounting, fully shrouded.
3P13 – 1 Noise filter to fit in mains lead of applicance up to 25a
3P15 – 1 waterproof case will take 200 watt transformer
3P16 – 1 signal box, 3 lamps on face plate of metal box size 5½ × 3½.
3P17 – 1 choke and starter to work 8" fluorescent tube at 125w
3P18 – 1 22v 3a mains transformer with bridge rect fitted on top panel
3P20 – 1 0-5a ammeter 3½ ac/dc ex equipment
3P21 – 1 power factor correction condenser 35uf 350ac
3P22 – 1 200va – auto transformer 230 to 115v toroidal encapsulated £1.50 post
3P23 – 1 36v-0-36v tapped 20v-0-20v 100va.
3P24 – 1 3" floppy disc for Amstrad etc
3P25 – 1 "" Electricians pliers

£4 POUNDERS

4P11 – 1 Car Radio aerial.
4P12 – 50m low loss co-ax 75 ohm + £1 post
4P13 – 3 Hortsman time and set switches 15 amp.
4P14 – 1 150w mains transformer "C" core 43v 3.5A secondary
4P15 – 1 powerful motor 2" stack fitted with gearbox final speed 80 rpm. mains operated, could operate door opener etc
4P17 – 1 Uniselector 3 pole 25w, 50v coil standard size
4P18 – 1 Volt meter with digital display (DIGIVISOR).
4P19 – 1 12v dc motor will fit to gearbox 4P20
4P20 – 1 Gear train giving speed reduction

£5 POUNDERS

5P86 – 1 Transformer upright mounting 230/240v primary 2 × 130 1a secondary.
5P88 – 1 transformer in waterproof metal box 24v 5a add £2 post
5P89 – 1 4 bank heating element each 2kw ideal convector heater
5P90 – 1 18" long tangential blower with motor at one end
5P91 – 1 14" blower, motor in middle
5P92 – 10m Audio co-ax double screened 750hm super low loss for TV
5P93 – 1 6" alarm bell 24v dc or ac.
5P94 – " Current transformer 14v out with 1a dc input
5P95 – 1 Vintage photo cell.
5P97 – 1 Impedence matching transformer 0-4-5-8-160 ohm 100 add £1.50 post
5P98a – 1 0-90a ammeter for mounting outside control panel
5P98b – 1 0-180a ammeter for mounting outside control panel
5P99 – 1 Mains operated blower centrafugal output size app 5 × 1½"
5P100 – 1 Mains splitter 45a switch 3 × 15a fused circuits
5P101 – 1 Model motor 1 rpm from 6v reversible

£7 POUNDERS

7P1 – 1 Instant heat solder gun – mains with renewable tip and job light.

£8 POUNDERS

8P1 – 1 Charger transformer 10a upright mounting 230/240 primary 16v 10a secondary
8P2 – 1 6" underdome alarmbell suitable for a fire alarm or burglar alarm mains operated.
8P3 – 1 heat sink big powerful so ideal for power transmitter
8P5 – 1 ⅓ hp motor 900 rpm capacitor run
8P6 – 1 24hr time switch – 2 on offs 16a c/o contacts 3" × 3" × 1½"
8P7 – 1 Silent sentinel invisible ray kit
8P8 – 1 Papst fan 3½ × 3½ × 1½ 230v metal bodied

£10 POUNDERS

10P13 – 1 reversible motor with gearbox 104rpm Parvalux
10P14 – 1 100a time switch 1 on/off per 24hr extra triggers £1 pair
10P15 – 1 Max demand meter 230 AC mains
10P16 – 1 powerful air mover 2 snail type blowers with motor in middle
10P18 – 1 mains operated klaxon.
10P19 – 1 12v alarm bell really loud, mains operated, in iron case + £5 post.
10P21 – 1 super metal box size 19" × 20" × 7" deep lockable + £3 post.
10P22 – 1 sensitive volt meter relay
10P23 – 1 fruit machine heart 3 fruit wheels each stepper motor operated
10P24 – 1 big panel meter face size 4¾ × 2½ 200ua movement scaled 1-10.
10P25 – 1 100w audio transformer 50-0-50w primary 8 ohm secondary
10P26 – 1 'Secretary' phone auto-dialler complete untested sold as such
10P29 – 1 12v engine cooling fan.
10P30 – 1 instrument psu on pcb has 4 outputs 12v 5v 6a 12v 5a/ 5v .5a.
10P31 – 1 7 day time switch 16a c/o contacts sep switches for each day
10P32 – 1 68 rpm 1/6th hp motor reversible

£15 POUNDERS

15P1 – 1 kit for 115w hi fi amp
15P2 – 1 kit for psu to supply one or two 15P1 amps
15P3 – 1 time switch battery or mains operated – 16a c/o contacts,7 day programmable has 36hr reserve

£25 POUNDERS

25P1 – 1 1500 PSI hydraulic pump 24v dc motor, made for operating aircraft undercarriage etc.

LIGHT CHASER KIT

Motor driven switch bank with connection diagram, used in connection with 4 sets of X-mas lights makes a very eye catching display for home, shop or disco, **only £5** ref 5P56.

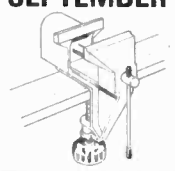
BARCLAYCARD VISA

EAST CORNWALL COMPONENTS

Access

1987 CATALOGUE available – range of components greatly increased – over 136 pages fully illustrated. Price £1.00 per copy (free upon request with orders over £15). Includes 50p Credit Note, Special Offer Sheets, Order Form and Pre-Paid Envelope. Order your copy now.

SEPTEMBER SPECIAL OFFER

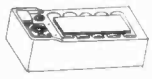


HOBBY VICE

DIECAST ALUMINIUM WITH POLISHED JAWS CAPACITY 50mm

ONLY £4.75
+ 75p P&P + 15% VAT

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 × 75 mm **£5.99**
P&P £1.85 + VAT

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 "FAST CHARGE UNITS", but, to prolong the life of the packs, we have modified them to a standard charger. Full charge of the packs is obtained after 10-12 hours (overnight) charging. Supplied complete with mains 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 **£15** 6-PIN **£16** + £1.85 P&P + 15% VAT

TWIN FLUORESCENT LAMP — 12" DOUBLE TUBE

Attractive white fitting, ribbed perspex diffuser. On/Off switch. 3ft. cable. Transistorised circuitry. Keyhole fitting. 12V DC. 8W Tubes.

PRICE: **£5.50** + VAT

INTEGRATED CIRCUITS (£) EACH

709C	0.35
741	0.16
CA358	0.66
CA810OM	1.20
CA3020	2.10
CA3065	1.60
HA1366WR	1.59
LA4422	3.20
LC7131	4.90
LM324N	0.40
LM380N8-P	0.80
LM380N14-P	1.80
LM1011N	3.20
LM1458N	1.35
LM3900N	0.50
M51513L	2.30
M51515L	3.15
MC1307P	1.99
MC1327P	1.50
ML237B	2.30
NE555	0.20
SAS560S	1.85
SAS570S	1.85
SAS580	2.85
SAS590	2.85
SN76226DN	1.30
SN76227N	1.10
SN76533N	1.75
STK015	6.20
TA7203P	2.50
TA7204P	2.50
TA7205AP	1.80
TAA550	0.50
TAA611A12	3.50
TAA621AX1	3.50
TA120B	1.30
SA/SQ	1.30
TBA520	1.50
TBA530	1.20
TBA540	1.64
TBA560C	1.50
TBA810S	1.20
TBA950/2A	3.05
TCA270SA	4.02
TDA1006A	2.45
TDA1035S	4.50
TDA1170S	1.99
TDA1352A	1.80
TDA2030	1.80
TDA2530	2.20
TDA2532	2.80
TDA2560	3.20
TL061	0.40
TL071	0.32
TL072	0.55
UPC575C2	1.45
UPC1350C	4.05
UPC1156H	2.75
UPC1182H	2.75
UPC1208C	1.25
UPC1356C2	3.00

TRANSISTORS + DIODES

Type	Price (£)	Type	Price (£)
AC127	0.28	BC125	0.14
AC128	0.30	BC140	0.48
AC128K	0.38	BC141	0.36
AC141	0.58	BC142	0.26
AC141K	0.38	BC143	0.36
AC142	0.40	BC147B	0.16
AC142K	0.38	BC148	0.10
AC151	0.45	BC148B	0.12
AC152	0.48	BC149	0.12
AC153	0.60	BC149C	0.14
AC153K	0.46	BC159	0.14
AC176	0.25	B/C	0.16
AC176K	0.32	BC160	0.38
AC187	0.40	BC161	0.30
AC187K	0.42	BC168B	0.25
AC188	0.24	BC170/A/B/C	0.12
AC188K	0.38	BC171/A/B	0.10
ACY22	1.50	BC172/B/C	0.12
AD142	0.88	BC177/B/C	0.24
AD143	0.88	BC182/AB/C	0.10
AD149	0.95	BC182L	0.10
AD161/162	1.20	LA LB LC	0.12
AD162	0.40	BC183/A/B/C	0.10
AF114	0.88	BC183L	0.10
AF115	2.10	LA LB LC	0.12
AF116	2.10	BC184	0.08
AF121	0.66	A B CL LC LB	0.10
AF124	0.70	BC212/A/B/C	0.10
AF125	0.50	BC212L	0.10
AF126	0.50	LA LB	0.10
AF127	0.50	BC213/A/B/C	0.10
AF139	0.56	BC213L	0.10
AF178	1.50	LA LB LC	0.10
AF239	0.65	BC237	0.12
AF279S	1.40	BC238	0.12
ASY80	5.20	BC251/A/B	0.14
ASZ17	2.00	BC262	0.26
AU110	2.90	A B	0.29
AY102	4.32	BC301	0.36
B40C200	1.03	BC302	0.38
BA115	0.12	BC303	0.36
BA121	0.40	BC307A	0.15
BA148	0.16	BC317B	0.15
BA155	0.12	BC323	0.90
BA157	0.20	BC327	0.10
BB105B	0.32	BC328	0.10
BB105G	0.30	BC337	0.08
BB110B	0.42	BC338	0.10
BC108	0.10	BC350A	0.24
A,B or C	0.14	BC351	0.16
BC109	0.10	BC516	0.35
A,B or C	0.14	BC547	0.08
BC115	0.15	BC440	0.36
BC117	0.28	BC548	0.08
BC118	0.20	A B or C	0.10
BC119	0.43	BC549	0.08
		A or B	0.10

Type	Price (£)
BC550	0.10
A or B	0.10
BC557A	0.10
BC558A	0.10
BCY70	0.36
BCZ10	3.21
BCZ11	2.60
BD124P	1.20
BD129	0.90
BD130Y	0.68
BD131	0.46
BD132	0.50
BD135	0.26
BD136	0.26
BD137	0.28
BD138	0.30
BD139	0.30
BD140	0.29
BD142	1.60
BD145	1.82
BD150B	0.50
BD160	1.58
BD165	0.45
BD183	0.70
BD201	0.52
BD202	0.57
BD222	0.80
BD225	0.40
BD232	0.52
BD234	0.30
BD235	0.30
BD236	0.36
BD237	0.38
BD410	0.76
BD438	0.64
BD439	0.85
BD441	0.85
BD507	1.05
BD520	1.20
BD587	0.88
BD707	0.80
BDX18	1.00
BDX32	1.75
BF115	0.32
BF117	0.50
BF119	0.82
BF125	0.42
BF127	0.44
BF154	0.14
BF157	0.46
BF160	0.23
BF167	0.32
BF177	0.42
BF178	0.36
BF180	0.27
BF181	0.27
BF182	0.32
BF183	0.32
BF184	0.47
BF185	0.28
BF194A	0.15
BF195	0.12
BF224J	0.20

Type	Price (£)
BF240	0.15
BF241	0.18
BF257	0.22
BF258	0.26
BF259	0.30
BF262	0.34
BF263	0.38
BF270	0.30
BF271	0.28
BF273	0.22
BF274	0.34
BF294	0.46
BF336	0.40
BF337	0.38
BF338	0.28
BF355	0.42
BF371	0.27
BF450	0.30
BF457	0.36
BFR51	0.36
BFR61	0.32
BFR90	0.86
BFT41	0.68
BFT43	0.38
BFY50	0.32
BFY51	0.32
BFY52	0.32
BFY90	0.80
BFY90S	1.34
BR100	0.20
BR101	0.76
BR103	0.60
BR303	2.75
BRY39	0.80
BRY56	0.42
BSX20	0.20
BSY52	0.35
BSY95A	0.25
BT100A/02	0.90
BT101/300	2.75
BT101/500	3.25
BT102/300	3.60
BT106	1.15
BT116	1.20
BT119	3.30
BT138/600	0.98
BT151/560R	0.90
BTY79/400R	2.80
BU104	1.80
BU105	1.40
BU108	1.90
BU126	1.60
BU133	1.90
BU204	1.60
BU205	1.40
BU208A	1.50
BU326S	1.75
BU407	1.40
BUX80	2.90
BUY20	2.75
BUY69A	2.90
BUY69B	1.98

Type	Price (£)
DX100	0.80
BY103	0.50
BY122	0.60
BY126	0.10
BY127	0.08
BY133	0.10
BY135	0.35
BY164	0.45
BY179	0.60
BY182	0.80
BY184	0.38
BY187	0.65
BY189	6.75
BY198	0.64
BY199	0.72
BY206	0.14
BY207	0.16
BY210/400	0.21
BY210/800	0.22
BY227	0.28
BY228	0.50
BY238	0.65
BYX10	0.28
BYX36/150	0.40
BYX36/600	0.48
BYX48/300	0.70
BYX55/600	0.30
BYX71/600	1.50
E1222	0.30
E5024	0.30
MCR106/5	1.20
ME0413	0.70
ME6002	0.26
MEU21	0.62
MJ400	1.45
MJ2955	1.10
MJ3000	1.80
MJE340	0.50
MJE520	0.60
MJE2955	1.60
MJE3055	1.40
MPSA05	0.30
MPSA12	0.30
MPSLO1	0.34
MPSUO5	1.05
MPSUO6	1.20
MR502	0.40
MR854	0.86
OA91	0.14
ORP12	0.95
R2008B	1.40
R2010B	1.20
R2540	2.71
TIP30A	0.35
TIP31C	0.30
TIP32	0.36
TIP33A	0.75
TIP34A	0.90
TIP41C	0.36
TIP42	0.38
TIP47	0.60

Type	Price (£)
TIP121	0.63
TIP2955	0.68
TIP3055	0.85
TIS88	0.50
TIS90	0.27
Y723	0.92
Y969	2.80
IN4001	0.04
IN4003	0.05
IN4004	0.05
IN4006/7	0.07
IN4148	0.04
IN5400	0.08
IN5402	0.12
IN5405	0.12
IN5406	0.14
IN5408	0.18
2N2122A	0.34
2N2222	0.30
2N2904A	0.48
2N2926G	0.14
2N3053	0.30
2N3054	0.80
2N3055	0.60
2N3703	0.14
2N3773	1.90
2SB337	1.90
2SC1098	0.94
2SC1172Y	1.70
2SC1173Y	0.88
2SC1413A	2.70
2AC1449	0.80
2SC1507	0.60
2SC1678	1.80
2SC1758	0.68
2SC1953	0.70
2SC1957	0.95
2SC2029	2.70
2SC2122A	3.20
2SC2335	1.50

VOLTAGE REGULATORS

78L05	0.28
78L08	0.28
78L12	0.28
78L15	0.28
7805	0.36
7808	0.36
7812	0.36
7815	0.36
7818	0.36
7824	0.36
7905	0.38
7912	0.38
7915	0.38
7918	0.38
7924	0.38
LM305H	1.48
LM317K	2.40
LM317T	0.95
LM723	0.65

VALVES

Enquiries are welcomed for any other valve not listed here.

Type	Price (£)
AZ31	4.55
AZ41	2.05
DAF96	1.05
DF96	0.80
DK96	2.70
DM71	3.00
DY86/87	0.70
DY802	1.00
CV850	2.55
CV4015	2.85
E180F	6.55
EABC80	1.05
EAF42	1.55
EB91	1.35
EBC41	2.05
EBF80	0.80
ECC81	1.05
ECC82	0.95
ECC83	1.05
ECC84	0.85
ECC85	1.00
ECC88	1.30
ECC189	0.90
ECF80	1.25
ECF82	0.90
ECF83	1.95
ECH35	3.80
ECH81	1.45
ECH84	1.55
ECL85	0.80
ECL86	1.80
EF80	0.80
EF86	1.85
EF91	2.05
EF95	1.70
EF183	0.95
EF184	1.05
EH90	1.00
EL34	3.30
EL36	2.30
EL81	7.00
EL84	1.05
EL85	5.00
EL86	6.95
EL509	7.90
EL519	8.00
EM80	0.90
EM84	1.80
EM87	2.60
EY51	0.95
EY86/87	0.70
EY88	0.80
EY500A	2.55
EZ41	2.85
EZ81	0.85
GY501	1.45
GZ32	1.25
KT66(G.E.C.)	18.00
KT77	11.50
KT88(G.E.C.)	19.00
PC88	1.45
PC92	3.05
PC93	1.45
PCC88	0.85
PCC89	0.80
PCC189	0.90
PCF80	1.00
PCF82	1.00
PCF84	0.80
PCF86	1.30
PCF87	0.60
PCF200	2.00
PCF201	2.00
PCF800	1.25
PCF801	1.10
PCF802	1.10
PCF805	2.05
PCF806	1.25
PCF808	1.65
PCL82	1.05
PCL83	2.55
PCL84	1.05
PCL86	0.95
PCL88	2.55
PCL805	1.10
PD500	2.95
PFL200	1.90
PL33	1.55
PL36	1.80
PL82	0.80
PL95	2.05
PL504	1.55
PL508	2.75
PL519/509	5.30
PL802	5.55
PY81/800	1.15
PY82	1.80
PY88	0.85
PY500A	2.25
PY801	0.75
UABC80	0.90
UAF42	1.30
UBC41	3.05
UBC81	1.55
UCC85	0.80
UCF80	1.25
UCH42	2.55
UCH81	2.05
UCL82	1.85
UCL83	3.30
UF41	1.30
UF89	2.55
UL84	1.30
UY85	1.20
2D21	1.65
6AT6	1.30
6AU6	1.05
6C4	1.05
6GH8A	1.25
6J5GT	2.55
6K7G	2.05
6K8G	2.80
6KD6	6.55
6X4	1.55
30FL2	1.75
30FL12	1.65

IDLER KITS/(REWIND KITS)

SHARP NIDL-0005 GE ZZ 0006	SHARP-0012	3.05
	SHARP-0013	3.05
SONY SLC5/7UB	IK-01	5.85
SONY SLC6UB	IK-02	4.70

VIDEO HEADS

AKAI	ALL	39.50
FERGUSON	3V00/22/16/23/24/31/29/30	39.50
HITACHI	VT5000E	37.99
JVC	ALL	39.44
NAT/PANASONIC	VE and NV FROM	39.44
SANYO	ALL	46.30
SONY	SLC 9UB/6/7/9/20/30/40/8000	49.95
TOSHIBA	ALL	48.66

SERVICE MANUALS

FIDELITY CTV 145/CTV140/R/CTV 2022	ALL	2.75
SONY HMK3000		2.45
SONY KV1810UB Mk.1/KV1400UB	ALL	8.15
SONY KV2212/KV2705/KV2252	ALL	5.85
SONY SLC5UB/SLC6UB/SLC7UB/SLC9UB	ALL	10.50

VIDEO BELT KITS

NAT/PANASONIC	VDB01	2.05
JVC HR 7700	VDB02	.40
HITACHI VT 5000E	VDB03	1.50
JVC HR 3360/HR3660	VDB04	4.15
SONY SLC7	VDB05	2.40
JVC HR3300/HR3320/HR3330/HR3600	VDBo6	4.65
SONY SL8000	VDB07	6.75
NAT/PANASONIC NV8600	VDB08	1.55
SONY SLT-7ME	VDB10	.98
SONY SLT-9ME	VDB11	.98
TOSHIBA V5470	VDB12	1.45
TOSHIBA V5475	VDB13	1.56
TOSHIBA V8600	VDB14	4.50
NAT/PANASONIC NV300	VDB15	2.05
SANYO 5500	SANYO-012	2.05
SANYO 9300	SANYO-013	4.05
SHARP VC381	SHARP-020	3.15
SHARP C6300	SHARP-021	5.33
SHARP VC7300	SHARP-023	5.65
SHARP VC9300	SHARP-024	3.30
SHARP VC9700	SHARP-025	2.65

BOOKS

DATA VOLUME 1 – Trans. data & drawings	
A-BUY	£9.99
DATA VOLUME 2 – as above C-Z	£10.75
DATA VOLUME 3 – 2N-2N6735	£10.20
DATA VOLUME 4 – 2SA & on	£13.50
DIODES VOLUME 1	£10.75
DIODES VOLUME 2	£10.65
Both Volumes	£20.60
I.C. CMOS	£8.95
I.C. TTL	£7.99
I.C. LIN VOLUME 1	£6.95
I.C. LIN VOLUME 2	£6.98
Both volumes	£13.00
THYRISTORS A to Z	£10.45
TRANSISTORS A to Z	£5.40
TRANSISTORS 2N-3N	£5.50
Both volumes	£10.00

COILED MAINS CABLES

0.2mm (1A) 1.8 metres	0.95
0.75mm (6A) 3.0 metres	2.25

SCREENED COIL CABLES

Single 4 8mm 6 metres Black/Red/Blue	1.75
Twin 5.0mm 6 metres Black	2.20
4-Core 6.0mm 1.8 metres Black	1.20

FUSES Prices per 10

20mm Quick Blow. 100, 125, 160, 200, 250, 315, 400, 500, 630, 800mA, 1, 1.25, 1.6, 2, 2.5, 3, 4, 5, 6.3A **45p. 20mm Time Delay.** 100, 125, 160, 200mA, 250, 315, 400, 500, 630, 800mA, **90p.** 1, 1.25, 1.6, 2, 2.5, 3.15, 4, 5, 6.3A **90p. 1" Mains.** 2, 3, 5, 7, 10, 13A **1.00.**
CAR FUSES – British/European cars 5A, 8A, 10A, 20A, 25A, 30A, **1 – 7p, 10 – 60p.** British/European/Japanese cars 7.5A, 10A, 15A, 20A, 30A, **1 – 12p, 10 – 1.00.**

METAL & VOLTAGE DETECTOR

Used for detecting pipes or cables in walls prior to drilling. Battery operated (not provided) **£6.99**

KNIVES – UTILITY complete with 5 blades stored in body **£1.56**

RETRACTABLE KNIVES complete with 5 spare blades **£2.56**

RESISTORS – CARBON FILM 5%

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

RESISTOR KITS – each value individually packed

¼W pack 10 each value E12 – 10R to 1M 610 pieces	4.50
¼W pack 5 each value E12 – 10R to 1M 305 pieces	2.95
½W pack 10 each value E12 – 2R2 to 2M2 730 pieces	7.75
½W pack 5 each value E12 – 2R2 to 2M2 365 pieces	4.70
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

RESISTORS – WIREWOUND, Generally 5%

2.5W – 0.22 to 270R – Available in preferred values	0.25
4W – 1R0 to 10K – Available in preferred values	0.24
7W – 0.47R to 22K – Available in preferred values	0.25
11W – 1R0 to 22K – Available in preferred values	0.30
17W –1R0 to 22K – Available in preferred values	0.38

MULTISECTION ELECTROLYTICS

THORN	850	100+300+100+16/300V	5.50
	1500	150+150+100/300V	2.40
	3000	1000/63V	0.90
	3500	175/400V+100+100/350V	3.00
	8000	400/350V	2.65
	8000/9500	2500+2500/63V	2.25
	8000	700/250V	2.50
		1000/70V	0.90
	9000	400/400V	3.50
Timer Amp		4700/25V	1.15
DECCA	10/30	400+400/350V	3.70
	1700	200+200+400/350V	4.90
GEC	2047	2048 2083 2084 2104 200+200+150+50/300V	2.90
		600/250V	2.40
ITT/KB		200+200+75+25/350V	3.00
		220/400V 3 tag	2.10
PHILIPS	G8	600/300V 2 tag	2.50
	G8 G9	600/250V	2.40
	G11	470/250V	3.10
	G9	2200/63V	1.35
EKCO	691	200+300/350V	4.50
	Series	600/300V	3.50
RANK		300+300/300V	3.75
	A823	2500+2500/30V	1.65
		220/400V	2.20
		600/300V	3.10

FULL RANGE IN CATALOGUE

TELEPHONE EQUIPMENT

BT App Telephone Plug + 3m Lead	£1.25
BT App Master Socket inc Wiring instrns	£2.75
BT App Secondary Socket	£1.85
4-way plug	25p each
BT 4-Core Cable per metre	15p/m
	£12.00/100m
Cable clips for above	10/15p 100/98p

ZENER DIODES

400mW Plastic 3V-75V	8p each. 10/75p
1.3W Plastic 3V-200V	15p each. 10/£1.40
1.5W Flange 4.7-47V	£1.25 each*
2.5W Plastic 7.5-75V	64p each*
20W Stud 7.5-75V	£1.35 each*

*Only available while stocks last

COAXIALS

Coax Plugs Metal	.20	.18/10
Coax Plugs Plastic	.10	.085/10
Coax Chassis Sockets	.12	.10/10
Coax Line Sockets	.25	.22/10
Coax Line Connectors	.12	.10/10
Coax Cable 75ohm TV Downlead		18p m – £12.50 100m reel

SOLDER: 60% TIN 40% ALLOY

22g. Non-corrosive Multi-core Solder

500gm Reel	£4.99 each
10 Reels	£3.75 each

REPLACEMENT TV MAINS DROPPERS

Decca	5R + 167 + 100 + 90 + 2K5	1.75
GEC 2018	10R + 15R + 19R + 70R + 63R + 188R	1.15
Philips G8	2.2R + 68 R	1.00
Philips G8	47R – 15W	0.48
Philips 70	6R + 124R + 84R	0.68
Philips 300	118R + 148R (with link)	1.35
RRI A640	250R + 14R + 156R 50W	1.05
RRI A816	302R + 70R + 6.2R	0.78
Thorn 1500	350R + 20R + 148R + 1.5K + 317R	1.34
Thorn 3000/3500	6R + 1R + 100R Fused	1.05
Thorn 8500	1K5 + 40R + 50R	1.28

Plus Many More. Please enquire.

SOLDERING SECTION

Soldering Station complete with 30W or 40W Iron (state which)	72.50
XS25 W Iron kit/complete with stand, 1m lead & plug attached	8.20
CS17 Iron Kit	7.99
C15 Iron Kit	8.30
Antex bits	1.20
Antex kit/complete with steel & plug attached	11.00
CS 18W, as above	10.90
Antex 15W iron	5.40
Antex 18W iron	5.60
Antex 25W iron	5.80
Antex elements	3.20
Antex bits	1.15
Antex stands	2.20
Soldersucker	4.50
Spare nozzles for Soldersucker	0.65

SERVICE AIDS

Goldkleene Degreasing Solvent	1.75
Switch Cleaner	1.15
Supa Freeze-it	1.38
Foam Cleanser	1.18
Video/Tape Head Cleaner	1.10
Plastic-Seal	1.35
Aero-Kleene	1.10
Anti-Static Spray ellist	1.20
Excel Polish	1.19
Aero Duster	1.49
Super 40	1.88
Rapid Fire Extinguisher	3.30
Silicone Grease Tube	1.80
Silicone Grease Spray	1.38
Heat Sink Compound	1.18

Solda-Mop

Light gauge 0.08mm	0.78
Standard gauge 1.2mm	0.76
Industrial reel 1.2mm	2.96

ZENER DIODE KIT
400 M/W 5 ea value – 55 Z/Diodes £3.50

CERAMIC KIT

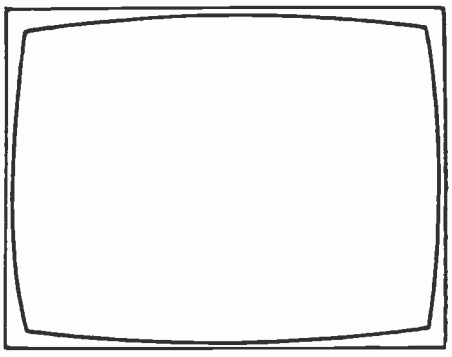
50 VOLT 5 ea value – 125 Caps £3.50

ORYX PORTASOL GAS IRON
Powered by lighter fuel **£14.50**

SPARE TIPS
1.0mm/2.4mm/3.2mm/4.8mm **£4.50**

EAST CORNWALL COMPONENTS
119 HIGH STREET
WEM
SHROPSHIRE SY4 5TT TEL: 0939 32689
TELEX: 35565

ORDERING: All components are brand new and to full specification. Please add 75p postage/packing (unless otherwise specified) to all orders and then add 15% VAT to the total. Minimum order £5.00. Either send cheque/cash/postal order or send/telephone your Access or Visa number. Official orders from schools, universities, colleges etc most welcome. (Do not forget to send for our 1987 catalogue – only £1.00 per copy). Delivery by return on ex-stock items. All prices subject to change without notice. RETAIL shop open Mon-Fri 9.00-5.00. Sat 9-12.00.



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COVER PHOTO
This month's cover photo shows the four-head drum used in the Hitachi VT19 videocassette recorder.

HELD OVER
We regret that due to shortage of space in this issue we have had to hold over until next month the concluding instalment of the Servicing Mechanical VCRs series.

MAINS CHECKER
We understand that 90V neons for the mains checker – see page 752 – can be obtained from J. & N. Bull Electrical (T), 259 Portland Road, Hove, Brighton, Sussex BN3 5QT.

Mega-Mergers

In commenting on Thomson's take-over of Ferguson last month we expressed some puzzlement as to the logic behind the move. Thorn had stated that Ferguson's weakness lay in its almost total dependence on the highly competitive UK market, and that merging it with a larger, international group would best guarantee its future as a consumer electronics manufacturing concern. But while Thomson is certainly large, it was hardly international in the broadest sense, being mainly dependent on the European market. The answer to this came with surprising speed during the course of last month with the announcement that Thomson is to purchase the consumer electronics interests, which take in RCA, of General Electric. In one move Thomson has acquired a major share of the US consumer electronics market.

The deal between GE and Thomson is in two parts. Thomson is to sell its medical electronics business CGR to GE, while GE is to sell its consumer electronics side to Thomson – for CGR and a considerable amount of cash that will depend on the current performance of GE's brown goods businesses. GE had taken over RCA in early 1986. Both companies had a long history as leading manufacturers and brands in the USA. Together, GE and RCA in 1986 had 23 per cent of the US TV market and 17 per cent of the VCR market. It seems however that GE had not intended to remain in the consumer electronics field. Its own brown goods business had a poor profit record that had apparently defied management effort to produce any improvement over a number of years. GE had taken over RCA primarily because of the latter's defence electronics interests and its ownership of the NBC broadcasting network. Thus Thomson's strategy of expansion in the international consumer electronics market came at an appropriate time for GE.

The extraordinary thing is that Thomson had itself not all that long since seriously considered withdrawing from the consumer electronics market. It had however managed to restructure this side of its business, which in 1985 produced a profit of some £40m, doubling to over £80m in 1986. For the present Thomson has decided, having sold off its lighting interests to Philips in 1982, its telecommunications interests to CGE in 1983, and having merged its semiconductor arm in an Italian-led joint venture with SGS, to concentrate on two core businesses, defence/professional electronics and the consumer field.

In adopting this strategy Thomson has not set an easy course for itself. Though Thomson is now one of the world's three largest consumer electronics manufacturers – the other two are Matsushita and Philips – it is aiming at markets that are saturated and highly competitive, and exposing itself to the full blast of the ever-formidable Japanese efforts in this field. Success in the consumer electronics market depends not only on size and manufacturing know-how but on product development, finding and exploiting new market openings and expert marketing. It will be interesting to see whether Thomson has or can summon up the expertise necessary to carry it off. Thomson has plants in the Far East but as yet little market presence there. Competition is ever increasing as the Koreans and others achieve a greater market share.

During the course of the month Thorn also made a major move on the international front in announcing the take-over of the US rental group Rent-A-Center. This makes clear where Thorn sees its future. Not long since Thorn was a major manufacturing concern, and at one point sought a future for itself in high-technology manufacturing through a take-over of British Aerospace. All that has changed. In fact Thorn has been going through a period of incredibly rapid change, having raised some £400m by selling 41 businesses since 1985. The strategy now is to concentrate on defence electronics, lighting, music and, as the major profit centre, electronics retailing (Rumbelows) and rental (DER, Radio Rentals, etc.).

Traditionally, the US retail scene has varied from state to state, with many small and medium-sized companies active. Rental was not strong – US householders like to own their goods. Rent-A-Center is an interesting company that has achieved rapid expansion by developing a new strategy – "rent to own". The idea is that rent is paid weekly and amounts to two-three times the basic cost of the product: after a two year period the renter owns the goods. A market opening for this approach was found amongst those without credit facilities. Rent-A-Center has an estimated nine per cent of the US rental market, which has been growing at around 35 per cent a year. Based in Wichita, Kansas, the company now has 270 stores and 168 franchised outlets in 38 states. Its product mix consists of TV sets 35 per cent, VCRs 13 per cent, domestic appliances 19 per cent and furniture 19 per cent. Net profits have risen from $2·8m in 1982, when the company had 52 stores, to $9·9m in 1986 and an estimated $13·8m for the present year. Thorn emphasises that the two companies have similar expertise and marketing arrangements. The aim is to expand the combined group's retail and rental activities internationally: Thorn sees this as a sure path to profitable growth.

In all we've been witnessing a period of extraordinary volatility in the affairs of major companies such as Thorn and Thomson. It's interesting to contrast Thorn's withdrawal from manufacturing with Thomson's decision to expand in this area. Presumably both feel that they have the right expertise to manage and develop their chosen activities. One wishes them well. It makes a strange contrast with the Japanese way of going about business.

Long-distance Television

Roger Bunney

June was an extremely active month for DX propagation. Signals were received in the UK from all parts of Europe. Our thanks to those who sent in reports: the following collated log of Sporadic E reception resembles a rundown of all the European broadcasters!

6/6/87 ORF (Austria) ch. E2a, E4; RAI (Italy) ch. IA, IB; ARD (West Germany) E2; JRT (Yugoslavia) E3; CST (Czechoslovakia) R1, 2; TVE (Spain) E2, 3, 4; RTP (Portugal) E2, 3.

7/6/87 JRT E3, 4; RAI IA, B; TVA (Italian free station) IA; RTS (Albania) IC, R4; ORF E2a; +PTT (Switzerland) E2, 3; JTV (Jordan) E3; DFF (GDR) E4; TSS (USSR) R1, 2, 3, 4, 5; MTV (Hungary) R1, 2; CST R1, 2, 3; SR (Sweden) E2, 3, 4; NRK (Norway) E2, 3, 4; C+ (Canal Plus, France) L3.

8/6/87 TSS R1, 2; TVP (Poland) R1, 2; ORF E2a; CST R2; JTV E3; TVE E2, 3, 4; RTP (Portugal) E2, 3; NRK E2, 3, 4; RAI IA, C; RUV (Iceland) E4.

9/6/87 RTP E3; TVE E2, 3, 4; RAI IA; DFF E4; CST R2.

10/6/87 TVE E2, 3, 4; RAI IA, B; ARD E3; SR E4; TVP R1; TSS R1; RUV E4.

11/6/87 TVE E2, 3, 4; RTP E2, 3; TVE-2 E2; RAI IA, B; C+ L3; ORF E2a, 4; DFF E4; JRT E4; TVP R2; TSS R1, 2.

12/6/87 C+ L3; TVE E2, 3, 4; RTP E2; RAI IA, B; JRT E3, 4; TVP R2; NRK E2, 3, 4; SR E2, 3, 4; RTB-F (see later).

13/6/87 SpE signals at blanket levels for much of the day.

14/6/87 TSS R1, 2, 3; NRK E2, 3, 4; YLE (Finland) E4; ORF E2a; ARD E2; MTV R1, 2; TVE E2, 3, 4; RTP E2, 3.

15/6/87 RTP E2, 3; TVE E2, 3, 4; TVE-2 E2; RAI IA, B; JRT E3; MTV R2; ARD E2; TSS R1, 2, 3, 4, 5; TVP R1, 2; SR E2.

16/6/87 DR (Denmark) E3; RTT (Tunisia) E4; EPT (Greece) E3; RAI IA, B; CST R1, 2; SR E2, 3, 4; NRK E2, 3, 4; YLE E3; TSS R1.

17/6/87 TVE-2 E2; TVE E2, 3, 4; RTP E2, 3; Italian free station E4 (see later).

18/6/87 DR E3, 4; NRK E2, 3, 4; SR E2, 3, 4; +PTT E4; C+ L3.

19/6/87 CST R2; DFF E4; DR E3; TVP R2; NRK E2, 3, 4; RTP E2; TVE-2 E2; TVE E2, 3, 4.

20/6/87 TVP R1, 2; TSS R1, 2, 3; MTV R1, 2; TVR (Rumania) R2; ORF E2a, E4; +PTT E3, 4; ARD E2, 3, 4; RTS IC; RTP E3; TVE E2, 3, 4; TVE-2 E2; NRK E3; NCT (Italian free station) IA.

22/6/87 TVE E3; TSS R1, 2, 3; YLE E4; RTP E2, 3.

23/6/87 TSS R1, 2; CST R1; SR E2, 3; NRK E2, 3; RTT (Tunisia) E4; +PTT E4; JRT E4; RAI IA, B; TVP R1; C+ L3.

24/6/87 RAI IA, B; NCT IA; TVQ (Italian free station) IA; MTV R1; TVR R2; TSS R1, 2; TVE E2, 3, 4; RTP E2, 3; C+ L3.

25/6/87 RAI IA, B; RTT E4; MTV R1; TSS R1, 2; ORF E2a; TVE E2, 3, 4; RTP E2.

26/6/87 RAI IA, B; MTV R1; TSS R1, 2.

27/6/87 TVE E3.

28/6/87 TVE E2, 3, 4; TVE-2 E2; RTP E3; +PTT E2, 4; JRT E3, 4; DR E3, 4; DFF E4; ORF E2a, 4; RTS IC; TSS R1, 2, 3; RAI IA, B, C; TVP R1, 2; NRK E2, 3; SR E2, 4.

Simon Hamer (Powys) noted RTB-F (Belgium) via lightning-flash scatter on the 12th. RTS (Albania) was logged on the 7th on both ch. IC and the new ch. R4, between 1805-1850 CET on programme.

The following Italian "free" stations were received during the month: NCT (Udine) ch. IA; Teledeportante News ch. E4/IB; TVA ch. IA; TVQ ch. IA; TV Alpha-Adria ch. IA. If anyone has an up-to-date list of Italian "free" stations we'd like to know – the situation there remains chaotic.

Blanket SpE was present on the 6th and 7th, with the m.u.f. reaching the 144MHz amateur band on the 6th. The 7th produced two-way trans-Atlantic (UK-USA) amateur communications. On the 11th the m.u.f. again rose to 144MHz, with signals from the Mediterranean area.

At the time of writing (July 2nd) high-pressure conditions are slowly being established over the UK and central Europe. This should produce enhanced tropospheric propagation. Tropospheric signals from France and the Benelux countries were received over much of the UK on the 11/12th – in Band III and at u.h.f.

Our thanks to Simon Hamer (Powys), Iain Menzies (Aberdeen), Cyril Willis (Norfolk), Bill Cotterill (Tipton), Roger Fussell (Torpoint), Peter Schubert (Rainham), Keith Chaplin (Barrow on Soar), Owen Jones (Stoke) and Ryn Muntjewerff (Holland) for sending in their reception reports.

News Items

UK: ATV (Amateur TV) allocations came under discussion at the IARU Region 1 conference in mid-April. Use of the 430MHz band is to continue where at present permitted but a move to the microwave bands is to be encouraged. The preferred 430MHz band is to be 434-440MHz, with a suggested carrier below 434·5MHz or above 438·5MHz – 439·25MHz has long been used in the UK. Specific allocations for ATV only are as follows: 1,241·1-1,251·5MHz and 1,270·1-1,286MHz.

Newspaper reports suggest that Sealand TV, based on an old wartime fort off the Essex coast, could start transmissions in early September, with films, pop video and sports from 1700-0200. The project is backed by a Bahamas-based investment company and would be run by Roy Bates who is known for his free radio activities. The channel isn't known. Sealand is seven miles off Harwich.

W. Germany: The ch. E23 services' transmitter at Viersen has been closed down: another at Rheindahlen has been opened, on the same channel with 0·5kW e.r.p. A new AFRTS/AFN transmitter has come into operation at Hessisch Oldendorf, on ch. E38 with 100W e.r.p. The westwards directional characteristics of the Buderich transmitter have been changed and the e.r.p. levels reduced. The transmitter carries ZDF on ch. E35 and WDR-1/3 on chs. E48 and E59.

Spain: Seven companies have expressed interest in starting private TV services which are expected to be on-air before 1990.

Pakistan: Viewers in Lahore and Karachi are erecting high-gain aerial systems in order to receive the service from the Indian Doordarshan transmitter. Apparently the price of head amplifiers has risen sharply. The Pakistan authorities, concerned about this invasion of air space, are increasing the powers of transmitters in the border areas with the aim of blotting out Doordarshan – that's the theory, anyway!

Satellite TV: Because of the increasing domestic reception

of programmes intended for cable networks, copyright holders are putting increased pressure on the various UK programme providers such as Premiere, Children's Channel etc. to adopt scrambling. The 16-channel Astra satellite, which is due to be launched in mid-1988, could carry eight English-language channels, three German, three French and two Skansat channels. There has been criticism that the CNN European service consists of the basic US service with a European weather forecast added: a "more effective" European service is promised in due course, maybe in late 1988/early 1989 to coincide with a move from the Intelsat V satellite at 27·5°W to the Astra satellite. Inselsat V at 27·5°W has been noted carrying a European service from the US NBC network: it seems that this was a test for a possible service in competition with CNN.

Rabbit Remote TV/VCR System

The "VCR Rabbit" system was described briefly in the July Teletopics column. It enables a VCR to feed up to five TV sets at various locations, with remote control of the VCR via any of the Rabbit receiver units linked to the TV sets. A Rabbit transmitter unit at the VCR sends the programme material to the receiver units at 40MHz, via a two-core cable – the receiver units up-convert the 40MHz signal to u.h.f. for feeding to the associated TV sets. Whether the Hong Kong manufactured units radiate remains to be seen. It seems that the system is at present undergoing modification to suit UK standards.

From our Correspondents . . .

We've not, unfortunately, had much space for readers' letters in recent columns. They're always welcome however, so please write in. We're always interested to hear of your equipment, results and comments. If you have any queries, include an s.a.e. for a rapid reply.

We were pleased to hear again from Hugh Cocks, who moved to Portugal about four years ago. He's recently moved to a house high in the mountains in the Algarve region, and the reception possibilities here are particularly interesting. I quote direct from his letter dated June 21st:

"There have been lots of signals over the last two weeks, some with identifications. On June 3rd at 2230 BST there were signals on chs. A2 and A3 (A2 vision and sound, A3 vision only). The A2 signal consisted of a weather report with identification WSB TV (with possibly one extra letter after the B), going on to Mash at 2236. It's quite common to hear French as well with odd references to CBC in English. The 12th produced another highlight with WFMY-TV Carolina and CBS news. Next, on the 19th, came WUNB-TV (Columbia?) at 2200 with references to Philadelphia.

The best day was the 19th, with signals from 1730-2230. On other days reception starts at 2230 and continues to 2400-0100. On the 19th the m.u.f. rose to ch. A5 vision. US System M reception was logged on the 3rd, 4th, 8th, 12th, 14th, 15th and the 17-19th. The signal on the 14th had French sound: it started at 1440 and faded out by 1530. Identification of these signals is difficult except on the hour when there's a station identification plus adverts.

Another highlight was JTV (Jordan) ch. E3 one lunchtime, quite strong followed by RTT (Tunisia) ch. E4. SpE reception from the North has not been too good so far this year. BRT ch. E2 and RTB ch. E3 were received on the 21st however. Also on this night there was a ch. A2 signal with Spanish sound and the identification

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"Telemundo Puerto Rico". Most of the time the pictures are ghosty, superimposed or weak, with lots of interference from RTE and Canarias ch. E3.

On the 23rd at 1325 BST a strong PM5544 test pattern was received on ch. E3, with Arabic writing at the top and "Ortas-Damas" at the bottom. The time was plus two hours and the source is assumed to be Syria. The Jordanian ch. E3 test card was received on the 24th at 0800-0830, while a weak ch. A2 signal was present from 1745-1800."

An enviable location indeed, with the possibility of reception from Europe, the Middle East, Africa and the US Atlantic seaboard through to central America. I wonder whether there are any jobs going in Portugal?!

Band II TV Reception

Band II TV reception tends to be neglected, DX-TV enthusiasts concentrating on Band I during SpE openings. Several tuners provide coverage above 70MHz however and, in conjunction with an up-converter, may give continuous coverage of the whole v.h.f. spectrum. The channels used for TV broadcasting in Band II are as follows:

Channel	*Vision carrier frequency*	*Sound carrier frequency*
R3	77·25MHz	83·75MHz
IC	82·25MHz	87·75MHz
R4	85·25MHz	91·75MHz
R5	93·25MHz	99·75MHz

Note that ch. IC uses 5·5MHz sound/vision spacing (System B) while chs. R3-5 have 6·5MHz sound/vision spacing

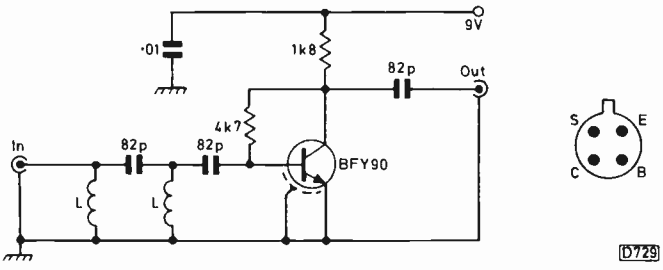

Fig. 1: Preamplifier circuit for use at v.h.f., covering 40-230MHz with a gain of 17dB at 90MHz. Consumption 5-6mA at 9V. Use silver mica capacitors and 10% resistors. L consists of 10 ⅛in. diameter turns of 24g enamelled copper wire, close-spaced. Follow usual v.h.f. construction practice in building the amplifier.

(System D). Many East European transmitters use channels R3-5. Channel IC is used by Italy and Albania – the latter is often received in the UK at good strength during SpE openings.

Though SpE propagation in Band II is less common than in Band I, during an intense opening several ch. R3-5 stations may be received. Conditions can resemble those in Band I, with signals from different transmitters alternating. From my own observations these Band II signals are generally more stable than their Band I counterparts, with slower fading – in fact the signals tend to resemble tropospheric ones, without the dramatic extremes of signal strength experienced in Band I.

A suitable tuner, e.g. the ELC2000, and a wideband amplifier will provide reception in conjunction with an aerial cut to the appropriate dimensions (see later). The BFY90 amplifier circuit shown in Fig. 1 covers 40-230MHz, with a gain of around 15dB at 80MHz.

Unless the incoming signal is strong reception of ch. R5 can be difficult, since it's within the UK f.m. radio broadcasting band. Careful aerial orientation helps, together with the use of notch filtering to remove local f.m. radio channels, but the wideband i.f. circuitry employed in modern receivers means that interference is to be expected. Use of switched selectivity helps a great deal – and improves the signal-to-noise ratio with weak signals. Suitable circuitry has been described in previous issues – or you can use the D100 integrated r.f./i.f. unit from HS Publications (7 Epping Close, Derby DE3 4HR).

The most important item however is the aerial. Experiments show that while a ch. R3 signal received with a Band II aerial will be presented to the receiver at a high level any attempt to pick up the same signal using a Band I aerial will result in a very low input. Thus thoughts of making do with a Band I aerial will prove a disappointment!

Since reception in the UK is basically from an east to south-east direction a Band II aerial can be fixed to the mast rather than increasing the load on the rotor unit. Position the aerial to face ESE: the chosen signal directions are within the −3dB points of the usual type of Band II aerial – taking into account also that in Band II direction change via SpE is less marked. Fig. 2 shows five aerial designs covering either chs. R3-5 inclusive or chs. R3-4 inclusive. The reduced bandwidth of the latter types is intended for use where interference from a nearby f.m. transmitter is likely to make reception of ch. R5 impractical. Much of the TV Band II lies within the mobile radio low band, and some intermittent interference from this source will also be experienced: a local known source could be removed by filtering, but otherwise such interference just has to be accepted.

The aerial designs are relatively simple and can be made from scrapped Band I aerials (visit your friendly local aerial rigger). If you have a small aerial company nearby they may be willing to supply new components. Otherwise you can purchase the aerials from Aerial Techniques of Poole (see advertisement). The design shown at (a) consists of a wideband dipole package, i.e. an active dipole with a passive resonator mounted close to it. This system covers 77-92MHz and is called type WB1/O (O for OIRT). A reflector is added in design (b), type WB2/O, which covers 77-100MHz and has a gain of approximately 2·5dB. Note that the dipole arrangement used in these two designs is based on the Antiference Tru-Match principle, in which the two closely coupled elements act together to reduce the inductive and capacitive reactance swings and thus give a better 75Ω resistive match over the bandwidth. Design (c) is a simple two-element dipole plus reflector arrangement, type WB2/O1, covering 77-92MHz. Designs (d) and (e), types WB3/O and WB3/OFD respectively, have three elements and thus a higher gain. The element spacing with the straight dipole is wider to give better matching at 75Ω: a folded dipole assists in this respect, giving a design that's shorter with higher gain and better wideband matching.

On my own mast I've sleeve fitted a Band II wideband dipole ahead of the first director of the Band I array. The Band I and II aerials thus share a common boom. If you already have a Band I array this might be the simplest solution.

Several designs for log-periodic aerials covering 45-100MHz exist. Such aerials are particularly favoured in the Benelux countries. Due to the more complex design and construction involved and the fact that there's a performance fall off when a vertical metal support mast passes through the chain (to support higher aerials) I've opted for the simpler and more practical Yagi approach. We would be pleased to feature other designs tried out by readers, and also their experiences with equipment for reception in Band II, so anyone wishing to contribute please write in!

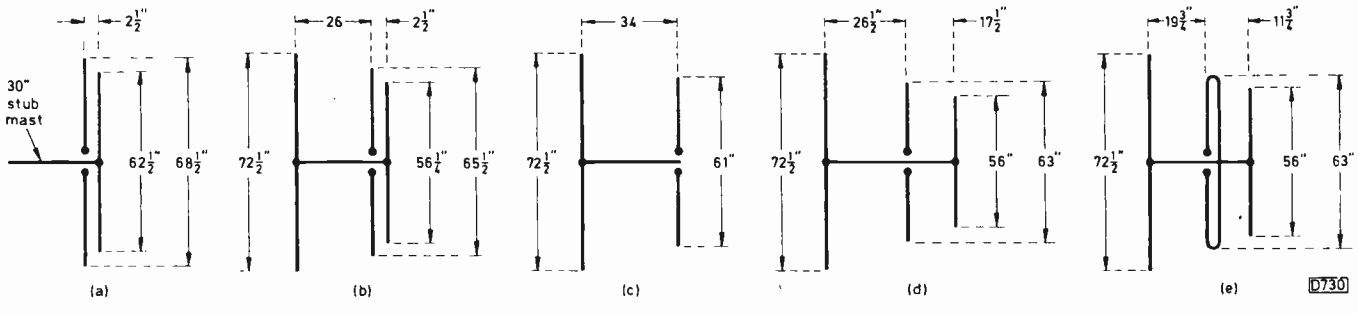

Fig. 2: Band II aerial designs. For details see text. All aerial elements ½ in. outside diameter, mast 1in.

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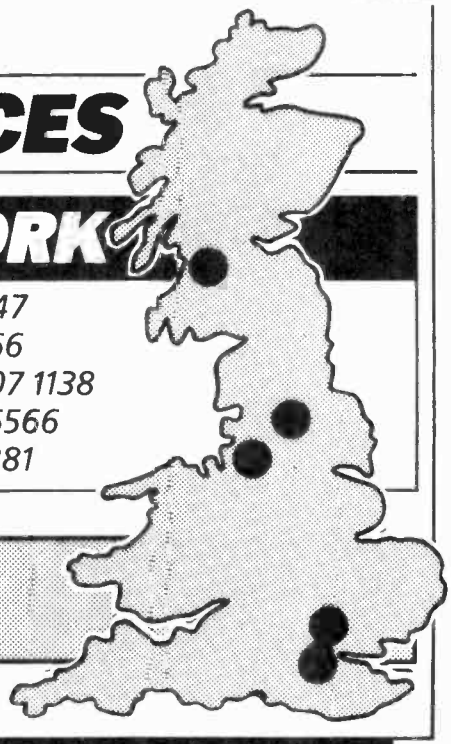

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Mr. Harass originally phoned to say that his Bush T20 was ghostly for the first two minutes or so, after which it was all right. Now I've had this business several times with T20s and T22s, and the cause has been the 47μF electrolytics in the switch-mode power supply. I looked for a spare unit and called out for one to show itself. Nothing doing, so I thought I'd call in on Geoff to see whether he would lend me one and, to be on the safe side, I took a couple of 47μF electrolytics with me.

Eddy's Advice

I landed at Moon Lane and slipped up the stairs to see Geoff. Having picked myself up, I could hear Geoff laughing and saying to Eddy "the silly old sod can't even walk up the stairs without falling over. Oh, hallo Les. Sure footed as a mountain goat as usual."

I smiled in my usual composed way and enquired about the availability of a T20 power supply.

"Certainly old chap, are you sure you need it?"

Ignoring the implication of this remark or query, I described the symptoms. "Ghostly for the first two minutes."

Eddy spoke up, "You need a tube base socket, not a power supply unit."

I smiled. "Thank you Eddy, but I'll borrow the power supply if I may."

With the unit clutched in my hand I left the shop of doubt and headed for Hollyberry Lane, trying to remember what it was that Honey Bunch had asked me to get from the corner shop next to where Mr. Harass lives. I thought I'd fit the power supply unit first and get the ham later.

"Good morning Mr. Harass. Are you the gentleman with the dicey power unit?" After being ushered into the room where the T20 lived I whipped the set round, removed the rear cover, hooked the chassis into the service position, lowered the timebase panel and had the power supply unit out before you could say dozy. I slipped the spare one in and connected it up. When I'd fitted the aerial and switched the set on the sound boomed out and a picture tried to appear. It was miles out of focus. I smiled a sickly smile at Mr. Harass. "Sorry sir, I'll have to pop it back to the shop for a few minutes, to make it better so to speak."

The T20's own power supply was refitted, the rear cover replaced and the whole lot was then carted back to the shop, pausing only in Moon Lane to return Geoff's power supply.

"Sorry Eddy. You were right as usual. The silly bugger didn't say it was out of focus. Have a nice day."

Back at the shop I removed the faulty tube base socket and fitted a new one. The picture was good from switch on. Only a slight touch on the focus control was required (remember that). In a trice the set was taken back home to beam its lovely picture at Mr. Harass. "LLJ triumphs again" I snarled as I sped back to the ranch.

Two Days Later

Two days later Mr. Harass phoned again, this time because of sound hum that varied with picture content. I selected my spare decoder/i.f. panel and wound my way up to his house. Oh yes, I'd forgotten to get the ham last time . . . I listened to the sound from his set and it did have a hum which changed when the scene changed. On fitting the spare panel the hum had gone.

"The picture's nowhere as good as it was" said Mr. Harass.

I adjusted the preset contrast control.

"That's better."

So off I went, hoping to hear no more. Some hope.

Two days later he was on again. "The picture's terrible. Can't see the stumps and can't read the score. I want my panel back."

Now I had spent hours on his panel, painstakingly removing every suspect capacitor and finding it good. I resolved to refit his panel and if necessary swap over the i.f. subpanel and tweak up his focus control. Have you noticed that if you alter the focus potentiometer setting you have to reset it back later? Not every time of course, just nearly every time.

So off we went again. I removed the rear cover and reset the focus control for a clear picture. I then refitted his panel and there was no hum at all.

"Ah, that's better" said Mr. Harass. "I knew that panel you fitted was no good."

I heaved a sigh and left it at that. I hope the focus control holds its contact this time.

Mrs Corker's KT3

I was busy talking to the dogs, telling Tessa what a pretty girl she was, when the phone rang. It was Mrs. Corker, her with the legs. She'd called to say that her Philips TV set (KT3) was on the blink. In fact it wasn't doing anything except stand there, and it wasn't doing that very well either. I promised to call during the afternoon.

I was greeted at the door by Mrs. Corker, who was wearing the shortest of short skirts. I swallowed hard and allowed her to precede me into the drawing room. She immediately lay under the set and gestured for me to do the same. I've been caught by this one before, and hesitated to tell her I was beyond it.

"Get up Mrs. Corker. We'll turn the set on its side."

She scrambled to her feet, looking I thought a little annoyed.

When the set had been turned on its side I tightened up the loose screw. I wonder who'd loosened it? After putting the set upright I switched on. Nothing.

"It's the switch" she said.

" Funny how all you women say that" I commented.

With the rear cover removed I found that there was h.t. at one end of the 4·7Ω surge limiter resistor but nothing at the other end. I removed it and fitted a more manly type. The set now came on but was tripping. After disconnecting the lead from the line output transformer to the tripler the tripping stopped.

"You need a new tripler Mrs. Corker."

"Will that stop the colour keep going off half way through the evening?"

"No dear. That's a little something that can be done in no time and I'll do it before I go."

So I fitted the tripler, taking the diode and earth leads

over the top, and soldered them together where the original single lead had come through, in my usual lazy way. I took out the left upper panel, cleaned the contacts, and refitted it. After switching on I was rewarded with a lovely clear picture in full colour, except for a predominant green which sorted itself out in a couple of minutes.

"What about the colour going off?" asked Mrs. Corker.

"That won't happen again, I promise you. Well not for a year or so anyway."

"I didn't see you do it."

"You were looking at that bird in the garden."

"Oh, lovely, I must give you something before you go."

"Yes dear. Thirty quid."

"Not negotiable?"

"Sorry."

The Thorn 9000

I limped back to the shop and found a Thorn 9000 on the bench. Now I'm not keen on these sets as they tend to play tricks on me. This one had had a new tripler fitted recently. I disconnected this, though I didn't suspect it. Switching on rewarded me with sullen silence, though there was h.t. on the syclops wall. I turned it over and checked the usual places. As all seemed to be in order I disconnected one end of R709, the 47Ω resistor connected between the base and emitter of the syclops transistor. It read something like 10Ω. I pushed the free end through, out of harm's way, and fitted a new 47Ω resistor on the underside (lazy me . . .). The thing then started up, leaving me just to reconnect the tripler. This resistor seems to be really playing up nowadays, but it makes a nice, easy repair. What we need is nice easy repairs. Where did they go?

Teletopics

ALL CHANGE

Following last month's announcement of the sale of Thorn-EMI's consumer electronics products manufacturing subsidiary Ferguson to the French firm Thomson Grand Public, this month brings news that Thomson has established a major presence in the US consumer electronics goods market by taking over General Electric's interests in this field. General Electric's share of the market increased considerably when it took over RCA in early 1986 – the two brands GE and RCA together form the market leader in the USA, with some 23 per cent of TV sales.

Thorn-EMI has announced completion of the sale of Ferguson to Thomson, the consideration, which includes repayment of loan accounts, being £90m. In addition Thomson will be acquiring, in separate deals, Ferguson (Ireland) Ltd. and Thorn-EMI's one third interest in the joint VCR manufacturing venture J2T. In the year to end-March 1987 Ferguson made a loss of £12m, including rationalisation costs of £8m. Its net assets are valued at £81m.

As we go to press Thorn-EMI has announced a major acquisition in the USA. It is taking over the US Rent-A-Centre group for £371m in a bid that has the backing of the Rent-A-Centre board. Rent-A-Centre is one of the three leading consumer electronics rental companies in the USA with an estimated nine per cent of the market. In the last five years the firm's net profits have risen from $2.8m to $9.9m – a further substantial increase is expected in the current year. In addition to consumer electronics goods, mainly TV sets and VCRs, Rent-A-Centre handles some furniture products.

For further information and comment on these moves see page 741.

DBS LATEST

British Satellite Broadcasting (BSB), which has the UK DBS franchise, has been holding talks with semiconductor manufacturers with the aim of ensuring that chips to decode the MAC signals will be available for incorporation in receivers by the time the service starts in late 1989. BSB has gone as far as offering to help fund the development of chip sets. One problem that seems to be holding the semiconductor manufacturers back is the fact that the transmission standard has not been decided: while BSB and the UK government favour the D-MAC standard it's likely that the French and W. German DBS services will use D2-MAC. The Norwegian semiconductor design firm Nordic claims to have developed a dual-standard chip set capable of handling both D-MAC and D2-MAC. A consortium that calls itself Euro-MAC and includes Philips and Thomson is urging the adoption of a common standard for European DBS transmissions.

Plessey Semiconductors has announced a down-converter chip, type SP5062, for use in satellite TV head-end units. The circuitry makes use of Plessey's s.h.f. bipolar technology.

Meanwhile two consultancy organisations have issued reports that cast doubt on the prospects for BSB's DBS service, at any rate in the early years. Logica Consultancy's report suggests that only around 600,000 UK homes will be able to receive the service after the first five years. CIT Research's report suggests that BSB would have 150,000 subscribers after five years and 500,000 after ten years. BSB's business plan assumes the installation of some 350,000 receivers at the start of the service and five million receivers in use after five years. CIT's managing director Patrick Whitten points out that if cable TV is taken as a guide only ten per cent of consumers are prepared to pay extra for a premium service. At the moment of course all this is pure guesswork.

SUBSCRIPTION TV RECOMMENDED

The report by CSP International, briefly mentioned last month, advocates the start of a subscription TV channel for UK viewers, using conventional terrestrial broadcasting. This report suggests that thirty per cent of households would be prepared to pay £10 a month for an additional, scrambled, premium channel. It says that plenty of spectrum space is available for such a service. If allocating further space to TV or finding ways of making greater use of the space already available proves to be unacceptable the report suggests curtailing the current services to slot in scrambled programming, or alternatively using periods when transmitters are at present off-air to download programmes. Such ideas are expected to be welcomed by those members of the government who favour a move to viewer payment for services provided.

CITIZEN'S POCKET COLOUR TV

Citizen is shortly to launch in the UK a colour pocket portable TV set using an LC display. The set, Model TC53, is expected to be the only PAL-I standard LCD set available in the UK before Christmas. The NTSC version has been on sale in Japan and the USA for some time.

The set has a 2.5in. (38.1 × 50.8mm) back-lit LCD screen with 57,600 pixels. We've seen a pre-production set working and would certainly say that the addition of colour greatly enhances an LC display. Citizen have adopted a trapezoidal pixel arrangement which avoids the rather jagged effect you tend to get with square picture elements. There's a comparatively dense RGB filter layout which also contributes to the resolution. The Citizen Super Matrix (CSM) arrangement, with the electrodes above the colour filters, enables a higher voltage to be applied, giving an increase in contrast of some 20 per cent. Power is from AA batteries, an a.c. adaptor or a car battery adaptor. The consumption is 2.4W and the battery life three hours (with alkaline cells).

NEW COLOUR SETS

Bush Radio is to return to the CTV market with sets manufactured in Turkey. The plant is understood to use Thorn-Ferguson technology so the innards may have a familiar look to them. The well-known Bush brand name has not been used in the CTV market for several years. Bush Radio is now owned by Prestwich Holdings: the sets will be supplied by Polly Peck.

The current Ferguson range of 14in. colour portables, using the TX85 chassis, includes a model with teletext.

New CTV chassis have been announced by Tatung and Fidelity. Tatung's Super CX chassis features a 21-pin SCART connector, CCT for improved colour performance, automatic switch-off at the end of a transmission, an on-screen channel display, and full-feature IR remote control with 30 pre-programmable channels. The sets have FS tubes in sizes ranging from 15in. to 28in. – they incorporate "Black Quartz" technology (a tinted filter to reduce reflections and improve the contrast). Fidelity has gone digital for its latest chassis, type ZX5000, which uses the ITT range of digital TV signal processing chips.

DEVELOPMENT WORK

Philips has suggested that record/playback video discs could be developed within three-four years. New compounds based on gallium and antimonide have made the breakthrough possible. They enable the laser beam to erase and write material as well as reading it.

Finlux's parent company Lohja Corporation has announced the development of a flat-screen TV set with a seven-inch electroluminescent display. The set is regarded as experimental but work on the project is continuing in conjunction with the Helsinki Technical College.

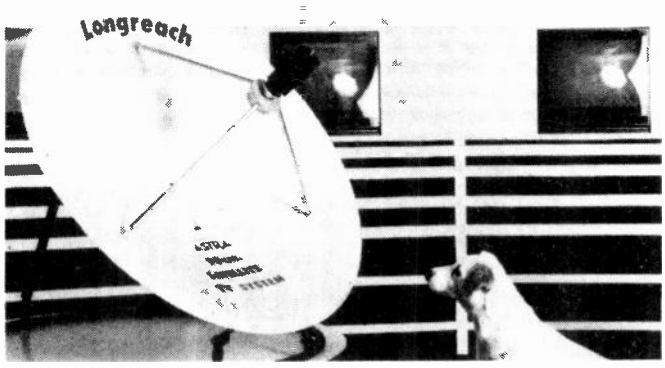
A 3D TV system has been developed by Dr. Max Robinson of Trent Polytechnic. The viewer wears shuttered glasses which are synchronised to the display. The system includes a video recorder as the signal source – it connects directly with a TV set – and a two-lens camera.

THOMSON SPARES

We have been notified of a correction to the spares announcement in this column last month. Spares for Thomson TV sets and VCRs are available from K. M. Services Ltd., 19 Market Place, Brackley, Northants NN13 5AB (0280 701 650). Service All Electronics, whose address was given last month, provide spares for Thomson microwaves and the CVM01P camera.

SATELLITE RECEIVER SYSTEM FOR £499

Longreach Marketing Ltd. (Riverside Business Park, Lower Bristol Road, Bath BA2 3DW – 0225 316 257) has



announced a satellite TV receiver system for £499 including VAT. It consists of a UK made 90cm dish, a Japanese LNB that employs three gallium-arsenide f.e.t.s, and an American receiver unit. The LM90 system is being marketed as "a high-quality TVRO installation for the price of a VCR".

NEW MULLARD RC DECODER CHIPS

Two new infra-red remote control decoder chips have been announced by Mullard. Type SAA3009 is for LED drive and type SAA3049 for low-current drive applications. The decoders check coded data received from the remote control transmitter, converting this to latched binary outputs. They accept RECS80 coded data with pulse-position modulation (from remote transmitter chip types SAA3004/7/8) or RC5 coded data with biphase transmission (from chip types SAA3006/3027). 64 remote control commands can be decoded, with a maximum of 32 sub-addresses. By adding circuitry for binary decoding of the data and address a maximum of 2,048 commands can be used. Six individual output ports can be operated with no external circuitry.

EDUCATIONAL

The London Electronics College has announced a new series of up-dated, one-year full-time BTEC National Certificate courses which start on September 21st. Subjects available will be as follows: (1) electronic equipment servicing, including TV, VCRs and CCTV; (2) computing technology, including microprocessors, interfacing and data communications; (3) information technology, including telecommunications, networks, satellite TV and compact discs; (4) software engineering, including assemblers, BASIC, Pascal, programming and CADCAM.

The Radio, Television and Electronics Examination Board has been awarded a £4,000 grant by the Distributive Industry Training Trust to assist in the development of ways of providing a practical fault location test for microprocessor-based equipment.

IN BRIEF

Bib has announced a VHS-C video head cleaner cassette kit at £9.98 including VAT . . . A new catalogue listing their extensive range of aerials, amplifiers and associated equipment is available for 75p by return post from Aerial Techniques, 11 Kent Road, Parkstone, Poole, Dorset BH12 2EH . . . An easy-to-fit, low-cost BNC connector that can be used over and over again has been announced by Specialist Electrical Engineers Ltd., (St. George's House, St. George's Lane, Cleveleys, Lancs FY5 3LT). Fitting is said to take only seven seconds and no soldering is required . . . Willow Vale Electronics Ltd. is holding a Trade Show at its Manchester branch on September 23rd, from 10am to 10pm. A buffet will be supplied.

TV Fault Finding

Reports from Chris Avis, R.T. Rees, R. Crockit, Michael Dranfield, Mick Dutton and Roger Burchett

National Panasonic TC2201

This one had the shivers – severe line tearing and enough h.f. radiation to upset other TV sets in the workshop. The h.t. rail was correct and adjustable and there was no visible arcing in the line output area. It was then discovered – by chance – that operating the service switch would stop the radiation! Checks were made around the chopper transistor TR801 whose emitter is decoupled by C826 (390pF). Bridging this with an additional 330pF capacitor also cleared the symptom, though a replacement 390pF capacitor didn't. TR801 showed a 1MΩ emitter-collector leak however and a replacement cleaned up the picture – on all the sets. Presumably operation of the service switch removed the fault symptom due to the reduced load on the power supply caused by no field scan and low beam current. **C.A.**

GEC C1405H

"The on/off switch is faulty" said the customer, incorrectly. In fact the set was tripping when switched on, except for the odd occasion when it would work normally for a while before cutting out. Tests revealed that the safety thyristor Q901 was inclined to cry wolf and inhibit the line drive when the operating conditions were actually correct. Q901's gate resistor R910 (10kΩ) was removed and checked. It read 13kΩ before one end fell off! **C.A.**

Sony KV1820

A case of Snow White Syndrome, or Whistle While You Work: there were erratic squeals from the power supply transformer and ragged verticals. A common cause of this symptom is C609 (0·47μF, 50V) in the power supply, but the seven dwarfs continued unabated when it was replaced. With precise use of freezer the fault was traced to one of the power supply pulse-width modulator transistors, Q604 (2SC634A). This had developed random base-emitter leakage – anything between about 50kΩ and 5MΩ. A BC183L proved to be a satisfactory replacement. **C.A.**

Ferguson TX90 Chassis

There was no colour on this portable TV set due to the line pulse at pin 9 of IC103 being of low amplitude at 2V. R171 (270kΩ) had gone high in value. **R.T.R.**

Rediffusion Mk 3 Chassis

The trouble with this set was intermittent brightness changes. Under the fault condition the voltage at the emitters of the RGB output transistors went very high. The culprit was the 7·5V zener diode 2D15 which returns the emitters to chassis. This diode is used to set the black level d.c. offset. It was going open-circuit intermittently. **R.T.R.**

Ferguson TX9 with Teletext

This set almost had a mind of its own, changing channels, going into standby or increasing the sound level (never the other way). A general resoldering of the joints in the area of the line output transformer improved things to the point where we had very intermittent channel changing or going to standby – days would go by with the set performing well, then off we'd go again. Resoldering all the joints in the infra-red receiver unit eventually cured the problem. **R.C.**

ITT CVC25/30 Series Chassis

This fault is showing up quite regularly. After replacing the tripler or after a flashover you may be presented with a washed out picture, the contrast control having no effect. The component to check is D3 (1N4148) in the beam limiter circuit. It's connected to the earthy end of the tripler and goes leaky. **M.D.**

Thorn 9000 Chassis

There was an odd fault on this set. It would work for five minutes after being switched on then start to trip. Disconnecting the power supply rails had no effect, neither did disconnecting the tripler. Attention was therefore turned to the regenerative trip switch. The input from the thick-film sensing unit arrives at connectors 20/4 and 20/5 on the syclops control panel. Under normal conditions the voltage here should be low, at 0·05V. We found that it was a little on the high side at 0·28V. After a minute or so it started to rise, eventually reaching about 0·5V after which the trip started to recycle. When the over-voltage thick-film unit was cooled the voltage dropped back to 0·28V. Zener diode W716 in the unit was heat sensitive, leaking when warm. A replacement thick film unit restored correct conditions. **M.D.**

Mitsubishi CT2027

Two of these sets came in recently with the complaint that they wouldn't switch on. In both cases the cause was R7A0 being open-circuit. This resistor provides the remote control receiver panel with a start-up supply. **M.Du.**

Decca 80 Chassis

The problem was low and distorted sound. On investigation the supply to the TBA800 audio amplifier/output chip was found to be low at 10V instead of 25V. We worked back to the regulator driver stage on the timebase panel and found that R368 (150Ω), which is in series with the base of the shunt regulator transistor, was burnt while the driver transistor Tr303 had overheated. We replaced these items and checked the regulator transistor Tr801. When we switched on R368 immediately began to smoke. Closer inspection revealed that connector PTA11 was dry-jointed, with the result that all the current was being diverted via the driver transistor and R368. **M.Du.**

Philips G11 Chassis

This set would go "dead" very intermittently. We exchanged the power supply, line timebase and line output panels but the fault persisted. In an attempt to narrow down the search we removed the beam current limiter transistors from the power supply panel. The set then worked all right. A look at the circuit led us back to the

colour decoder panel. When we removed this we found a crack in the print at the rear of plug 6C. This was causing the beam limiter to be connected to the h.t. rail via R6065 without the benefit of zener diode D6011 to hold down the voltage level. Repairing the print cured the problem.

On another of these sets there was no output from the power supply as R4067 had sprung open. When this was resoldered the power supply worked but the output was high at 180V. R4024 (220kΩ) in the set h.t. control network had increased in value to over 400kΩ. **M.Du.**

Thorn 1615 Chassis

The complaint with this set was no flyback blanking. As the voltages around the blanking transistor seemed to be correct we decided to take a look at the waveforms. These were all correct at the blanking transistor but seemed to be of very low amplitude at the video output transistor. W18 (1S44) which is connected between the collector of the blanking transistor and the emitter of the video output transistor was not conducting, though it measured all right on a meter test. **M.Du.**

Ferguson 37141 – TX90 Chassis

This set would not go into the standby mode and the customer complained that it would intermittently shut down. The standby problem was caused by TR902 (ZTX750) being short-circuit while the intermittently dead problem was due to dry-joints around the line output transistor. We also resoldered the field output transistors: these were badly dry-jointed, as you often find with this chassis. **M.Du.**

Rediffusion Mk 1 Chassis

This set was covered by a maintenance agreement until last year, when Granada decided not to continue with it. This is how I came on the scene. There were quite a few botches, the worst being that the cutout had been linked out. After carrying out a post mortem it seems that the focus spark gap had shorted out, melted and in dripping down the tube base panel had scorched this and started the Paxolin burning. Fortunately the 3A mains fuse then blew, bringing the conflagration to a not untimely end. The owner is an increasingly senile old lady who could never have got to the set in time had a real conflagration started.

At the moment I await instructions as to what to do with the set. The owner's son is a solicitor, so action may be taken. Surely the big boys in the trade should realise that a maintenance agreement means just that – maintaining the set in as near perfect condition as possible until it's too old, then telling the owner so. As a postscript the focus control, which had also melted, is with the local fire brigade: they display such horrors on open days. **R.B.**

Grundig CUC120 Chassis

This set was shutting down and not always restarting. Switching off and on again a short time later sometimes produced results. At other times it wouldn't start at all. Voltage checks indicated that the TDA4600 chopper control chip was receiving a start-up supply, but nothing much else was happening. A quick squirt of freezer on the chip and the set burst into life, only to stop a few minutes later. Another dose of cooling spray and the set came on again. As nothing obvious was amiss we replaced the chip. No change. Attention was then directed at the components nearby. R632 is very close to the chip and freezing it started the set up. But this resistor would have to fall in value to have any effect: it's connected to pin 5 of the chip, i.e. the safety circuit which shuts the set down when the voltage at this pin is less than 2·2V. A check on the voltage showed that it rose when the set stopped! Various other components were tested or replaced before, in frustration, I flexed the panel hard with a screwdriver handle. The set then tried to start. Tapping the panel had no effect but flexing it did. The only thing to do was to start resoldering: the faulty joint was found to be on L631, which is in the chopper transistor's base drive circuit. Presumably the freezer was moving the joint sufficiently for it to remake – the joint is very close to the chip. **R.B.**

Review: Sony Fault-Finding Guides

Eugene Trundle

Manufacturers vary in their provision of servicing information to the trade. All produce service manuals of course. Some of these are good, some bad and others indifferent. Some setmakers go a good deal further than this, collating and publishing "common fault" data for their products as an aid to speedy servicing. The subject of this review is a recently published series of fault-finding guides from Sony. The information contained in them has been gathered from a wide net of service companies and manufacturer's depots in the UK and continental Europe.

It's easy to dismiss such "symptom and cure" guides as idiots' handbooks – "monkey charts" is an expression often used. Except for the lucky few however most of us are in the repair business to make a living rather than glorify in our diagnostic skills, and when you're working against the clock any help that speeds the process of turning the product round and getting it back out of the door is welcome! I for one am happy to "stand on the shoulders of giants" when they point me in the direction of a little leaky diode or whatever as the probable cause of some horribly obscure set of fault symptoms. Plainly such guides cannot provide a guaranteed definitive answer to every fault that may be encountered, but with these particular guides there's a statistically high probability that for each symptom the suggested cause and remedy will be applicable to the set on your bench. This provides a tremendous saving in trouble-shooting time and hence in servicing costs.

The Sony Service Fault-Finding Guide comes in three volumes which were originally published in November 1986. Volume one, with 508 pages, covers video products including cameras; volume two with 311 pages deals with TV sets and has a small section on home computers; volume three with 381 pages is concerned with audio equipment. For the purpose of this review I've concentrated on the first two.

The format adopted in these books is one fault per page. Taking one at random we get: Model no.: CCDV8. Symptom group: Picture. Symptom: Camera defective, white spot with green lines. Cause: Polarity of C730 incorrect. Remedy: Replace C730 on board CP11. Description: 0·47μ, 20%, 25V, part no. 113508300. On

each page space is provided below this information for the user's own notes. Some pages call attention to Sony Service Bulletins where these are applicable, i.e. for official modifications etc., and quote the bulletin number. The fact that the information given is so specific shows that it's based on experience and practice. The same information is in a few cases repeated on other pages where different models share common circuits, components and symptoms.

The guides go back a long way. Early models like the KV1300, SL8000 and SLC5 are covered as well as the latest equipment, though it must not be expected that the spare parts referred to will in all cases still be available – nor that their part numbers will not have been changed.

An in depth browse showed that most (but not all!) of the faults we've come across twice or more are listed. In order to complete the picture, each book's introduction includes a cordial invitation by Sony to inform them of faults encountered and cures applied for inclusion in the next edition.

The only slight criticism I have concerns the order in which models are listed in the video book. It could lead to vital information being missed or to a longer than necessary search for the correct page. The sequence is: SL8000; SLC20/30/40; SLC5/6/7/9; SLF series. The TV book has no such problems. In both cases edge block markings on the pages help achieve quick access to the required information.

Apart from the "access" problem just described I found that these Sony books are excellent in concept and execution, and would heartily commend them to all engaged in servicing Sony products – if only because their cost could well be recouped by the first two or three "instant diagnoses" they provide.

Certainly you cannot throw away your scope, test meter, etc. when you get these books, but they will be a useful weapon in the armoury of any service department. It would be a welcome thing if other manufacturers followed this example of providing fault/repair data in easy access booklet form which can be updated at intervals with new editions. Indeed Panasonic/Technics have produced a similar publication: its first edition is at present out of print but is soon to be replaced by an enlarged and updated version. We'll be reporting on it as soon as a copy comes to hand.

The Sony guides are available form their Spares Department at Sony (UK) Ltd., Pipers Way, Thatcham, Newbury, Berks RG13 4LZ under part numbers S-79620201 (video), S-79510001 (TV) and S-76900001 (audio). They cost £4·95 each including VAT.

Mains Supply Problems

Gordon Haigh

The article on dealing with mains interference, in the April issue, was most interesting. Although it's not necessarily a problem – except in the case noted by Roger Bunney of an interfering v.h.f. transmitter suspected of using the mains wiring as an aerial – there does seem to be a growing trend for the mains supply to be used for communications purposes. In fact a draft frequency plan for mains use has been published, covering 40-150kHz. Certain sections are allocated for specific uses, e.g. 40-90kHz for the electricity supply authorities and 140-150kHz for fire/security uses. Equipment is at present in use outside this band, for example mains intercoms that use 100-300kHz. Some computer data interchange has been reported – how well this works against all the unwanted nasties present is anyone's guess!

The shock hazard is forever present. You would not think that a brush with the chassis of a Rank A823 receiver would be memorable with the mains plug wired correctly, but it was. Inspection of how the live mains reached the power board revealed that the polarity prong on the connector had broken off, with resulting reversed connection.

The mains leads on some imported radios have not in the past been as safe as they should be, consisting of twin single coated wire. Whiskers of wire can protrude through the insulation, giving that tingling feeling – or, if draped near a metal sink top, you can get a hole blasted through the insulation. Hidden breaks in and around the appliance end-moulded mains plug, due to constant bending, can be the cause of intermittent operation of some TV and radio sets and cassette recorders.

A simple circuit that will give an at a glance warning of the hazards with a customer's power sockets is shown in Fig. 1. It was originally published some years ago in *Practical Electronics*. The neons are all 90V types and the resistors 0·25W, 5 per cent types. With a safe, correctly wired socket only neons Ne1 and Ne2 should light. With no earth connection neon Ne1 only will light. With reversed live and neutral connections Ne1 and Ne3 light. Flickering neons indicate bad contacts.

Each neon is designed to draw 3·5mA. This ensures that floating earths are identified as such, providing the live-to-earth cable capacitance is less than about 50nF (corresponding to several kilometres of cable). The plug should be removed soon after noting which neons are alight since it's not good practice to pass current between the live and earth lines.

With a little skill the components can all be built into a standard 13A plug, with holes drilled for the neons. Faults like open-circuit or bad earths, reversed socket wiring, switches not in the live circuit and dead sockets can be quickly discovered. Simply insert the plug into the wall socket and observe the neons.

On one occasion I was called to see an old Bush monochrome set that was reported to be dead. It was installed in a bedroom. After checks in the set I discovered that there was no mains supply – there was no supply at the socket either. It transpired that the owner had not lived on the premises long. A previous owner, being a DIY fan, had wired the socket to the white meter circuit (timed cheap-rate off-peak circuit). It was timed to be off when I called – the safety plug would have come in handy on that occasion.

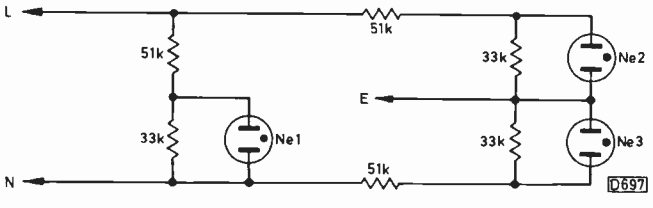


Fig. 1: Neon mains checker circuit.

Letters

VIDEO COPYRIGHT – A WARNING

Several recent articles in *Television* have drawn attention to the satellite TV services now available in the UK. Clearly many engineers will be having a go at reception. And a good thing too, because as usual the service engineer is the final and vital link between the equipment manufacturer and the public. Unless engineers become experienced and adept at installing satellite TV receiving gear the whole thing could founder. Once again, only actual work will provide the necessary know-how – an ounce of practice is worth a ton of theory. There's a danger however that may not be generally appreciated. Whilst no one would suggest that readers of *Television* would be tempted to do anything illegal, such a situation could nevertheless happen by accident.

The problem lies with the complicated laws on copyright and other matters relating to material transmitted via satellites for use by cable TV networks. When new feature films are sent out in this way it's inevitable that the temptation will arise for unauthorised people to record them. Laws are breached however even where domestic use only is intended. The situation is infinitely worse when the recording is lent out to another potential viewer. At this point the person concerned is at risk under the Copyright Act and the Video Recordings Act – and possibly the Obscene Publications Act if the material concerned is "blue" and doesn't have the appropriate sensor's certificate. An organisation exists to enforce compliance with these laws. It's the British Federation Against Copyright Theft, which has its headquarters at Isleworth, Middlesex. While the Federation may not be widely known, to show that it has teeth and is prepared to use them just consider the case of Raymond Sharkey of Huddersfield.

Earlier this year legitimate traders in the video films business in and around Huddersfield became aware that recordings of feature films that had not yet been released for home viewing were being circulated in the area. In complaints to the police the traders alleged that Mr. Sharkey was making illegal recordings and then selling or renting them out, to the detriment of their own business. The police consulted the Federation and subsequently raided Mr. Starkey's home, from which they took satellite receiving and video recording equipment. In due course the Federation instituted proceedings that led to Mr. Starkey's appearance in court early last May on ten charges under the Acts previously mentioned. He was found guilty, fined a total of £2,000, and had to pay the Federation's costs of £250. In addition the Federation had Mr. Starkey's gear, clearly of considerable value, handed over to it. The court was apparently determined to show that in this type of case at least crime doesn't pay.

The warning is clear to anyone who is, no matter with what innocent intent, inveigled into assisting with video piracy. The penalties are far too severe for the risk to be worthwhile. Verb. sap.

Chas E. Miller,
Woodseaves, Staffs.

BATTERY ALTERNATIVES

The backup batteries in a Panasonic NV7200 VCR had failed. As replacements of the correct type were not to hand I decided to fit an alternative. Four rechargeable AA size cells in a two-by-two type holder (end to end type, not four in a row) were found to fit in the space just behind the tuner controls. The holder was held in place with a few blobs from a glue gun. Good quality cells should be used, or additional protection provided so that if they leak deposits won't fall on the PCB below. Such damage could be costly to repair. The new arrangement should provide backup cover for a longer period than the original battery.

Fitting rechargeable batteries to the remote control unit requires slight adjustment of the positive terminals to get them to reach – the positive end of the battery rested on the plastic and the nipple wasn't long enough to reach the metal. I've noticed that a battery that appears to provide reasonable power, as measured with an Avo, when the control unit is activated might nevertheless not be adequate. This is because the unit takes power in the form of high-current pulses which reduce the terminal voltage for such a short time that the Avo doesn't register them.

Primary cells, i.e. non-rechargeable types, will however still run LCD appliances such as digital clocks and thermometers for a time towards the end of their lives .

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

TANDBERG TIP

There are still many 22 and 26in. Tandberg CTV2-2 colour sets around with a perfectly good tube but a dud tuning drawer. Instead of throwing the set in the skip because the drawer is rather expensive and unreliable, the following approach is either very cheap or free and provides a complete and lasting answer. First, rescue all those tuning units used in the 520 etc. version of the Philips G8 chassis. Next remove the Tandberg tuning drawer and throw away the printed resistor unit. Note the connections at the rear of the unit – these apply to the six channels, the 30V supply and chassis. Leave the a.f.c. connections, which are still available when the drawer is pulled out slightly. Having prepared the G8 unit with its leads, solder these in the correct order to the rear of the Tandberg drawer. Screw the G8 unit on to the wood just inside the left-hand side of the cabinet, then cut the shape out of the backboard (very easy) and the job is done.

Hugh MacMullen,
Newquay, Cornwall.

CABLE TV

I was interested to read J. LeJeune's article (August) on the development of cable TV systems. It took me back to my school days when, at 16, I had to look after a 250W, 1938 vintage relay system. At the same time, in 1966, I was asked to design and did produce a 405-line TV relay system. It was required to work with off-air, fringe area signals and the output of a Pye Lynx camera, feeding sets up to 600 yards away without any intermediate amplifiers. I used channel 3 (56MHz) for distribution. Only one programme – BBC, TWW or from the CCTV camera – was relayed at a time.

A strange fault was reported from the next town, Bradford-on-Avon. Someone complained that they suddenly had a bad ghost to the left of their picture. There was a cable TV system in the street to which the set's owner didn't subscribe. The cause of the problem was traced to one of the cable system's T-off points – the box was broken and was radiating a strong signal. The

complainant's set was receiving a good signal from the cable system, the ghost actually being the direct signal from the "local" transmitter (Wenvoe, South Wales).
Alex Clapton, B.Sc.,
Ipswich, Suffolk.

SERVICING CHARGES

I agree with everything Mr. Tasker says (July letters) – except for the price! It's far too high, unless he has a special price for pensioners. These people have lost so much through inflation that they have very little left, so let's give them a hand if we can.

Thanks Les (same issue) for your note on those modern fuses. I was one of those who knew what they looked like but not the value! Incidentally, a lady recently appeared at the counter and asked for a 32mm 1A glass fuse with a wire running down the outside. I suggested that she should use a nut and bolt.
John Hopkins,
The TV Workshop, Felixstowe, Suffolk.

RESTORE TO CORRECT SPEC

I must disagree with J. McCorry (letters, June) who criticised Mr. Roberts for assuming that a customer's 3V29 VCR was being used for taping off-air programmes in addition to its playback role. An engineer should surely endeavour to restore, to the best of his ability, any faulty piece of equipment to its original design specification – unless the customer requests otherwise. Mr. Roberts also came in for criticism for not obtaining more information about the nature of the VCR's faults. The request, which was more than likely given to a sales assistant, was quite simply "to repair the machine". Also, he would have great difficulty in supplying an estimate or quotation to a customer who left a false name and address and no telephone number.

At the end of the day, when one considers the overheads – which include the upkeep of premises, engineers' wages, test equipment, the provision of transport, etc. – there's little room in the television service industry for excessive profits to be made.
Les Grogan,
Prestatyn, Clwyd.

VINTAGE TV

In reply to Mr. Mathews' letter (July), Ostar-Ganz high-voltage valves could be supplied with either a.c. or d.c. and were wired in parallel directly across the mains. They were marketed in the UK by Eugen J. Forbat from various addresses in the Covent Garden, London WC2 area. The company also sold sets in kit form, chassis and complete radios. Advertisements for the valves emphasised "no barretters, no mains transformers and no breaking down resistances required. This is truly the valve of the future. Old receivers modernised and guaranteed to compare with up-to-date models." Unfortunately no prices were given for the valves. Can any reader help with this information?
Douglas Byrne, G3KPO,
Communications and Electronics Museum Trust,
Ryde, Isle of Wight.

With reference to Mr. Mathews' letter (July), I built a set using Ostar-Ganz valves when I was fourteen. All very simple: no mains transformer and half-wave rectification with neutral to chassis (a bit daring in those days of two-pin plugs). They were very good valves, with a higher mA/V characteristic than most contemporaries. The Austrians overcame the heater/cathode insulation problem at 350V and the valves could be run with a.c. or d.c. at "100/250V, 24mA input" (output valves 37mA). There were only two heater pins, so there may have been two types. The special 7-pin holders had a screening plate between the control grid and the heater to avoid hum pickup. They represented an interesting milestone.
G. Cox,
Bexhill-on-Sea, East Sussex.

The interesting letter from Mr. Mathews on the subject of high-voltage heater valves jogged my memory. In 1936 I had on hand a project that used quite a few Ostar-Ganz valves. I still have full technical details of the valves. With the exception of the full-wave rectifier and output pentode the heaters were rated at 250V, 24mA a.c./d.c.: the rectifier took 44mA and the output pentode 37mA.

Unfortunately the first lot I had to handle turned up with Continental 7-pin bases. Valveholders for these were rather hard to come by, though the valves subsequently became available with standard British bases.

I now wonder whether some innocent servicemen in the thirties had a great surprise when they found the full mains voltage on the heater pins – if indeed they didn't land up on the floor!
Robert Crawford,
Uddingston, Glasgow.

Though they make me feel my age I always enjoy reading Chas E. Miller's Vintage TV articles. In respect of the Ekco Model TMB272 however I suspect that his memory is ailing (as mine is!). This set did in fact have an internal vibrator power supply, using a mains transformer winding that doubled as part of the heater circuit when used with a mains supply.

In areas with no mains supply I used the series-parallel heater arrangement to enable one or two 9in. BBC-only sets to be used with a 12V d.c. supply – in conjunction with an ex-government rotary converter to provide the h.t.

Ask Chas to tell us about that Murphy set where you had to change the sound output valve when the picture wouldn't focus!
Peter Nutkins,
Charmouth, Dorset.

HITACHI SOUND PROBLEMS

In later versions of the Hitachi Model CPT2024 some improvements were made to the volume and tone control circuit. They tend to increase the distortion however. Advice was given in an earlier letter (April 1986) on rewiring the woofer and tweeter loudspeakers to give improved sound. In addition, further modification should be carried out on control panel PC131 as follows: remove C426 and replace it with a link wire; change C427 (0·15μF) to 0·1μF polyester (C426 can be used). Replace the panel and ensure that woofer SP401 and tweeter SP402 are wired with reverse polarity to the audio output transformer via PL/D1 negative connection and PL/D2 positive connection.

In some later versions of the NP82CQ chassis the quadrature coil L402 in the sound channel was incorrectly

adjusted. This is easy to put right. Tune to a test pattern signal and adjust L402 for maximum sound output – no more than one turn clockwise or anti-clockwise.

P.C. Rowe,
Camborne, Cornwall.

RC TRANSMITTER TEST

Whilst experimenting with an infra-red remote control unit near a medium-wave radio receiver I realised that this arrangement provides a test as to whether the unit is working. These control units produce quite a loud pulsing sound from the radio when one of the buttons is pressed. Tune the radio set to an unoccupied part of the medium waveband for the test. Different controls give slightly different sounds. The long waveband is also affected.

One control unit I tested, a Thomson unit with no indicator LED, gave a louder sound when the transmitter window was held near the radio set. It would be interesting to hear what other control units do.

Robin Gray, B.Eng.,
Nottingham.

25kV EHT PROBE

Several people have queried the availability of the 200μA f.s.d. meter used in my 25kV e.h.t. probe (see June 1987 issue). In the prototype I used a small VU meter which I had to hand. This doesn't seem to be generally available, but RS Components list at 250μA f.s.d. VU "mini-meter" (order no. 258-013) which would be suitable provided the following modifications are made to the original design:

(1) Reduce the total series resistance required to 100MΩ. This means that one hundred 1MΩ resistors are required.

(2) Since the potential across each resistor is now 250V, a different type is required. RS Components list a 1MΩ 0·5W metal film resistor with $\pm$1% tolerance (order no. 149-975). This has a maximum working voltage of 350V and is thus suitable.

(3) The VU meter has a non-linear characteristic and must therefore be scaled at each required voltage against either a reliable source or an e.h.t. probe.

RS Components' items can be obtained by post from Electromail, PO Box 33, Corby, Northants NN17 9EL (telephone 0536 204 555).

Andrew J. Heron,
Lowestoft, Suffolk.

VIEW FROM NEW ZEALAND

Over the forty years I've been in the servicing trade I've had to deal with TV receivers, radio sets, electrical appliances and transmitting equipment. More recently I've had to take on VCRs. All this has meant a great deal of study and research. It seems to me that the time of the GP in the electronics field is numbered, though the public will no doubt expect the younger generation to know all about everything. Without enthusiasm, I'd say that the next generation of servicemen will find times ahead difficult.

We had yet another new experience the other day. A Teac VCR, Model MV430, which is made by Funai and is also marketed in NZ under the name Canon, came in with the complaint no contrast and no colour. A voltage check plus a video output test revealed that module HIC101 was faulty. This has surface-mounted i.c.s, with several variable resistors for adjustment, and is designed as a complete replacement unit (though only one i.c. was faulty). A replacement unit had to be ordered and worked first time without any adjustment being necessary.

Just thought you might like to hear from one of your more distant readers!

F.R. Nankivell,
Bay View, New Zealand.

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HELP WANTED

I've had a Tandberg CTV4 in my possession for some months now with a faulty line output transformer. Unfortunately the transformer no longer seems to be available as a replacement and a well-known LOPT manufacturer tells me that a rewind isn't possible as the core can't be split. R.D E. Tandberg in Bradford provide spares for most Tandberg sets but not the CTV4.

This is rather a shame. Quite a number of these sets were sold in this area and their performance is excellent. Can anyone help with this problem?

N. Rickman,
Lymington, Hants.

Can anyone supply or suggest a source for a microprocessor chip type MM76EL B8634-11? The device was made by Rockwell who say that it's now out of production. It was the heart of a water softener control unit of French design. Unfortunately the French manufacturers will now supply only complete units, at £80 trade, which makes for dissatisfied customers. To date I have repaired about fifty of them by cannibalisation but some chips would be a help!

Bill Harrison,
Windsor, Berks.

VM6101 Teletext Decoder Interface

Keith Cummins

Regular readers will be aware that recent changes to the broadcast teletext signal have caused problems when the Texas Instruments' XM11 teletext decoder is used. This decoder was designed before the specification for the UK teletext transmission standard was finalised, and recent permissible changes to incorporate datatext etc. have resulted in every fifth row of text being ignored by the decoder. When the initial experiments with datatext were being carried out I for one was very puzzled as to what was going on. A number of letters on the subject appeared in *Television*, including one from myself, before Mr. W.J. Winston of the BBC finally explained (in the August 1986 issue) what was happening. I was particularly aggrieved by this since I'd written an article in the September 1985 issue on the general principles involved in adding teletext facilities to a TV receiver not originally designed for teletext reception, and as a practical example had provided details on using the XM11 decoder with a Sony Model KV1820UB.

Two events prompted me to look into the possibility of replacing the XM11 decoder in this project with the readily available Mullard VM6101 teletext decoder. First, the realisation in January this year that Channel 4 was the only one I could effectively use for teletext, and secondly the publication of Peter Marlow's article on a low-cost teletext decoder in the December 1986 and January 1987 issues. I found that with a bit of hardware assistance Peter's programmed 8748 microcontroller chip, which is still available from Video Interface Products Ltd. (Charlton House, 32 Charlton Lane, Cheltenham, Gloucestershire GL53 9DX), can be used to interface a modified XM11 style keypad and a Mullard VM6101 decoder. Other things also had to be sorted out in this interface, but once the decoder differences are appreciated it's possible to produce an effective modification. The results obtained are very pleasing, since the VM6101 has background colour and the display is prettier and more interesting than that produced by the XM11. The current price of the programmed 8748 chip from VIP Ltd. is £12·50 plus VAT plus £1 post and packing.

What's Involved

I'd best start by explaining the gains and losses. The XM11 keypad has to be modified. TV channels 1 to 4 remain unchanged. So do the text and pic buttons, digits 0 to 9 and reveal. Sound on (speaker symbol) becomes recall. Sound off (speaker symbol struck through) becomes non-functional. Update becomes full page, time becomes top, mix becomes bottom and page becomes hold. So we've lost the update and time facilities and also mix (which I'd always considered pretty useless anyway). We do have proper subtitles and newsflash however which can't be inlaid on the picture using the low-cost teletext decoder. The new keypad legends can be applied using black Dymotape, which doesn't look too unprofessional. The new interface design normally mutes the sound when the text is on. As this isn't always what's wanted I've included an option switch at the TV receiver end to override the muting if desired.

The interface modifications that follow relate specifically to the original design published in the September 1985 *Television*. The general principles can be applied to any interface however, and I hope this will enable readers to evolve suitable changes for other receivers that employ the XM11 decoder. I should emphasise however that this is not a job for the faint-hearted, involving as it does a lot of work. It pays to get well organised and banish the wife, kids, pets and (especially) home brew during the critical phases. Static precautions should be taken at all times while carrying out constructional work.

The Microcontroller Interface

My first task was to build the microcontroller interface. This is shown in Fig. 1 and, as you'd expect, bears a striking resemblance to the right-hand part of Peter Marlow's interface circuit (Fig. 4, page 113, December 1986). I obtained from Video Interface Products Ltd. a programmed 8748 microcontroller chip, a 4040 counter chip and KBR6·0M resonator. As Peter had explained in his article that the 8748 could be upset by being too close to the line scan part of the TV receiver I found a position in the Sony set as far as possible from the line timebase. Another thing that worried me was the thought of hanging a long multi-cable from the keypad straight on to the 8748's output port, so I included a 4050 non-inverting buffer to drive the cable. The four output port lines remain high at all times until a matrix switch is closed by

Table 1: Keypad wiring table

Function	*Lead colour*	*Keypad connections*
BBC-1	Yellow/red	1
BBC-2	Yellow	2
ITV	Red	3
Ch4	Brown	4
Pic	Green/red	12
Text	Green	20
Chassis	Black	5, 6, 7, 8, 13, 21

4 × 4 Matrix

Wire to	*Lead colour*	*Keypad connections**	*Function*
P10	Grey	U 9, 10, 11 L 16	Digits 7/4/1 Reveal
P11	Light green	L 30, 31, 32 L 37	Digits 8/5/2 Zero
P12	Pink	L 22, 23, 24 L 29	Digits 9/6/3 Hold
P13	Blue	L 14, 15 U 4, 8	Bot & top Full page and recall
DB0	Orange	L 36, 28, 9 U 7	Zero, hold, reveal Recall
DB1	Mauve	L 17, 25, 33 U 3	Digits 3/2/1 Full page
DB2	White	L 18, 26, 34 L 11	Digits 6/5/4 Bottom
DB3	Red/blue	L 19, 27, 35 L 10	Digits 9/8/7 Top

* L = lower, U = upper.

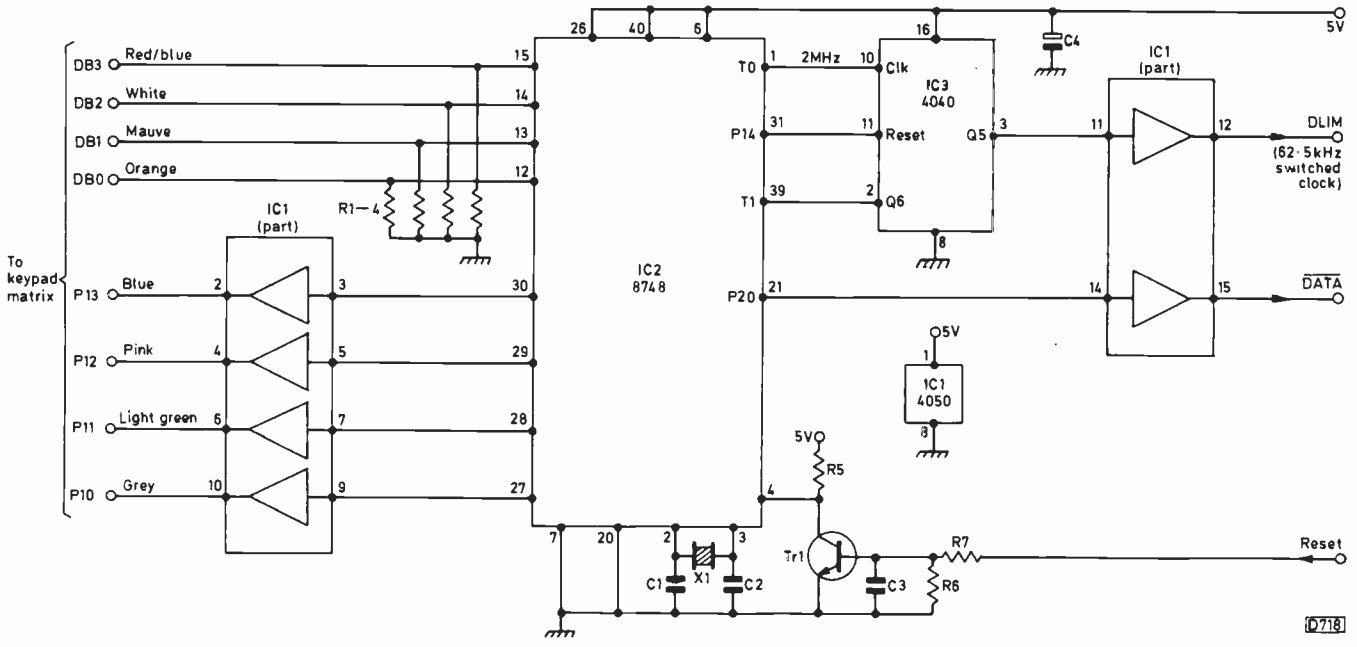

Fig. 1: Keypad-VM6101 interface using a programmed 8748 microcontroller chip.

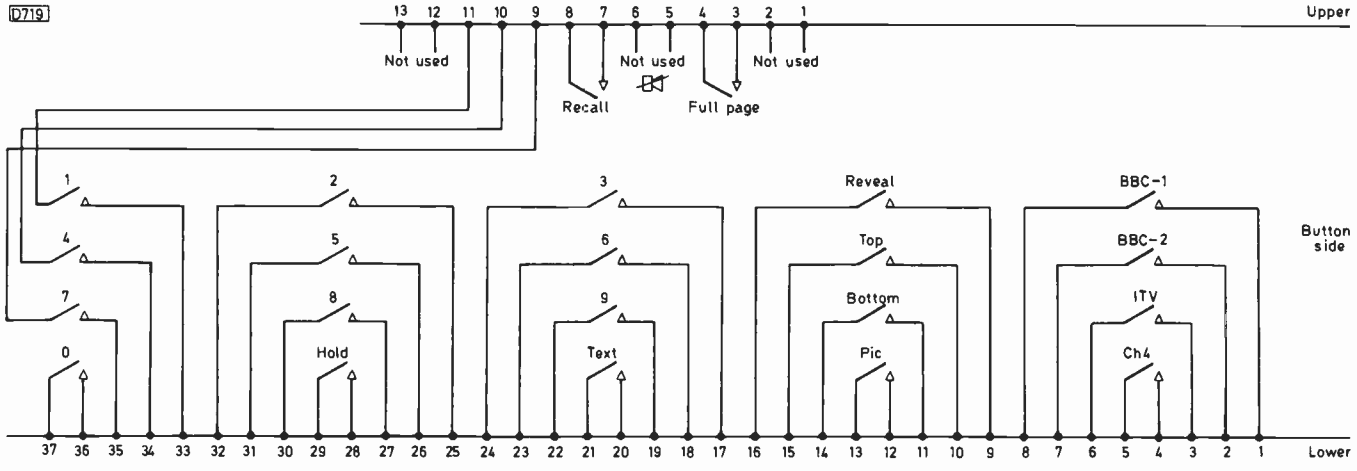

Fig. 2: Connections to the keypad, viewed from the button side. Note: hold was page; full frame was update; top was time; bottom was mix; recall was speaker symbol; cancelled speaker symbol not used.

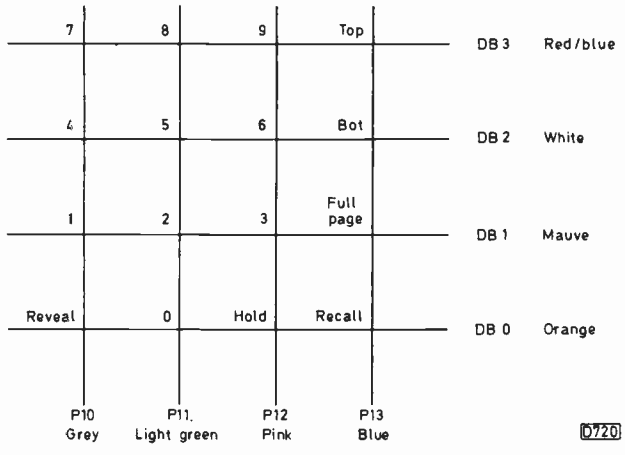

Fig. 3: 4 × 4 matrix configuration.

the keypad: the three lines not involved then go low while the active one goes low briefly then returns to the high state. The 4050 is a much better current sink than source and is thus good for this mode of operation. I also reduced the value of the pull-down resistors connected to the four data bus lines from 100kΩ to 10kΩ to reduce the impedance and keep capacitive effects to a minimum.

The arrangement just described used four of the six buffers in the 4050. Because they were there, I used the remaining two as output buffers for the DLIM and / DATA outputs. Since they pull down well I found that there was no need to short out the 470Ω input resistors for these lines on the VM6101 panel. As the microcontroller was being built into a TV set it seemed a good idea to modify the reset circuit to allow for an external reset from the channel change circuit. This is why Tr1 is included (more about this later). The circuit was built up on Veroboard.

The buffering arrangements seemed to be a good idea and on test the microcontroller interface worked well first time (except that pins 14 and 13 of the 8748 chip are shown crossed over in the December 1986 issue – this caused a "wrong button" situation in the matrix). The colours shown in Fig. 1 relate to the multi-cable lines to the modified keypad.

Keypad Modifications

Modifying the keypad is a tedious business. First I had to crack the connection pattern (50 pads to 25 buttons –

o.k. four pads aren't used, but it was still a pain!). Take the keypad apart carefully and put the top with its buttons in a safe place where it won't get knocked and fall to bits. Next, unsolder all the wires from the multi-cable. Using desoldering braid, unsolder all the connections between the small PCB and the main switch panel. Ease off the small PCB and throw it away.

Now it's fun time. Fig. 2 shows the connections to the individual switches on the keypad. Rewire it in accordance with Table 1. The connections are best made by first soldering in Maxi-wrap wire links, then finally connecting the coloured leads from the interconnecting cable. Forty-four of the possible fifty connections are used – it pays to check and recheck that you've got them right. After reassembly, measure the resistance from point to point and press the appropriate buttons to ensure that you get continuity. Check that the basic function buttons all connect down to zero volts, as per the top part of Table 1. Then check the matrix, using Fig. 3.

System Check

The microcontroller enables us to talk to the VM6101 module. If you want to check that this part is working, wire the matrix lines into the microcontroller board and run it from a 5V supply. Connect the two traces of a double-beam scope to the DLIM (clock) and /DATA lines. Trigger the scope from pin 11 of IC3 (reset). Reset the microcontroller chip by momentarily shorting the emitter and collector of Tr1. Then, when the matrix buttons are pressed and you've got the scope triggering right, you'll see the bursts of clock and data pulses.

Receiver-VM6101 Interface

Fig. 4 shows the interface between the VM6101 module and the Sony KV1820UB TV receiver. Some readers may like to compare this with my design for use with the XM11 decoder module (see page 627 of the September 1985 issue). First, we no longer need a 5V supply for the interface though we still need a 5V supply for the VM6101 decoder module and the microcontroller circuit. It can pass through the interface panel, where it's not needed. This contrasts with the XM11 interface design which used a 7416 hex inverting buffer to invert and level translate between the teletext decoder module and the rest of the circuit. The three colour signal outputs from the VM6101 are in opposite sense to the XM11, i.e. they are active positive. Consequently no signal inversion is required. Furthermore the open-drain outputs can be pulled up to 12V (not being restricted to 5V), so a 4050 non-inverting buffer can be used in place of the 7416. The polarity of the VM6101's blanking output signal is the same as with the XM11, but it doesn't matter (as we'll see later) if, in the interests of consistency, this output is also passed through a non-inverting buffer.

Although it's possible for the VM6101 to receive an instruction to allow TV to be displayed this function is not included in the microcontroller's program (it didn't need to be in the original application). This is no great problem. The picture and text lines from the keypad are separate and can be used to control a latch – two parts of a 4011 quad two-input nand gate – in the interface. This latch's output (pin 11) is gated with the blanking signal in the third gate of this i.c. A low at pin 1 of this gate causes the output at pin 3 to be high at all times. This is the picture condition. At the same time the complementary output from the latch (IC4 pin 10) turns on an analogue switch in IC3 to remove the pull-up voltage from the resistors (R1-3) that feed the decoder's colour output stages. This ensures that no crosstalk occurs between the text and the video signals. The optional sound mute on text facility is also driven by pin 10, via the option switch SW1.

When the text button is pressed the TV/text latch changes state and the input at pin 1 of IC4 goes high. The initialisation process (we'll deal with this later) sets the VM6101 module in the text mode, so its blanking output goes high. This output is connected to pin 2 of IC4 via a buffer. A high at both pins 1 and 2 results in pin 3 going low: this output (the switching bus) changes over the analogue switches that handle the colour and luminance signals in IC2 and IC3.

Any decoder function that calls for a boxed display (e.g. newsflash or subtitles) results in the blanking line going high during the box period only. As it's low at other times the switching bus reverts to the high state, the result being that a normal picture is displayed except where the box is required. When text is selected the latch operates a further switch in IC3: this, via pins 14 and 12, connects 12V to the pull-up resistors (R1-3) linked to the decoder's RGB outputs, thus enabling these outputs. The original XM11 interface design didn't need this arrangement: the pull-up was to 5V and there wasn't any observable crosstalk. The use of a 12V supply results in greater cross-coupling and I found that a faint text display could just be seen in the background of some pictures in the TV mode. Switching the 12V supply in the manner described overcomes this problem. R20 is a pull-down resistor.

The last function of the latch is to mute the sound in the text mode, using one of the switches in IC3, unless this function is overridden by SW1.

Generation of the RGB text drive was described in the September 1985 article, but a short recap won't come amiss. In any event the circuit is now slightly different since we are using a 4050 non-inverting CMOS buffer instead of a 7416 TTL inverting buffer. The 7416 has open collectors, but there's no equivalent open-collector device in the CMOS range. It's necessary therefore to include the isolating diodes D3, D4 and D5.

Since the R, G and B circuits are identical I'll describe just one, blue, which we'll pick up at pin 2 of the buffer chip IC1. When a blue output from the teletext decoder appears at pin 3 of IC1 pin 2 goes high, taking the cathode of D3 with it. Prior to this, the IC1 buffer was sinking current via D3 and R10 from the 12V supply. Now that pin 2 is high, the voltage at the anode of D3 swings positively, along with the input at pin 12 of the analogue switch IC2 and the anode of D6. The cathode of D6 is returned to a preset d.c. level which determines how high the voltage at its anode can go, and this sets the intensity of the text display. The current flowing via the catching diode D6 flows via the pnp emitter-follower transistor Tr1: VR2 in its base circuit sets the d.c. level for the catching diodes. Note that as soon as D6 provides clamping D3 becomes reverse biased. This diode (D3) prevents D6 trying to clamp the high output of the 4050 buffer.

IC2 switches between the teletext colour and the TV colour-difference signals. Its outputs are applied to the three emitter-followers Tr2/3/4 which drive the RGB output transistors on the Sony KV1820UB's tube base panel. Likewise one-third of IC3 is used to switch the luminance/text background (d.c. pedestal) level applied to emitter-follower Tr5 which provides the common

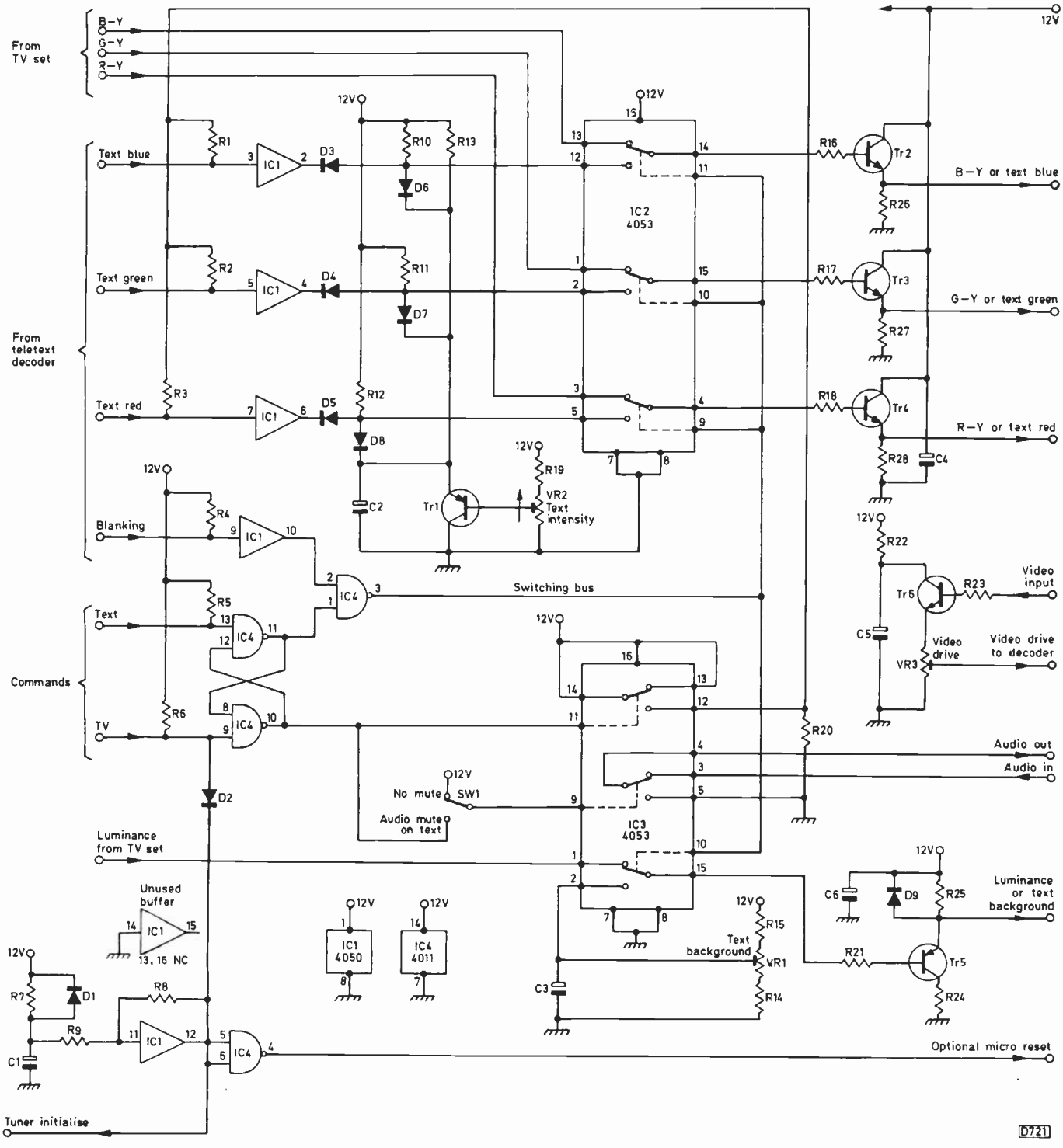

Fig. 4: Receiver-VM6101 interface for use with the Sony Model KV1820UB.

luminance drive for the Sony set's RGB output transistors.

Initialisation

Four of the six buffers in IC1 have now been accounted for. One is not used, while the last one (pins 11/12) is part of the initialisation circuit. As it's non-inverting, it can be made into a Schmitt trigger by using one feedback and one input resistor. At switch on C1 is discharged and the output from the 4050, at pin 12, is low. This pulls the TV command line low via D2, thereby setting the TV/text latch to TV. C1 then charges via R7 until the point is reached when the Schmitt trigger flips over. D2 is now reverse biased, thus allowing the keypad TV/text commands to be accepted. The rising edge also initialises the tuner circuit (described in the September 1985 issue) so that BBC-1 is selected. A complementary output from pin 4 of IC4 can be used to initialise the microcontroller if required. In my own case I used the positive-going clock pulse from the channel selector circuit (pin 13 of IC1, see Fig. 5 on page 628 of the September 1985 issue) instead. This has the advantage that every time the channel is changed the microcontroller is reset. The first thing it does after being reset is to call page 100 to initialise the teletext decoder and produce the index page. Now that all channels respond in the same way to page 100 and produce the index page it's possible either to produce the index page

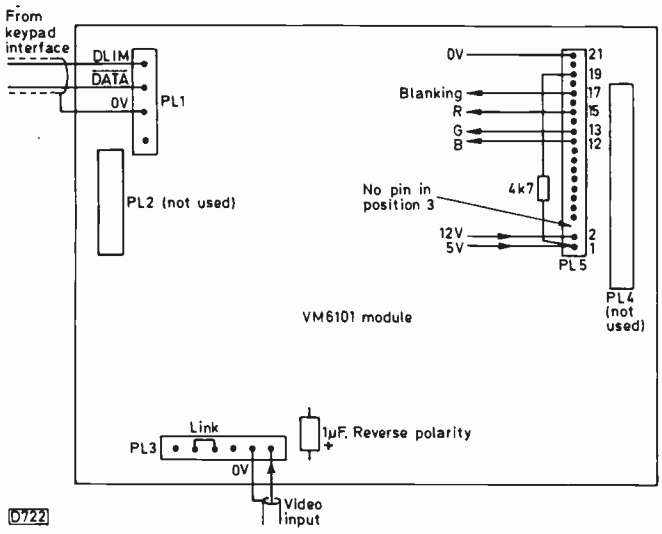

Fig. 5: Connections to the VM6101 decoder panel. The 4·7kΩ resistor (/superimpose pull up) between pins 1 and 19 of PL5 is not included in the components list.

reverse the polarity of the 1μF video input coupling capacitor which is connected to pin 1 of PL3. Then wire up the decoder as shown in Fig. 5. A block diagram of the system is shown in Fig. 6. Add the 4·7kΩ resistor between pins 1 and 19 of PL5 to pull up the /superimpose connection, which is not used. Note that the decoder requires a 12V as well as a 5V supply. Its consumption is 120mA at 12V and 450mA at 5V (compared with a maximum of 900mA at 5V for the XM11). Note also that the VM6101 does not need a line pulse input.

In Conclusion

While incorporating this modification in a set previously adapted for use with the XM11 decoder is time consuming it's not terribly expensive. A check on the advertisements in *Television* will show that the VM6101 can be obtained for £10. The price of the programmed 8748 chip was given earlier. The interface panels (keypad to decoder and decoder to TV set) were built up on Veroboard, to fit the

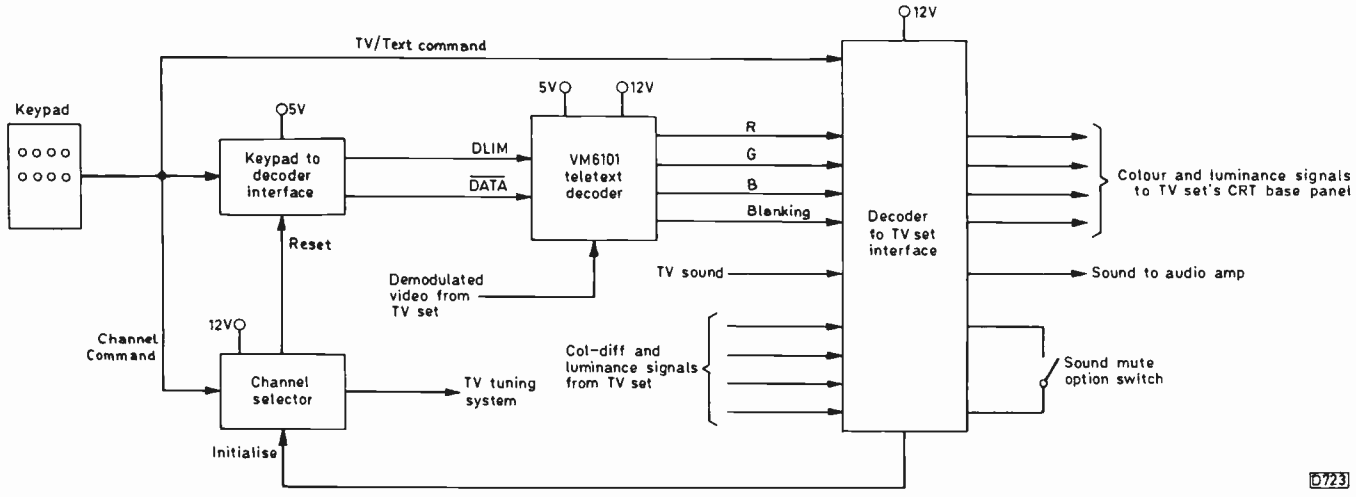

Fig. 6: System block diagram.

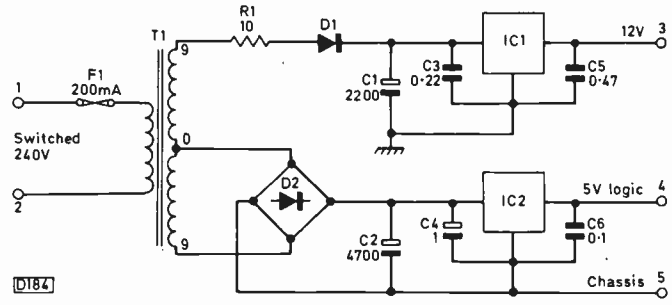

Fig. 7: Suitable power supply circuit.

by changing channel or to have it waiting for you when you decide to select the text mode. As the power-on initialisation circuit resets the channel selector this in turn resets the microcontroller.

The VM6101

The video input signal level required by the VM6101 is 2·4V peak-to-peak, positive-going. The Sony KV1820UB produces 2·8V which is of course ideal. The exact level can be set by VR3, the video drive control (originally used for the XM11).

A couple of things need to be done to the VM6101 before it can be put into service in this application. First, space available in the receiver. The power supply arrangement 1 devised for use with the XM11 (see Fig. 7) can be used without modification.

My thanks are due to Peter Marlow for coming up with the programmed 8748 at the right time. While on the subject of the 8748, it's important to reset it correctly at switch on. If you think it's not working, look for the 2MHz clock signal at pin 1: if this is missing it's most likely that the reset isn't working. Short the emitter and collector of Trl (Fig. 1) briefly – this should start the chip up. Note that my use of a transistor for resetting was done deliberately since it's very difficult, even with a defective transistor, for an excessive voltage from (say) a 12V reset signal to break into the 8748 and cause damage.

With a job of this kind, care and thorough checking are essential. Follow the diagrams and wiring details carefully, ponder well upon the peculiarities of your particular interface problem, and you should be o.k. Component lists are provided for the two interface circuits. While this article has been prepared on a stand-alone basis it would probably be worthwhile for those interested in this type of modification to read my previous article "An Approach to Adding Teletext" in the September 1985 issue and Peter Marlow's "Low-cost Teletext Decoder Project" articles in the December 1986 and January 1987 issues.

Finally some remarks on operating the modified equip-

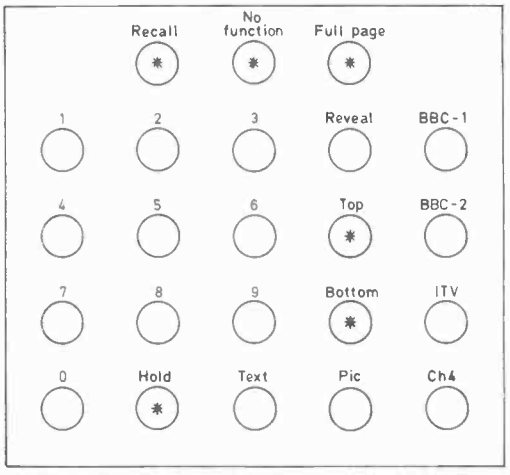

*Fig. 8: XM11-type keypad revised for use with the VM6101. Change functions marked *.*

ment. You should find the keypad easy to use once the changed functions have been relabelled. You don't have to call page (there isn't a page button now) before loading a page number: just punch it in and the header line will turn green until the page is found, whereupon it reverts to white. The eight-deep recall memory in the microcontroller is particularly useful for retracing your steps, one at a time, back up the tree again to find another branch point. Reveal works normally and you can cancel it by pressing full page. Top and bot expand either the top or bottom of the page to fill the screen. Again, cancel by pressing full page. Hold freezes the page indefinitely and is cancelled by punching in a new page number or pressing recall, which initially recalls the held page number.

Components list

Keypad-VM6101 interface (Fig. 1)

Resistors:
R1-4 10k
R5,7 15k
R6 4k7
All 5%, 0·3W

Capacitors:
C1,2 33p ceramic
C3 0·1µ ceramic
C4 100µ, 10V tant.

Miscellaneous:
X1, KBR6·0M resonator, Veroboard, Veropins, DIL sockets, link wire, etc.

Semiconductors:
IC1 4050
IC2 8748*
IC3 4040
Tr1 BC109B
* programmed

VM6101–TV set interface (Fig. 4)

Resistors:

R1-3	3k3
R4	6k8
R5-7	100k
R8	4M7
R9	1M
R10-12	2k2
R13	10k
R14-15	470Ω
R16-18	220Ω
R19	1k8
R20	15k
R21	220Ω
R22-24	47Ω
R25	470Ω
R26-28	2k2

All 5%, 0·3W

Capacitors:
C1 4·7µ, 16V tant.
C2-4 10µ, 16V electro.
C5-6 220µ, 16V electro.

Presets:
VR1 1k
VR2 4k7
VR3 470Ω

Semiconductors:
D1-9 1N4148
IC1 4050
IC2,3 4053
Tr1,5 BC212L
Tr2-4,6 BC109B

Miscellaneous
Switch SW1 s.p.d.t. min. toggle, Veroboard, Veropins, DIL sockets, link wire, etc.

next month in TELEVISION

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Don't miss next month's issue with its cover-mounted free gift – a bag of cable ties for keeping loose wiring secure and safe.

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VCR Clinic

Reports from Les Grogan, Nick Beer, Philip Blundell, Eng. Tech., Alfred Damp and Eugene Trundle

Philips VR6462

We've had a number of faults with these machines, some of which are outlined below.

When the mains supply is first applied the following initialisation procedure takes place: the cassette carriage is loaded, the rewind mode is then entered for a couple of seconds, followed by a brief spin in the fast forward mode after which the carriage is ejected. In one case the carriage loaded but after this the machine remained in the rewind mode. First thoughts were of an end sensor or even a system control fault, but we noticed that the threading-in position switch P671 (mounted close to the cassette LED) was not being operated and that the loading arms seemed rather floppy. These two symptoms led us to a sheared cog on the gear wheel that drives the loading arms. After replacing the gear wheel the machine worked normally, but the job is not one to be taken lightly – it involves removal of the heads, the head drum motor, the audio/control and erase heads, the impedance roller, the supply spool and the back tension arm before the threading-in plate can be lifted clear to give access to the drive cogs.

Inability to tune in the stations at the top end of the band was traced to the +31a rail being at 18V instead of 30V. This supply is provided by a series regulator on the tuner/i.f. panel. The 18V zener diode D6601 in this circuit was found to be leaky.

On one of these machines the test signal was displayed even with a cassette loaded and being played back. With the cassette-in switch closed, transistor T7508 on the power supply panel is, under the control of microcomputer chip IC7501, responsible for switching the test signal on and off. It was found to be open-circuit.

Excessive head speed is usually caused by an open-circuit optocoupler or cassette LED. In one case however the optocoupler interrupter (engineer's finger slicer) had come adrift from the top of the head drum. As a result the drum speed servo was open-circuit.

The job ticket attached to one machine read "completely dead". In fact there wasn't even a clock display. No faults could be found with the supply rails so we checked the voltage at the main microcomputer chip's reset pin (IC7501, pin 17). The reading was 5V, indicating that no reset was being applied to the various microcomputer chips. The reset voltage comes from IC7001 in the power supply: after a short delay it's taken low by the conduction of transistor T7125 which is connected across the reset line. T7125 was found to be open-circuit and after replacing it we had a machine that worked perfectly.

Line twitching on playback and record is the only way to describe the fault on another of these machines. We noticed that after pressing the stop control the heads very quickly ceased to spin. Spinning them by hand revealed that the drum wasn't aligned correctly – in fact it was catching on the lower drum motor assembly. Realignment, using the two mica spacing washers, cured the twitch and allowed the head drum to spin freely.

The complaint with another machine was no play or record. Rewind and fast forward were normal but when play was selected the head drum didn't attempt to rotate and after a few seconds the machine unlaced. Replacing the drum motor drive chip IC7002 restored normal operation. **L.G.**

Panasonic NV333

No rewind or fast forward coupled with no cue or review facilities pointed to the fact that there was no reel motor rotation. The reel motor drive amplifier supply comes from regulator transistor Q6023. On checking the 18V feed to this transistor the cause of the fault became apparent – Q6023's emitter was dry-jointed. **L.G.**

Ferguson 3V44/JVC HRD140

The head drum would spin in reverse (clockwise) then the machine would switch off. As the voltages around the drum motor drive amplifier chip IC1 didn't reveal anything of a conclusive nature attention was turned to the servo control section. The drum error voltage at pin 1 of IC404 should be 2·8V but was found to be 0V because zener diode D408 (5·1V) was short-circuit. Replacing this diode cured the head drum fault but there was an intermittent blank raster on playback, due to absence of the playback 5V feed at pin 19 of the video processor chip IC102. The cause was a dry-joint on L116. **L.G.**

Hitachi VT9300

In the forward picture search mode there was first a squeal, then a louder squeal followed by a still frame after which the machine stopped. The capstan motor was faulty. We've had to fit new capstan motors to several of these machines recently to cure various fault symptoms. **N.B.**

Panasonic NV333

The following fault is becoming common and could well appear in other models: in the reverse picture search mode the tape loops into the machine. You can replace all the idlers and clutches you like, but the cause is the head drum. The engraved tracks wear thin and the tape sticks. Replacement is the only cure. **N.B.**

Finlux VR1010/Philips VR6462

No luminance on record, E-to-E or playback was the fault with this machine. We found that there was no output from pin 7 of the TDA3740 chip. The input and supplies were o.k., but no sync pulses were present at pin 6. IC7051 (4016) was faulty. **P.B.**

Ferguson 3V29/JVC HRD110

Are you sitting comfortably? Then I'll begin. This machine had a very odd colour fault on record. The picture was perfect with pale colours – and on monochrome – but with strong primary colours the display was obliterated by a dot pattern. Fortunately I'd once seen a similar problem with a twiddled 3V16 and homed in on the setting of the record colour level control. Turning this to maximum cured the fault, so I knew that the record colour signal

was low. Then I made the big mistake! As I had another 3V29 in the workshop I compared waveforms. The faulty machine had a low signal at pin 7 of IC401, so a happy hour was spent chasing around this chip before I found that the values of R418, R420, R421 and C421 were different in the two machines. Back to square one! D.C. checks around the record colour level control revealed that it had gone high in value. **P.B.**

Sharp VC9300

This machine came in for chewing tapes and intermittent play/record. We initially thought that the cause of the two faults would be the same, a defective reel idler assembly, but after repairing this we found that the drum motor sometimes didn't start. If the motor was held by hand it wouldn't start when released. Also if stopped by hand while running it wouldn't restart when released. A new motor cured the fault. **A.D.**

Mitsubishi HS337

"Smell of burning" was the complaint noted on the job card. Fortunately there were obvious physical clues. Q9A4 was cracked and discoloured and IC9A0 was short-circuit. These two items form a 30V stabiliser. **A.D.**

Philips VKR6800 Camcorder

The customer's complaint was no picture. Connecting the unit to a monitor produced good quality pictures in all modes, E-E and playback of recordings. The fault was in the viewfinder – a dim raster in all modes. So a check was made on the supplies to the half-inch c.r.t. The cathode, control and screen grid voltages were all correct but the focus and final anode voltges were both at 900V. A short-circuit between these two electrodes could be measured on a cold check. A replacement c.r.t. had to be fitted. **A.D.**

Sony CCDV8/Pioneer VEM800

We've had several of these camcorders with dry-joints at the soldered connections between the viewfinder socket and its mini-PCB – see the top left-hand corner of the cover photo in the April 1987 issue. The effect is intermittent viewfinder operation.

A delicate and fiddly job we've had to carry out on these V8 camcorders is replacement of a broken back-tension band around the supply turntable. When it breaks there's a juddering motion with terrible picture and sound, generally culminating in a chewed tape. **E.T.**

Toshiba V9600

After some heartsearching with regard to the economic viability of the job the owner gave us the go-ahead to fit a new video head disc and service this middle aged machine. When the disc was fitted we found that we couldn't get a satisfactory r.f. envelope waveform: with adjustment of the tracking control one head's output would rise as the other's fell – the best that could be achieved was an unsatisfactory compromise. It seemed certain that the heads were on different levels.

Since we've had similar problems in the past with Toshiba head discs, and to save the time involved in exchanging the assembly, we fitted a shim under one fixing screw to raise the low head. The spacer was only a few microns thick – of the type that Toshiba fit between the upper drum assembly and its mount. It worked well, permitting good replay of the alignment tape. **E.T.**

JVC GRC2

The complaint with this camcorder was that it wouldn't turn on, though the LCD tape counter worked. We found that the machine was operating correctly in so far as the relay was being energised by a set pulse at switch on, but its armature wasn't moving. This relay is a latching type with set/reset windings. When removed from the PCB it worked perfectly but when replaced in the panel it wouldn't budge. In fact the reset winding was being half-energised by leakage in the switch-off transistor Q22 (2SD601), a surface-mounted device. This accounted for a continuous current drain of about 23mA from the power supply. **E.T.**

Sanyo VRH1100

VCR faults are sometimes not as logical as they should be! This machine would happily load a cassette and the function indicator LEDs on the front panel would then respond to the control keys. The deck wouldn't. A case of the right hand (syscon) not knowing what the left hand (deck) was doing! The problem lay in a dry-joint at pin 2 of connector CN3010, via which the loading (mode) motor is linked to its drive circuit on the syscon board. An open-circuit loading motor would obviously have the same effect. **E.T.**

Finlux VR1010/Philips VR6462

On more than one occasion drift of the u.h.f. modulator's output frequency has been traced to zener diode D6601 (ZTK18) in the network that supplies the modulator's varicap voltage. Unusually this and similar Philips-derived VCRs have a resistive trimmer to preset the r.f. output to channel 36: it's essential that the supply voltage to this trimmer is stable. When the fault occurs it may go unnoticed – much depends on the tuning point and the a.f.c. characteristics of the monitoring TV set. **E.T.**

JVC HRD180

The delivery man brought this brand new machine into the workshop after an abortive attempt to install it. The E-E picture was crushed, with faces deathly white and colours washed out: the sync pulses were also affected, causing sideways pulling of parts of the picture. The culprit turned out to be IC102 (7VT2, de-emphasis) on the video/luminance board. The fault disappeared by itself, but the slightest squirt of freezer on the body of this strange looking chip would bring it back. **E.T.**

Ferguson 3V29/JVC HRD110

This machine's channel selector system was in trouble. At switch on channel one would come up in the normal way but pressing any of the other seven buttons would bring up channel eight. There it stuck and the only way to get the tuner off channel eight was to switch the machine off and on again. We eventually discovered that each time the input select switch was moved from AUX to TV the channel indicator would step forward! All this did have a logical cause, in that D219 (on the presetter board) was leaky, inhibiting the normal action of the "step-and-scan" chip IC201. **E.T.**

ECONOMIC DEVICES & QUICK SAVE T.V. SPARES

15/80H	3.71	2SA940	0.59	2SC535	0.79	AF180	0.55	BA656	5.46	BC560C	0.14	BDX63A	1.96	BFY52	0.27	BYX71-350	1.40
15/85R	3.30	2SA940-2	2.14	2SC536	0.33	AF181	0.53	BA7100	11.35	BC635	0.36	BDY20	1.21	BFY79	0.49	BYX94	0.16
16039	0.79	2SA950	0.72	2SC537	0.54	AF186	0.53	BA841A	28.98	BC636	0.42	BDY81	1.18	BFY90	0.61	BYY56	1.20
16181	1.04	2SA951	1.26	2SC605L	1.16	AF239	0.43	BA843	3.96	BC637	0.24	BF115	0.40	BLY49	2.20	BZY93C30	1.86
16182	1.04	2SA966-Y	1.16	2SC620	1.46	AF279	0.88	BA854	5.76	BC639	0.20	BF117	0.66	BR100	0.22	BZY88 RANGE	0.10
16334	0.98	2SA999	1.36	2SC643A	1.54	AL113	1.36	BAV18	0.21	BC640	0.24	BF118	0.67	BR101	0.65	BZX61 RANGE	0.18
16335	0.94	2SB774	1.15	2SC668	0.67	AN115	3.98	BAV19	0.11	BC879	0.39	BF121	0.25	BR103	0.75	BZX79 RANGE	0.10
16446	0.98	2SB185	1.13	2SC681	4.40	AN155	1.89	BAV20	0.31	BC880	0.31	BF123	0.21	BR303	1.23	C106D	0.46
16600	1.38	2SB375	3.87	2SC682	1.88	AN206	2.58	BAV21	0.34	BCX34	0.40	BF127	0.13	BRC116	0.67	C106M	0.76
16802	1.27	2SB400	0.40	2SC684	1.65	AN208	3.55	BAW62	0.19	BCY70	0.30	BF137	0.29	BRC300	2.01	C1129	0.58
17052	5.61	2SB405	1.03	2SC693	0.63	AN210	2.28	BAX12	0.44	BCY71	0.21	BF153	0.58	BRC5296	0.77	CA3046	2.55
17053	5.61	2SB449B	6.98	2SC710	0.69	AN211	3.25	BAX13	0.11	BCY72	0.20	BF154	0.26	BRC6109	0.83	CA3089	0.83
17074	9.30	2SB511	2.50	2SC711A	0.50	AN214Q	2.75	BAX16	0.11	BD115	0.46	BF157	0.33	BRC82	1.08	CA3090AQ	3.25
17089	3.45	2SB54	1.39	2SC717	1.28	AN234	5.92	BC107	0.13	BD116	0.70	BF158	0.18	BRC83	2.19	CA3094	2.20
17127	3.51	2SB546	3.75	2SC734	1.43	AN236	3.78	BC107A	0.11	BD124	1.31	BF159	0.18	BRC84	2.08	CA3131EM	3.12
17376	1.58	2SB56	2.80	2SC761-Y	0.95	AN239	6.95	BC107B	0.18	BD124P+KIT	0.69	BF160	0.31	BRX44	0.60	CBF16848N-071	1.56
17523	1.95	2SB618A	2.22	2SC783	3.98	AN240P	1.52	BC108	0.15	BD131	0.57	BF167	0.38	BRX49	0.67	CD4001	0.34
17524	1.32	2SB631	3.25	2SC790Y	1.73	AN241	1.71	BC108B	0.15	BD132	0.42	BF173	0.34	BRY39	0.69	CD4002	0.27
1N4001	0.06	2SB643	0.61	2SC828	0.28	AN245	4.49	BC109	0.12	BD133	0.53	BF177	0.35	BSS38	0.87	CD4008	1.35
1N4002	0.06	2SB669	3.67	2SC867A	3.84	AN253	2.97	BC109B	0.15	BD135	0.36	BF178	0.40	BSTB0140G	5.25	CD4011	0.29
1N4003	0.06	2SB681	3.96	2SC876	0.96	AN260	3.85	BC109C	0.12	BD136	0.26	BF179	0.36	BSTC0246	6.99	CD4012	0.24
1N4004	0.08	2SB695	1.98	2SC930	0.54	AN262	1.98	BC113	0.14	BD137	0.36	BF180	0.36	BSTC0233	7.25	CD4013	0.33
1N4005	0.08	2SB75	1.04	2SC935	4.13	AN272	7.92	BC119	0.36	BD138	0.46	BF181	0.32	BSTCC0143	3.07	CD4016	0.46
1N4006	0.08	2SB774	0.61	2SC936	8.66	AN281	6.65	BC126	0.23	BD139	0.34	BF182	0.34	BSTD1043	2.85	CD4017	0.82
1N4007	0.07	2SB819	0.89	2SC940	4.68	AN295	5.52	BC132	0.14	BD140	0.29	BF183	0.39	BSV57B	3.49	CD4020	1.23
1N4148	0.03	2SC1034	6.75	2SD1128	2.90	AN301	3.60	BC135	0.14	BD144	1.70	BF184	0.43	BSW68	0.60	CD4021	0.39
1N4448	0.05	2SC1050	5.06	2SD1138	0.84	AN302	3.99	BC137	0.18	BD150	1.25	BF185	0.39	BSX19	1.29	CD4023	0.28
1N5401	0.14	2SC1096	1.16	2SD1273	1.36	AN303	4.39	BC138	0.34	BD157	0.67	BF194	0.14	BSX20	0.34	CD4025	0.64
1N5402	0.15	2SC1104	3.98	2SD1453	5.39	AN305	8.95	BC139	0.28	BD160	1.60	BF195	0.14	BSY52	0.50	CD4028	0.84
1N5403	0.16	2SC1106	4.54	2SD152K	2.64	AN315	2.46	BC140	0.45	BD163	0.71	BF196	0.17	BSY79	0.51	CD4040B	0.85
1N5404	0.15	2SC1114	3.25	2SD198	3.87	AN316	5.53	BC141	0.34	BD165	0.62	BF197	0.18	BT100A	1.61	CD4047	1.06
1N5408	0.35	2SC1116	4.95	2SD234	0.49	AN318	5.44	BC142	0.34	BD166	0.42	BF198	0.17	BT106	1.55	CD4049	0.46
1N914	0.04	2SC1124	1.28	2SD235	0.60	AN320	5.47	BC143	0.19	BD168	0.73	BF199	0.17	BT108	1.45	CD4052	0.75
IR3403	5.00	2SC1129	0.34	2SD24	2.29	AN321	2.25	BC147	0.08	BD175	0.60	BF200	0.37	BT119	1.76	CD4066	0.30
1S1555	0.31	2SC1131	0.64	2SD257	2.94	AN322	5.85	BC148A	0.10	BD179	0.49	BF218	0.36	BT120	2.17	CD4069	0.29
1S44	0.10	2SC1158	3.33	2SD292	2.59	AN331	4.59	BC148B	0.13	BD181	0.99	BF224	0.17	BT121	2.48	CD4070	0.66
1S5012A	0.81	2SC1162	1.05	2SD313	2.59	AN337	3.81	BC148C	0.11	BD182	0.99	BF237	0.65	BT123	1.98	CD4081	0.35
1S921	0.10	2SC1172	2.22	2SD325D	2.26	AN340P	1.17	BC149	0.11	BD183	0.99	BF240	0.17	TBA970	3.06	CD4093	0.72
2N1303	0.38	2SC1195	5.80	2SD348	16.13	AN355	5.98	BC149B	0.13	BD184	1.21	BF241	0.17	BT151-800R	0.89	CD4511	1.10
2N2219A	0.33	2SC1212A	1.97	2SD350	5.20	AN362	1.75	BC153	0.14	BD187	0.53	BF245	0.50	BTT6018	2.42	CD4528	2.04
2N2222	0.38	2SC1213	0.89	2SD350A	2.80	AN370	3.95	BC154	0.14	BD189	0.69	BF245A	0.52	BTT8124	4.89	CD4556	1.47
2N2646	0.80	2SC1226	1.46	2SD353	8.38	AN5010	5.70	BC159	0.36	BD190	0.69	BF245B	0.49	BU106	2.48	CR02AM-8	1.55
2N2904	0.36	2SC1293	0.90	2SD389	2.41	AN5111	2.92	BC160	0.40	BD201	0.98	BF246A	2.52	BU108	1.50	CV12E	4.09
2N2905	0.43	2SC1306	1.98	2SD401	1.55	AN5120N	4.50	BC161	0.28	BD202	0.60	BF255	0.20	BU109	2.65	CX095D	3.14
2N2906	0.38	2SC1316	10.25	2SD414	1.98	AN5132	4.39	BC168	0.36	BD203	0.50	BF256	0.38	BU110	5.69	CX104	9.64
2N2926	0.15	2SC1317	0.87	2SD471	2.13	AN5250	3.98	BC169C	0.16	BD204	0.61	BF256LB	0.42	BU111Y	4.16	CX108	10.50
2N3053	0.27	2SC1364	0.49	2SD560	2.95	AN5435	3.08	BC170	0.16	BD207	1.79	BF256LC	0.42	BU125	2.48	CX109	7.86
2N3054	0.99	2SC1383	1.20	2SD588A	2.36	AN5610	2.85	BC171	0.11	BD208	0.34	BF257	0.34	BU126	1.25	CX130	8.76
2N3055	0.61	2SC1391	2.45	2SD600	3.25	AN5612	4.68	BC172	0.13	BD222	0.49	BF258	0.36	BU137	6.53	CX134	12.32
2N3442	1.56	2SC1398	0.94	2SD601R	0.65	AN5613	4.63	BC172B	0.27	BD225	0.49	BF259	0.34	BU205	1.08	CX136	11.49
2N3702	0.14	2SC1413A	3.05	2SD613	1.03	AN5630	3.95	BC173	0.17	BD228	0.63	BF262	0.57	BU206	1.27	CX139	11.83
2N3703	0.18	2SC1446	1.25	2SD621	12.85	AN5701N	1.66	BC174B	0.27	BD229	1.05	BF263	0.57	BU207	1.65	CX157	4.84
2N3705	0.16	2SC1447	2.07	2SD636	0.55	AN6250	2.95	BC177	0.35	BD232	0.50	BF271	0.34	BU208	1.46	CX158	5.52
2N3706	0.14	2SC1475	0.37	2SD639-R	0.77	AN6300	4.40	BC178	0.26	BD234	0.42	BF273	0.20	BU208/02	1.97	CX177	6.46
2N3707	0.16	2SC1505	1.00	2SD655	0.98	AN6310	8.74	BC179	0.26	BD237	0.47	BF274	0.20	BU208A	1.12	CX187	6.84
2N3711	0.11	2SC1514	1.69	2SD657	3.50	AN6320N	4.28	BC182	0.08	BD238	0.39	BF324	0.35	BU208D	1.95	CX755	12.95
2N3771	0.70	2SC1573Q	1.25	2SD661A	0.80	AN6340	11.00	BC182L	0.10	BD239	0.45	BF336	0.33	BU209	1.93	CX885A	6.85
2N3772	1.71	2SC1578	8.74	2SD731	2.45	AN6341	5.98	BC182LB	0.14	BD240	0.37	BF337	0.40	BU226	2.95	DEC1	2.20
2N3773	2.29	2SC1583	1.17	2SD773	0.33	AN6342	1.61	BC183L	0.11	BD241	0.39	BF338	0.33	BU326	2.00	DEC2	2.20
2N3819	0.42	2SC1617	3.89	2SD811	7.65	AN6363	16.00	BC183LB	0.26	BD242	0.39	BF355	0.29	BU326A	2.20	DS3486N	4.33
2N3823	1.17	2SC675	1.41	2SD823	1.98	AN6371	9.24	BC184	0.13	BD243A	0.33	BF362	0.66	BU326S	2.20	DS3487N	4.33
2N3904	0.62	2SC1678	1.98	2SD837	1.56	AN6387	10.65	BC184L	0.14	BD243C	0.29	BF363	0.60	BU406	1.49	E1222	0.40
2N3908	0.62	2SC1741	1.25	2SD841	3.65	AN6531	1.95	BC184LB	0.26	BD244	0.51	BF371	0.50	BU406D	1.79	E5024	0.28
2N4101	1.73	2SC1810	1.70	2SD856	1.45	AN6551	1.35	BC186	0.27	BD244C	0.79	BF391	0.25	BU407	0.82	E5386	0.25
2N4240	3.30	2SC1815	0.66	2SD857Q	1.84	AN6552	0.68	BC187	0.28	BD245C	0.99	BF417	0.84	BU407D	1.09	E9003	0.46
2N4444	1.73	2SC1826	0.65	2SD882	1.50	AN6610	2.40	BC204	0.16	BD246C	1.25	BF418	1.87	BU412	9.15	E9005	0.50
2N5293	0.50	2SC1829	3.34	2SD894	1.63	AN6677	8.95	BC207	0.14	BD253	1.05	BF422	0.29	BU426A	1.13	ESM310BP	4.15
2N5294	0.50	2SC1875	5.85	2SD898	3.45	AN7111	1.45	BC212	0.11	BD278A	0.80	BF423	0.52	BU500	1.95	FND500	5.78
2N5296	0.49	2SC1881K	2.98	2SK105H	2.15	AN7114E	8.54	BC212B	0.26	BD317	2.60	BF450	0.35	BU508A	1.75	GC374	1.65
2N5297	0.50	2SC1893	3.02	2SK152	2.95	AN7115	3.38	BC213L	0.10	BD318	2.85	BF451	0.29	BU536	5.80	GD243	4.95
2N5298	0.61	2SC1906	0.98	2SK34	0.76	AN7120	4.65	BC213LB	0.15	BD375	0.42	BF457	0.41	BU608	2.65	GF758	0.84
2N5771	1.18	2SC1921	1.37	2SK41	1.07	AN7145	2.80	BC214	0.10	BD380	0.76	BF458	0.39	BU705	2.25	GH3F	1.82
2N6109	1.58	2SC1923	1.07	2SK79	2.98	AN7146	4.35	BC214LB	0.26	BD410	0.52	BF459	0.52	BU806	1.79	HA11215	4.50
2N6130	0.72	2SC1929	2.25	40408	0.50	AN7151	2.26	BC225	0.40	BD433	0.47	BF460	0.60	BU807	0.80	HA11211	2.53
2N6133	1.25	2SC1942	4.20	40594	1.53	AN7156	2.85	BC237	0.10	BD434	0.49	BF469	0.31	BU826A	2.15	HA11225	4.29
2N6180	0.95	2SC1945	7.99	40636	1.43	AN7158	6.75	BC237BJ	0.12	BD435	0.49	BF470	0.55	BUW84	1.39	HA11226	10.44
2N6292	1.65	2SC1959	0.45	4EX581	0.80	AN7218	1.64	BC238	0.10	BD436	0.60	BF471	0.33	BUX84	1.00	HA11229	0.85
2N696	0.43	2SC1957	1.09	741	0.30	AN7223	4.25	BC238A	0.13	BD437	0.49	BF472	0.33	BUX85	1.10	HA11235	2.48
2N698	0.43	2SC1953	1.93	7805-T022	0.63	AU107	3.50	BC238B	0.13	BD438	0.40	BF479	0.61	BUY69A	2.04	HA11124	5.25
2SA1006	1.50	2SC1962	1.93	7806	0.73	AU110	2.25	BC239	0.12	BD441	1.42	BF480	1.38	BY126	0.13	HA11244	2.82
2SA1011	1.65	2SC1969	3.10	7808	0.85	AU113	5.25	BC239B	0.25	BD442	1.41	BF491	1.99	BY127	0.08	HA11251	4.47
2SA1015	0.49	2SC1983	8.35	7812-T022	1.16	AY105K	2.08	BC251A	0.31	BD509	1.65	BF495	0.64	BY133	0.13	HA1125	4.29
2SA1012	1.25	2SC1985	1.55	7815	0.64	AY106	1.09	BC294	0.50	BD510	1.07	BF506	0.43	BY164	0.47	HA1137W	2.87
2SA1020Y	0.89	2SC2009	0.34	7818	0.92	BA524	8.21	BC300	0.35	BD519	1.50	BF509	0.41	BY176	0.52	HA1138	5.03
2SA1027R	0.45	2SC2029	2.33	7824	0.64	BA524	2.65	BC301	0.45	BD529	1.32	BF523	0.24	BY179	1.08	HA11414	5.65
2SA473	0.75	2SC2028	2.11	7905	0.80	B250	1.55	BC302	0.53	BD530	1.18	BF532	0.45	BY182	0.95	HA1144	7.87
2SA766S	4.95	2SC2063	0.99	9368	10.70	B40	1.04	BC303	1.04	BD533	0.67	BF596	0.18	BY184	0.47	HA1156	1.16
2SC1173Y	1.25	2SC2078	3.11	AA133	0.12	BA130	0.14	BC307	0.18	BD534	0.53	BF597	0.27	BY187	0.77	HA1160	4.78
2SC1474	1.25	2SC2073	2.25	AC133	0.12	BA1310	1.98	BC307A	0.14	BD535	0.79	BF694	0.22	BY189	1.79	HA1166	1.96
2SC1509	1.35	2SC2085-Q	1.40	AC123K	0.43	BA1320	1.38	BC308	0.18	BD536	0.61	BF757	0.59	BY198	1.62	HA1166X	5.36
2SD1391RL	3.95	2SC2091	1.30	AC127	0.27	BA1322	3.95	BC308A	0.11	BD537	0.74	BF759	0.47	BY201/2	1.50	HA1167	5.36
2SA1095	3.74	2SC2141	1.86	AC128	0.34	BA1330	2.75	BC309	0.17	BD538	1.45	BF761	1.05	BY203/20	0.59	HA11706	9.50
2SA1103	6.55	2SC2166	1.98	AC138	0.24	BA145	0.19	BC317A	0.13	BD544B	0.83	BF762	0.75	BY207	0.22	HA11705	8.00
2SA329	0.40	2SC2216	0.69	AC141	0.29	BA148	0.25	BC327	0.15	BD598	1.25	BF869	0.47	BY208	0.46	HA11703	4.95
2SA489	1.17	2SC2233	2.20	AC142K	0.44	BA154	0.40	BC328	0.11	BD677	0.56	BF870	0.30	BY210-400	0.19	HA11701	4.56
2SA490	2.25	2SC2236	1.65	AC151	0.28	BA155	0.12	BC337	0.09	BD679	0.57	BF959	0.42	BY210-600	0.27	HA11710	9.50
2SA493	2.25	2SC2278	1.69	AC176	0.30	BA156	0.05	BC338	0.34	BD680	0.76	BF960	0.49	BY210-800	0.34	HA11713	9.75
2SA562	0.57	2SC2314	2.17	AC179	0.28	BA159	0.15	BC368	0.24	BD681	1.48	BF970	0.69	BY218	1.64	HA11711	20.16
2SA564	0.75	2SC2335-KI	10.41	AC183	0.72	BA182	0.24	BC440	1.09	BD696	2.47	BFR39	0.44	BY223	1.23	HA11715	3.25
2SA614	4.88	2SC2551	1.26	AC187	0.39	BA222	1.66	BC441	0.44	BD699	3.49	BFR61	0.50	BY224-600	1.88	HA11714	9.75
2SA628	1.14	2SC2565	3.92	AC187K	0.43	BA302	1.24	BC454	0.36	BD700	3.70	BFR62	0.50	BY225-100	1.13	HA11716	13.10
2SA639S	1.75	2SC2570	2.88	AC188	0.47	BA311	1.32	BC460	0.42	BD707	1.06	BFR79	0.29	BY226	0.25	HA11725	18.26
2SA659	0.49	2SC2577	3.58	AC188-01	0.49	BA312	1.05	BC461	0.47	BD709	1.12	BFR81	1.65	BY227	0.49	HA11725MP	16.00
2SA673	1.50	2SC2578	6.75	AC188K	0.43	BA313	0.76	BC462	1.15	BD710	0.80	BFR86	1.08	BY228	0.60	HA117555P	6.23
2SA684	1.61	2SC2671	1.99	AC193K	0.65	BA317	0.08	BC463	0.64	BD809	0.85	BFR89	1.63	BY229-1000	1.12	HA11781	8.90
2SA697	0.82	2SC2826	2.07	AC194K	0.65	BA318	0.02	BC477	0.37	BD810	0.69	BFR90A	0.70	BY229-600	0.92	HA1180	5.15
2SA699	1.75	2SC288A	1.85	AD140	1.06	BA328	4.77	BC478	0.32	BD879	0.74	BFT42	0.43	BY255	0.69	HA1196	7.43
2SA715	0.95	2SC3153	5.26	AD143	1.93	BA333	1.37	BC479	0.41	BD880	0.79	BFT43	0.43	BY295-600	1.03	HA13001	2.25
2SA747	10.74	2SC372	1.40	AD145	1.60	BA335	6.27	BC532	0.28	BD895	2.31	BFT84	0.40	BY298	0.36	HA1306	2.26
2SA748	1.36	2SC373	1.16	AD161	0.56	BA5102A	2.86	BC546	0.17	BD899	2.48	BFW10	0.60	BY299	0.45	HA1338	7.50
2SA817	0.65	2SC383	1.33	AD162	0.45	BA511	2.92	BC547	0.10	BD901	0.79	BFX29	0.34	BY407	0.90	HA1339	2.33
2SA818	1.82	2SC388	0.50	AD262	1.25	BA514	2.20	BC548	0.10	BD902	0.84	BFX84	0.37	BY409	1.49	HA13402	7.87
2SA835	2.50	2SC394V	0.81	AF114	2.47	BA521	2.52	BC549	0.10	BDW83C	1.56	BFX85	0.41	BY448	1.35	HA13342	2.65
2SA836	0.89	2SC403C	0.60	AF115	1.24	BA524	8.94	BC550	0.10	BDW84C	1.56	BFX86	0.36	BY713	1.10	HA13365	4.02
2SA844	0.65	2SC41	2.19	AF118	1.20	BA526	7.98	BC556	0.16	BDX32	1.75	BFX87	0.55	BYW19/1000	0.69	HA1366WR	1.86
2SA872	0.70	2SC458	0.39	AF127	0.50	BA527	2.98	BC557	0.10	BDX53A	4.93	BFX88	0.34	BYW56	0.34	HA1367	4.32
2SA884	2.15	2SC495	0.92	AF139	0.53	BA532	1.56	BC558	0.10	BDX53B	1.85	BFX89	0.44	BYX10	0.29	HA1368R	2.45
2SA937R	0.97	2SC515A	2.85	AF178	1.45	BA536	2.95	BC559	0.10	BDX54B	2.16	BFY50	0.32	BYX55-600	0.19	HA1368	2.07
				AF179	0.55	BA6209	5.52	BC559B	0.11	BDX62A	2.15	BFY51	0.50	BYX71-600	0.90	HA1370	3.71

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HA1374	4.80	LR3419	9.37	NE565N	1.33	SKE4F2/08	1.24	STK3042	10.25	TA7312P	2.45	TD62105P	2.50	TDA3560	5.25	TUA2000	8.98
HA1377	4.98	LR3471	9.37	NE645BN	3.35	SKE4F2/06	0.85	STK3044	5.75	TA7313AP	1.36	TD62104P	2.50	TDA3571Q	2.97	TV106	1.86
HA1389R	2.05	LU1141	7.27	NP1106	8.60	SKE4F2/10	1.24	STK4019	4.50	TA7314	5.94	TD62706P	4.50	TDA3576	7.09	TY6010B	2.97
HA1389	2.39	LU52012	5.95	DA202	0.11	SKE4G2/02	0.96	STK430	11.75	TA7323P	3.15	TDA1001B	2.31	TDA3590	5.79	U05G	1.14
HA1392	1.65	LU52011	14.95	DA47	0.16	SKE5F3/10	1.60	STK433	6.25	TA7325P	1.15	TDA1003A	2.25	TDA3591	6.45	ULN2204	11.45
HA1394	3.95	LU03112	12.37	DA91	0.09	SKS1/10	2.15	STK4332	8.25	TA7339P	1.75	TDA1005A	2.22	TDA3650	7.95	UPA53C	4.94
HA1397	3.76	M193	12.75	DA95	0.12	SL1310	3.14	STK435	5.94	TA7340P	5.06	TDA1006A	2.11	TDA3652	2.95	UPC1003	5.95
HA1398	3.98	M21C	1.13	DC28	2.95	SL1430T	2.32	STK4352	12.25	TA7607AP	3.10	TDA1010AF	4.25	TDA3651AQ	2.95	UPC1009C	8.95
HA1406	2.47	M23C	2.83	DC29	2.15	SL414	3.69	STK436	4.70	TA7609	3.28	TDA1011	2.98	TDA3651	1.95	UPC1025H	3.00
HA1452	0.85	M293	6.95	DC36	1.28	SL432A	3.44	STK437	9.65	TA7611AP	4.80	TDA1010	1.25	TDA3651A	2.75	UPC1026C	1.24
HBF4030AF	2.48	M51102L	6.35	DC44	0.35	SL439	2.48	STK4372	3.85	TA7616P	5.25	TDA1011A	3.25	TDA3950	2.95	UPC1028H	2.00
HD14538	2.07	M5115P	5.24	DC45	0.18	SL471	4.78	STK439	7.25	TA7622AP	8.94	TDA1028	2.45	TDA4050B	3.95	UPC1020H	2.77
HD38702-A2	8.95	M51203L	3.15	DC72	0.44	SL480	3.98	STK441	10.25	TA7628P	5.06	TDA1034B	2.42	TDA4280	7.20	UPC1032H	0.62
HD38750A53	8.95	M51231P	0.95	DC75	0.44	SL490	2.44	STK443	10.29	TA7629P	7.50	TDA1035S	2.95	TDA4290	4.47	UPC1042C	8.95
HD38750A-7	7.25	M5134-9341	4.13	DN236	1.06	SL901B	6.95	STK457	13.45	TA7630P	2.98	TDA1035T	1.85	TDA4400	2.27	UPC1156H	2.96
HD38800A50	14.09	M51353P	5.25	DN782	1.98	SL918A	6.98	STK460	6.95	TA7640AP	2.29	TDA1037	1.78	TDA4420	4.02	UPC1158	5.84
HD44801A05	18.25	M51381P	5.09	DT121	1.45	SN16861AN0	4.95	STK461	9.68	TA7672P	2.40	TDA1037D	2.05	TDA4422	3.65	UPC1161C	4.50
HEF4001BP	0.67	M51393AP	9.35	PT6042	2.45	SN16862AN	2.98	STK463	11.53	TA7676P	2.81	TDA1044	2.62	TDA4427S	9.00	UPC1182H	1.22
HISH1010	8.59	M51394P	11.97	PT8504	4.98	SN16966N	10.25	STK466	11.77	TA7726P	10.25	TDA1047	4.10	TDA4431	2.27	UPC1186H	1.05
HISH1004	6.00	M5142P	6.85	R1038	2.19	SN29717N	7.19	STK4833	16.95	TAA320A	1.27	TDA1059B	0.98	TDA4440	3.26	UPC1181H	1.25
HISH1002	9.50	M5144P	4.25	R1039	2.19	SN29716N	3.66	STK501	6.32	TAA350A	6.45	TDA1054M	1.35	TDA4442	4.75	UPC1185H	1.95
HM6231	9.81	M51513L	2.55	R2008B	1.33	SN29715N	6.04	STK502	5.74	TAA570	1.74	TDA1060	2.60	TDA4500	4.55	UPC1188	7.40
HM6232	10.65	M51515BL	3.23	R2009	1.98	SN29722	11.95	STK5314	12.32	TAA621AX1	4.85	TDA1082	3.25	TDA4600	2.84	UPC1212C	1.72
HM6251	6.25	M51517L	3.71	R2010B	1.33	SN29723AN	7.65	STK5730	3.95	TAA621A12	2.14	TDA1087	1.22	TDA4610	4.80	UPC1225H	3.25
HM7103	4.85	M5192	2.20	R2029	1.33	SN29764AN	1.38	STK7216	14.50	TAA661B	2.62	TDA1151	2.25	TDA4620	4.78	UPC1230	5.24
HM9032	3.22	M5194AP	5.74	R2030	1.33	SN29767	4.98	STK772	6.95	TAA691	8.58	TDA1170S	2.11	TDA5500	6.03	UPC1238	4.09
HM9012	3.22	M5231L	1.95	R2257	3.71	SN29770BN	3.84	STR1096	5.45	TAA700	3.75	TDA1190	3.96	TDA5700	2.75	UPC1263	4.09
HM9015	3.24	M53274P	1.33	R2265	1.49	SN29772BN	4.91	STR4090	11.98	TAA930	4.87	TDA1190Z	1.50	TDA7270S	2.25	UPC1277H	5.85
HT4207	17.16	M54532P	2.15	R2305	1.18	SN29771BN	1.48	STR440	7.85	TAA970	2.83	TDA1200	3.88	TDA8190	2.47	UPC1278H	5.80
HT4208	18.25	M54544L	4.75	R2322	0.59	SN29791	2.98	STR441	6.95	TAA110	2.52	TDA1235	4.30	TDA9403	2.35	UPC1351C	1.81
IN5401	0.11	M58478P	8.77	R2323	0.76	SN29798N	5.56	STR451	5.54	TAG232-600	0.79	TDA1236	3.55	TDA9503	2.92	UPC1350C	1.40
IR2403	4.25	M58485P	13.65	R2354A	2.01	SN2709	0.44	STR453	8.16	TAG626-600	1.20	TDA1270	1.33	TDA9513	5.44	UPC1353	7.85
IR2C05	4.25	MA06	1.07	R2354B	2.01	SN7400N	0.34	STR454	7.50	TBA120AS	1.24	TDA1327A	1.05	TDB1033	2.68	UPC1355C	2.13
IR3P06	2.25	MA8001	0.82	R2443	0.88	SN7401N	0.36	STR6020	8.31	TBA120SB	1.05	TDA1412	1.05	TDE1081	7.05	UPC1363	4.20
IR3P08	4.95	MA8003	1.16	R2461	1.50	SN7402N	0.65	T6029V	5.75	TBA120T	0.95	TDA1420	2.55	TE626	1.49	UPC1362	2.98
IR94558	6.25	MB3705	1.98	R2540	1.95	SN7404N	0.24	T6035V	0.73	TBA120U	2.50	TDA1440	3.45	TEA1002	2.55	UPC1365C	6.98
IS751	2.85	MB3712	1.85	R2540X	3.30	SN7408N	0.27	T6036	0.67	TBA120A	1.05	TDA1470	2.25	TEA1009	1.86	UPC1366	8.38
ITT425	0.18	MB3713	1.69	R2615	0.67	SN7410N	0.27	T6037	2.11	TBA1440	2.03	TDA1470P	4.25	TEA1014	3.30	UPC1360C	4.51
IZ0003GE	5.37	MB3730	2.94	RCA16600	1.38	SN74121	1.60	T6044V	0.97	TBA1440G	5.20	TDA1506	7.85	TEA1020SP	8.21	UPC1378H	4.25
IZ0020GE	5.93	MC13002	3.69	RCA16802	1.08	SN7413N	0.37	T6045	1.20	TBA1441	2.80	TDA1510	6.28	TIC106C	0.61	UPC141C	3.75
K174YP	3.46	MC1310P	2.25	RCA17074	6.60	SN74141N	2.65	T6049	1.45	TBA240A	3.99	TDA1512	3.69	TIC106M	0.57	UPC1458	8.66
KA2101	2.92	MC1327P	1.33	RCA17376	1.58	SN74151AN	1.51	T6052V	0.87	TBA395	1.10	TDA1515	6.97	TIC116Y100	2.07	UPC151C	2.95
KC581C	6.32	MC1330P	2.88	RCA17524	0.83	SN74154N	1.27	T6058	3.08	TBA395Q	1.10	TDA1559	3.15	TIC44	0.72	UPC2002	1.48
KC582C	3.97	MC1350P	1.61	RCA17523	0.83	SN74190	1.35	T6059	2.77	TBA396	2.90	TDA1670	4.48	TIC45	0.77	UPC30C	2.51
KC583C	6.63	MC1351P	3.96	RCA2060	2.00	SN7420N	0.34	T9003V	1.25	TBA400	2.39	TDA1770	3.85	TIC47	0.35	UPC324C	4.17
L200CV	1.69	MC1352P	2.50	RGP01-15	1.65	SN7430	0.49	T9005V	2.38	TBA440P	1.55	TDA1905	1.76	TIP120	1.06	UPC32C	5.25
LA1201	1.02	MC1357P	2.15	RGP10	0.30	SN7440N	0.27	T9011V	0.49	TBA480Q	1.30	TDA1908	1.95	TIP110	0.45	UPC339C	4.90
LA1210	1.56	MC1358P	1.55	RGP30M	0.40	SN7472	1.54	T9013V	7.96	TBA500P	6.58	TDA1940	1.95	TIP112E	0.85	UPC41C	4.10
LA1230	2.87	MC14001	2.40	RT402	1.58	SN7474N	0.44	T9014V	2.60	TBA510	2.11	TDA1950	2.95	TIP112	0.88	UPC4558C	2.15
LA1320	2.87	MC14013	0.41	RT905A	2.38	SN7490AN	0.93	T9016	1.02	TBA520	1.84	TDA2005	3.95	TIP117	0.95	UPC474	5.11
LA1352	1.75	MC14493P	11.95	S1299	7.98	SN74LS26N	0.53	T9019W	1.98	TBA520Q	1.68	TDA2006	1.55	TIP121	0.87	UPC554C	1.85
LA1357N	11.07	MC14494P	2.15	S175	31.48	SN76001N	1.65	T9034V	1.45	TBA530	1.30	TDA2004	2.27	TIP126	0.73	UPC566H	2.95
LA1363	1.05	MC14497	3.16	S2062D	2.07	SN76013ND	7.50	T9035V	2.33	TBA530	1.30	TDA2002	0.90	TIP132	1.40	UPC574	3.25
LA1364	3.02	MC14510BAL	3.75	S2800D	5.54	SN76023N	5.15	T9051	7.30	TBA540	1.15	TDA2003	1.75	TIP137	1.50	UPC575C2	2.40
LA1365J	3.44	MC14511BCP	1.10	S2802	3.47	SN76023ND	3.96	T9054V	3.95	TBA540Q	1.15	TDA2010	1.68	TIP29	0.84	UPC576H	2.58
LA1385	1.94	MC14528BCP	2.70	S2818	4.05	SN76033N	3.65	T9057V	0.70	TBA560C	1.40	TDA2020	2.35	TIP2955	0.95	UPC577H	1.25
LA1387	8.10	MC1712	3.88	S3702S	6.15	SN76110N	0.90	T9062V	0.49	TBA560CQ	1.60	TDA2030	1.99	TIP29A	0.46	UPC578C	8.70
LA3155	1.25	MC5192	19.50	S40W	16.68	SN76115AN	1.61	T9064	1.03	TBA570Q	1.60	TDA2140	1.68	TIP29B	0.63	UPC580C	4.13
LA3301	1.65	MC7724CP	3.49	S6080B	8.80	SN76131	1.92	TA6002	4.35	TBA570A	1.71	TDA2150	6.20	TIP29C	0.40	UPC587C2	1.34
LA3350	1.43	MC7818C	2.18	SA8063	5.17	SN76227N	1.33	TA7027	4.80	TBA641A12	4.13	TDA2151	2.07	TIP29D	0.75	UPC592H	2.15
LA3361	3.89	MCR100/7	1.65	SAA1006	1.75	SN76226DN	1.98	TA7050	1.74	TBA641B72	3.03	TDA2160	4.01	TIP3055	0.75	UPC595	2.95
LA3365	3.98	MCR106-5/6	0.95	SAA1020	4.76	SN76228N	3.27	TA7051	1.74	TBA651	0.87	TDA2161	1.85	TIP30A	0.41	UPC596	1.98
LA3390	4.25	MCR220/7	2.28	SAA1025	4.40	SN76242	8.95	TA7054	2.55	TBA673	2.60	TDA2170	3.45	TIP30C	0.16	UPD1514C	8.95
LA4030P	4.20	ME0402	0.17	SAA1024	2.81	SN76243	8.50	TA7060AP	0.71	TBA700	1.85	TDA2270	4.65	TIP31A	0.34	UPD2819C	4.98
LA4031P	3.20	ME0404/2	0.47	SAA1075	6.25	SN76396	2.90	TA7061AP	1.27	TBA720	2.65	TDA2510	7.85	TIP31B	0.38	UPD4013B	4.00
LA4032P	2.35	ME0411	0.28	SAA1121	7.44	SN76533N	2.47	TA7069	3.13	TBA730	3.55	TDA2520	2.37	TIP31C	0.50	UPD4066B	4.95
LA4100	1.25	ME6002	0.26	SAA1124	3.25	SN76532N	2.95	TA7070P	1.83	TBA750Q	2.90	TDA2522	3.46	TIP32A	0.53	UPD553-164	19.25
LA4101	1.30	ME6102	0.28	SAA1130	4.99	SN76545	3.87	TA7072P	2.57	TBA760	1.71	TDA2524	4.50	TIP32B	0.69	UPD8049C-1	11.50
LA4102	2.81	ME8001	0.34	SAA1174	7.77	SN76546N	3.47	TA7073P	5.86	TBA800	0.85	TDA2521	3.71	TIP32C	0.40	X0007TA	4.68
LA4112	0.56	ME0411	0.75	SAA1250	4.15	SN76549	2.59	TA7074P	1.98	TBA810S	1.61	TDA2525	3.80	TIP33	0.85	X0022CE	5.75
LA4125	2.25	MJ2501	3.30	SAA1251	5.85	SN76570	3.08	TA7076P	7.80	TBA810T	1.50	TDA2532	2.50	TIP33A	1.05	X0029CE	7.09
LA4138	3.45	MJ3001	1.76	SAA11351	4.95	SN76611	2.59	TA7089P	3.10	TBA810AS	1.00	TDA2530	2.70	TIP33C	0.80	X0031CE	4.95
LA4140	1.15	MJ481	1.53	SAA3027P	10.65	SN76620	2.59	TA7092P	8.65	TBA820	1.52	TDA2541	2.48	TIP34	3.54	X0035TA	5.98
LA4192	4.29	MJ802	4.90	SAA5000	2.95	SN76660N	2.48	TA7093P	3.99	TBA820M	1.10	TDA2540	2.15	TIP41A	0.49	X0040TA	4.50
LA4220	1.62	MJE2955	1.89	SAA5010	5.39	SN76666N	1.41	TA7102P	5.88	TBA890	2.50	TDA2545Q	5.94	TIP41B	0.65	X0042CE	4.35
LA4250	6.75	MJE3055	1.05	SAA5012	5.20	SN76708	4.86	TA7108P	1.61	TBA920	1.89	TDA2560	2.17	TIP41C	0.49	X0043CE	2.75
LA4400	3.92	MJE340	0.49	SAA5020	5.78	SN76709N	25.54	TA7109	3.71	TBA920Q	2.31	TDA2575A	0.50	TIP42A	0.49	X0056CE	6.25
LA4420	1.72	MJE520	0.49	SAA5030	8.25	SN76707N	5.11	TA7122B/P	0.92	TBA940	1.87	TDA2576A	2.85	TIP42B	0.53	X0057GE	6.00
LA4422	1.72	ML231	3.33	SAA5050	7.74	SN76705N	1.34	TA7124P	2.34	TBA950	1.84	TDA2571A	3.66	TIP42C	0.33	X0062CE	6.52
LA4430	1.56	ML232B	3.65	SAB1009B	5.98	SN76730	6.00	TA7129P	1.50	TBA970	3.56	TDA2578A	2.57	TIP47	0.65	X0065CE	4.25
LA4440	2.95	ML237B	2.51	SAB3011	7.34	SN76810N	0.60	TA7130P	1.27	TBA990	1.82	TDA2576A+K	12.35	TIP48	0.92	X0074GE	10.00
LA4445	3.95	ML238	5.77	SAB3013	5.61	SN76832N	3.25	TA7136AP	1.27	TBA990Q	1.68	TDA2581	1.98	TIP49	3.61	X0077GE	15.96
LA4460	2.32	ML923	3.35	SAB3021	7.90	SN94041	5.54	TA7137P	0.98	TC4001BP	3.25	TDA2582	1.45	TIP55A	3.65	X0079CE	4.95
LA4461	2.95	ML926	3.98	SAB3024	6.36	SN94042	5.54	TA7141AP	3.87	TC4011BP	3.50	TDA2591	2.50	TIS43	1.43	X0092CE	4.95
LA4505	7.25	MM5314N	4.02	SAB3209	5.82	SP8385	0.55	TA7146	2.50	TC4013BP	3.75	TDA2594	3.26	TIS90	0.28	X0096CE	5.98
LA5112N	2.98	MM5316N	9.16	SAB3210	3.49	SPS5384	1.98	TA7146P	4.23	TC4016BP	3.15	TDA2593	2.47	TL011CP	0.95	X0109CE	11.25
LA7020	13.86	MM5318N	3.11	SAF1032P	5.50	ST1702L	0.99	TA7148P	1.67	TC40538P	4.34	TDA2591Q	0.83	TL072	1.85	X0113CE	2.07
LA7025	11.97	MM5369N	2.01	SAF1039	3.35	STA401	6.76	TA7149P	3.26	TC4069	2.25	TDA2595	3.65	TL494CN	8.75	X0195CE	7.50
LA7027	10.92	MM5387AA/N	6.20	SAS5010	8.39	STA441C	3.00	TA7152P	2.09	TC4071BP	2.76	TDA2600	6.50	TL072CP	2.55	X0204CE	8.74
LA7040	9.20	MM5841N	6.64	SAS560S	2.26	STA471C	7.56	TA7161P	5.45	TC4081BP	3.25	TDA2611AQ	2.98	TMP4320	15.00	X0261CE	8.75
LA7042	3.58	MN1400VL	13.65	SAS560T	5.42	STK0029	5.54	TA7162P	3.25	TC40H000	1.98	TDA2612Q	4.68	TMS1024NLL	11.25	X1222AF	3.63
LA7800	2.65	MN1401	12.95	SAS570T	5.42	STK0039	5.11	TA7169	7.95	TC4514BP	5.44	TDA2611A	1.25	TMS1025N	16.95	IX0111CE	2.95
LA7801	1.92	MN1435VX	11.48	SAS570S	2.61	STK0040	12.78	TA7172P	1.41	TC9002BP	11.34	TDA2610	2.79	TMS3720ANS	19.50	Y969	0.82
LB1274	3.08	MN6016A	20.56	SAS580	2.85	STK0050	7.72	TA7176P	2.48	TCA270Q	1.71	TDA2620	2.15	TMS3748NS	14.95	TDA3310	2.15
LC7800	9.20	MP1192	5.07	SAS6600	1.33	STK0080	9.16	TA7193AP	14.05	TCA270S	1.27	TDA2630	1.96	TMS3755	13.65	ZPY120	3.25
LD3120	1.13	MP2794	4.00	SAS660	2.97	STK011	5.08	TA7193P	7.25	TCA270SQ	1.65	TDA2631	2.73	TMS3894NL	19.25	ZTK33	0.43
LD3150	2.25	MP2812	5.07	SAS6700	1.33	STK013	9.25	TA7201P	2.71	TCA290A	2.39	TDA2640	2.95	MS5102NLL	6.25		
LM1017N	4.29	MP8512	1.57	SAS670	3.96	STK014	9.80	TA7203P	2.18	TCA420A	2.16	TDA2652	13.45				
LM1877	10.92	MPC596	2.13	SAS6710	1.93	STK015	7.75	TA7204P	2.16	TCA440	2.25	TDA2653	3.65				
LM224	1.75	MPF256C	0.60	SBA750	1.61	STK016	8.45	TA7205P	1.38	TCA530	2.24	TDA2654	6.18				
LM2808	6.25	MPS6570	0.48	SC84203	19.35	STK022	5.25	TA7206P	6.35	TCA640	7.36	TDA2670	2.54				
LM2877	5.25	MPSA42	0.65	SC9504P	1.95	STK025	12.50	TA7207P	3.34	TCA650	2.04	TDA2680	3.20				
LM317CKC	1.38	MPSA56	0.27	SDA2006	18.95	STK031	12.95	TA7208P	2.15	TCA660B	3.30	TDA2690A	2.65				
LM324N	0.54	MPSA92	0.49	SDA2112/2	12.85	STK040	9.40	TA7210P	3.58	TCA730	3.81	TDA2740	6.00				
LM339N	0.80	MPSU05	0.86	SG264A	6.45	STK043	13.44	TA7214P	3.63	TCA750	2.25	TDA2780AQ	5.14				
LM340K	11.85	MPSU10	1.56	SG613	8.87	STK054	7.13	TA7215P	2.58	TCA800Q	6.95	TDA2795	2.78				
LM342P	1.62	MPSU56	0.78	SG629	8.27	STK058	18.25	TA7217AP	1.45	TCA830S	2.38	TDA2791	2.5				
LM342P	1.62	MPSU60	1.98	SG6533	11.96	STK077	7.67	TA7222	1.95	TCA890	5.44	TDA2910	13.25				
LM348N	2.15	MR818	0.33	SI-1020H	10.89	STK078	8.91	TA7226	3.57	TCA900	2.04	TDA3000T	2.75				
LM380N	2.80	MR854	0.72	SI-1125HD	17.63	STK080	16.50	TA7227P	2.81	TCA910	2.04	TDA3300B	6.98				
LM384N01	3.25	MR914	1.20	SI1125H	7.50	STK082	11.86	TA7229P	4.45	TCA940	2.47	TDA3330	2.95				
LM567CN	1.71	MSM5816RS	17.35	SI1225HD	19.27	STK086	13.59	TA7230P	4.98	TCA940E	2.93	TDA3506	7.98				
LM6402/011	10.23	MSM5840H	9.70	SI1630HD	21.98	STK1039	5.75	TA7232P	6.60	TCE330	3.89	TDA3501	7.25				
LM6402A093	10.15	MVS460-02	0.61	SI6900	12.00	STK2110	7.33	TA7233P	3.15	TCEP100Q	10.25	TDA3500	4.25				
LM748	1.82	NE542	2.50	SKE1/02	1.85	STK2145	16.25	TA7240AP	7.83	TCEP100	9.61	TDA3510	4.55				
LM8360	3.87	NE545B	4.86	SKE2F1/04	1.39	STK2230	7.70	TA7245P	5.92	TD3406AP	3.98	TDA3520	9.71				
LM8361	3.57	NE555	0.30	SKE2G3/04	1.05	STK2240	14.40	TA7270	7.50	TD3F800R	4.16	TDA3540	6.99				
LR2612	11.95	NE556	0.95	SKE4F1/06	0.35	STK2250	18.95	TA7310P	2.15	TD3F900H	4.16	TDA3541	3.80				

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Salora's Satellite TV Receivers

Though satellite TV receiving equipment has been on the market for some time now we have not so far given much indication as to what goes on in a satellite TV receiver. It seems an appropriate time to provide some brief details.

Fig. 1 shows a simplified block diagram of the Salora SRV1150 satellite receiver unit. It consists of a mother board on which the power supply, the video and audio amplifiers and the tuning system are mounted, a tuner/i.f. unit, and a display module. The four sound demodulator modules are also mounted on the mother board. We have taken this receiver as a representative example though it has to be said that there's considerable variation in satellite TV receiver design at present. The basic signal processing required remains the same of course, but how it's done varies quite a bit. Salora's sister company Luxor for example has a totally different design – even the i.f.s differ. With the Luxor Mark 2 receiver the 950-1750MHz signal from the dish-mounted head unit is first converted to 380MHz, with a subsequent conversion to 70MHz. The Salora design opts for a single conversion to 134MHz. Salora's earlier Model SRV11 has much in common with the arrangement shown in Fig. 1, but remote control is not incorporated and there were only three sound detector modules.

Tuner/i.f. Module

The down-converted 950-1750MHz signal from the head unit is fed to the tuner/i.f. module which is housed in a metal case to provide screening. The first section of this module consists of a two-stage wideband amplifier which is followed by a tracking filter. This is capacitance diode tuned to ensure adequate image rejection for the selected channel. The mixer stage uses dual-gate MOSFET transistors, the local oscillator frequency being 1084-1884MHz. The mixer's output is selected by a 134MHz (centre frequency) fifth order *LC* filter with a bandwidth of 32MHz.

The following i.f. section is conventional, bearing in mind that f.m. is used for satellite TV video signals. An i.f. amplifier and limiter section, using two bipolar transistors and an i.c., is followed by a phase-locked loop demodulator. The principle involved here is similar to that of flywheel line sync: you feed the incoming signal and a local signal to a phase detector which produces an "error" output, in this case the demodulated video. The output is buffered and includes any accompying sound signal(s).

The tuner/i.f. unit also provides a d.c. output proportional to the r.f. input level to drive a LED bar display (r.f. level indicator), and an a.f.c. output which is summed with the tuning voltage on the main panel.

The Video Amplifiers

The demodulated output from the tuner/i.f. module is fed to a video amplifier with a bandwidth of about

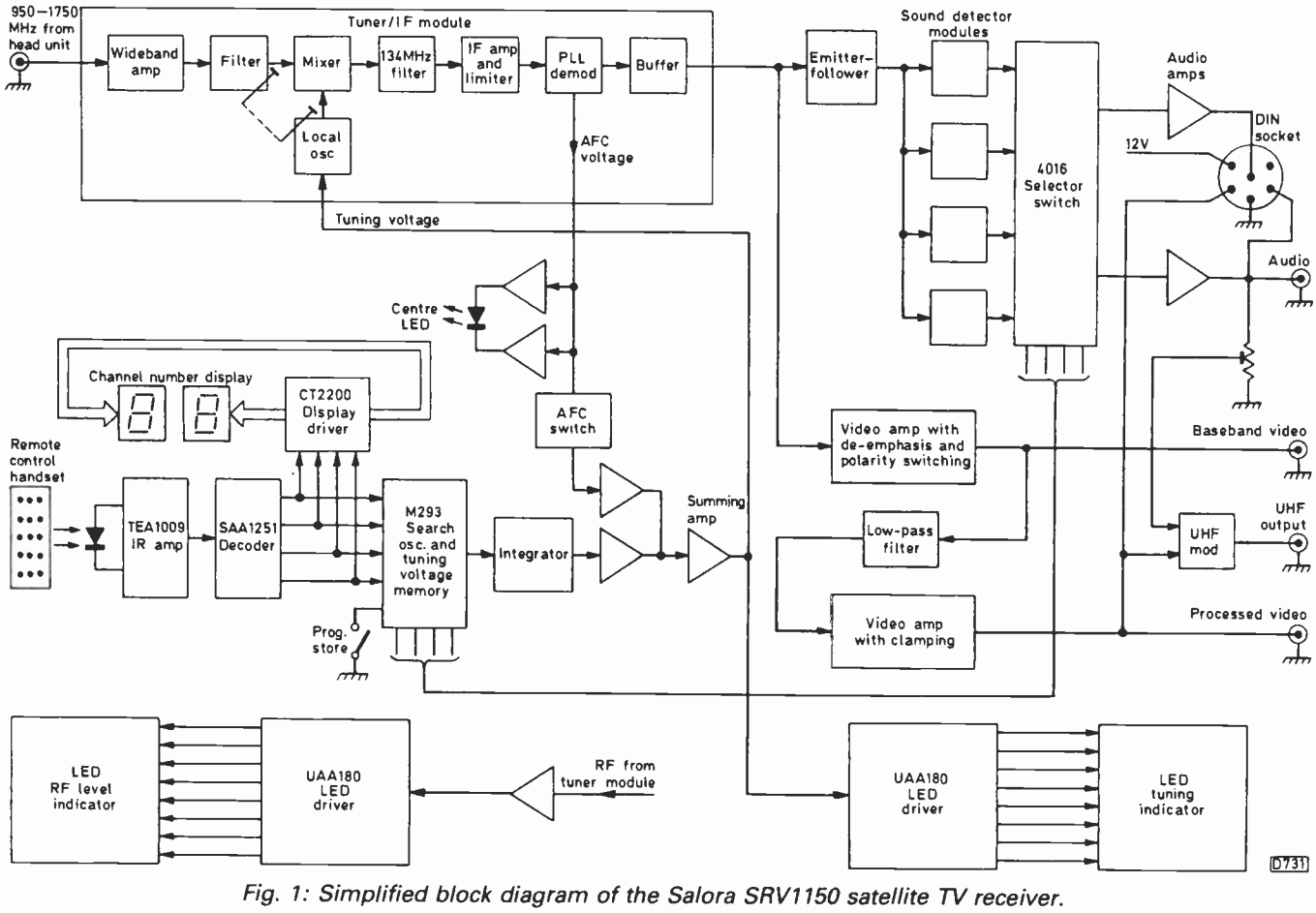


Fig. 1: Simplified block diagram of the Salora SRV1150 satellite TV receiver.

10MHz. This amplifier incorporates video polarity switching and de-emphasis. Its output is taken to the baseband BNC output socket and also, via a filter unit to remove the sound subcarrier(s), to a second video amplifier which uses similar circuitry to the first one. This video amplifier incorporates a clamp to remove the 25Hz dispersion signal that's added to satellite TV transmissions. It feeds the video output BNC socket and also a u.h.f. modulator whose output is tunable over chs. 30-39.

Sound System

The output from the tuner/i.f. unit is also fed to an emitter-follower stage which drives four sound demodulator modules. Apart from the de-emphasis components and tuning these modules are identical, using conventional circuitry based on the TBA120U sound i.f. chip. A 4016 switching i.c. is used to select the required output which is fed to two separate audio amplifiers – these employ 741 operational amplifier chips.

Tuning and Remote Control

Most of the remaining circuitry will be familiar to those conversant with current TV remote control and tuning systems. The remote control signals are decoded by an SAA1251 i.c. (the handset remote control transmitter uses the partnering SAA1250 chip). The SAA1251's parallel output, on four lines, goes to the channel display driver chip and to an M293 chip which incorporates a search oscillator and a tuning voltage memory. Digital information corresponding to the channel varicap tuning voltages, also sound selection information, is stored in this chip. The selected tuning voltage information emerges at pin 19 in pulse-modulated form and is then integrated, amplified and applied to a summing amplifier along with the a.f.c. voltage. The summing amplifier also feeds a UAA180 chip which drives a LED bar tuning indicator. The a.f.c. voltage is also taken to a dual operational amplifier chip which detects whether the a.f.c. voltage is within the limits 3·5-4·6V, lighting the centre LED indicator when this condition is detected – the a.f.c. circuit is designed to keep the tuner/i.f. unit's output at 4·2V.

In General

As mentioned at the beginning of this artical the design of satellite TV receivers differs considerably at present. We seem to be at a stage akin to the early days of TV receivers, when individual designers tended to do their own thing with the circuit elements currently available. Doubtless when some dedicated chips come along we shall see a move towards design standardisation. Meanwhile if you're called upon to service such equipment be prepared to spend some time finding out how the unit works.

A Vintage Tube Renovation

Jeffrey D. Borin, B.Sc. (Eng.)

The BBC's high-definition TV service is over fifty years old. Unfortunately so are the tubes in the surviving early receivers. Of the 20,000 or so sets made before the 1939-45 war only a few hundred still exist. All of them will have tube problems either now or in the not too distant future. You can't get say an Emiscope 6/6 from your friendly local tube dealer. Nor can you get one regunned because you can't get a replacement gun. So what do you do when you've boosted the poor thing as far as it will go?

The problem seems to be worst with the de luxe 12in. models. The museum at the Thorn-EMI Central Research Laboratories has on display a magnificent HMV Model 900, with mirror lid and a beautifully veneered cabinet, but no one seems to have a good replacement tube for it. Incidentally although the building is new the laboratories are where Schoenburg, Blumlein and their colleagues developed the 405-line system in the early 1930s. We had a choice of four tubes to try in the set. The best one produced a marginally viewable picture with a fifty per cent heater boost. It was dying fast.

I knew little about c.r.t. technology but was convinced that someone would be able to help. After all if they could do it in 1936 surely we can now! I phoned several c.r.t. regunners – there aren't many left, as the demand for domestic c.r.t. regunning is a declining one. The heroes of the hour were Display Electronics Ltd. of Uxbridge. To broaden their business they'd branched out into dealing with professional c.r.t.s for monitors, radar, etc. Their managing director Terry Smith was enthusiastic and a member of their staff, Charlie Bradley, a highly skilled glassblower, had been involved in making tubes at EMI in the early days.

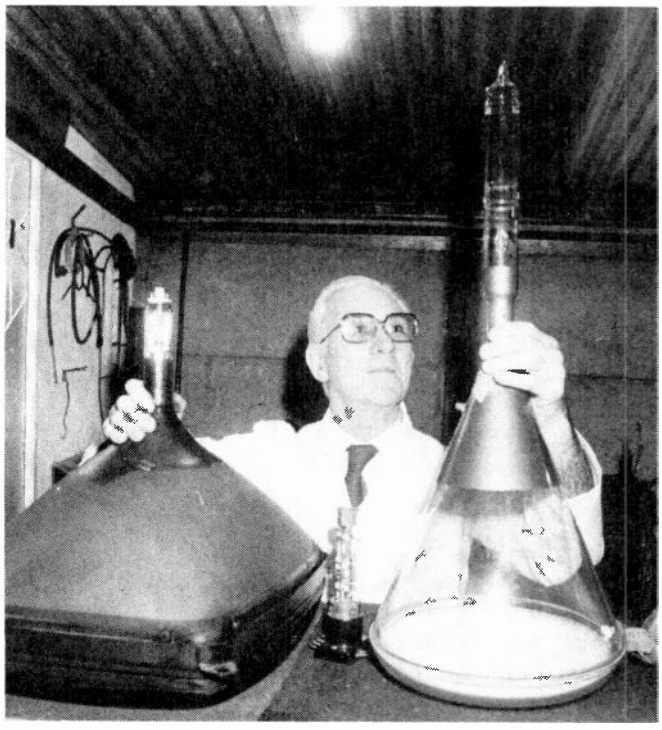
This was half the battle over. We could now do all the glass and vacuum work. It's not quite as simple as this might sound however. These old tubes were made of Pyrex-type glass, which is no longer used. To bring the gun connections out of the glass envelope you need glass-to-metal seals, known in the trade as a pinch. Only tungsten wire will do for a Pyrex pinch, and the result is obsolete and rather unreliable. The solution was to use a modern, ready-made pinch, but these are made of a special soft glass which can't be joined directly to Pyrex glass – if you tried to do so the glass would crack when heated due to the different expansion rates of the two types of glass. A graded seal is necessary to get over this problem. It puts several different grades of glass between the Pyrex tube envelope and the soft glass pinch. Only a highly skilled glassblower like Charlie Bradley could manage this trick.

Pumping

Pumping out the air to produce a new vacuum sounds easy: you connect the tube to the pump and bake it in an oven to get rid of gasses trapped in the glass and metal parts. The Emiscope 6/6 tube is nearly three feet long however, and the ovens aren't. Display Electronics' largest oven was just big enough – if modified slightly.

The Gun

So we could open up the tube and put it back together, but what were we to do about the gun? New guns are not available. Only the cathode and heater actually wear out



Charlie Bradley with the Emiscope 6/6 tube (right). The gun (centre) has been removed and the tube temporarily pumped and sealed. For comparison, an A66-120X colour tube is shown on the left. Photograph by courtesy of the Middlesex County Press.

however, which helps. How were we to replace or recondition the cathode, and who was going to do the precision assembly work on the gun?

Enter John Griffiths and Jim Wardley, directors of Thorn-EMI Electron Tubes. They were interested and helpful. Though Thorn-EMI Electron Tubes has not made c.r.t.s for years they still make camera tubes and other special devices. They certainly know which end of a gun is which. When I visited the firm I met Peter Roux, a man of vast experience and long memory. He was enthusiastic and willing to fit the work into a busy schedule. This involved taking the gun apart and putting it together again – and getting it right.

These tubes have a huge 3mm cathode and a 4V heater. The cathode could be revived by spraying on a new emitting surface, but the heater would probably not survive and it seemed that a modern 6·3V element would have to be fitted. Never to be defeated Peter Roux phoned an ex-colleague, Ron Goodwin, who is now manufacturing director of Rank-Brimar Ltd. They still make flying-spot scanning tubes for the broadcasters, and these have 3mm cathodes and 4V heaters. He generously sent us some samples. This enabled us to dismantle the tube and rebuild the gun with a new cathode-heater assembly – and a new problem!

Gettering

All valves and tubes are gettered – this produces the familiar silvery coating on part of the glass. The purpose of the gettering material is to absorb gas over the life of the tube and keep the vacuum good. The modern getter holder is ring shaped and is mounted at the front of the gun, where it would unfortunately affect the old gun's electron lens. Not only that but gettering involves rather violent firing with an induction heater. As a result, the gettering material spreads about a bit. You don't want it on the screen or on the gun's ceramic supports. The original gun was fitted with pouch getter holders mounted at the base, the idea being that the gettering material would land on the tube's neck. Some of it would do so in the area of the graded seal, with the risk of the tube shattering due to heat stress. The advice of Dr. Bernard Mayo and other retired EMI staff was sought. It was decided that the new getter holders would have to be mounted in much the same position and the risk taken.

With fingers crossed and wood touched the tube was pumped and baked. It was carefully sealed by hand. The getters were then fired. One fell off – the heat of firing probably broke the weld that attached it. Fortunately it landed in a safe position – but if anyone turns that tube face down they'll be shot (and so will the tube). Finally the cathode was activated, another heating process, and gently aged by drawing current from it without making an e.h.t. connection.

Back to the Receiver

I took the tube, carefully packed, back to the Central Research Laboratories. Robbie Robinson, who had restored the HMV set, and I removed the sad old tube. With these EMI tubes the scan coils don't slide off. They have to be unbolted and dismantled to remove them from the narrowest part of the neck.

Once everthing had been carefully reconnected, checked and double checked we applied power. There was a nasty hissing and zapping. Power off – quickly. Was the tube shorted internally (remember the errant getter holder)? There followed much head scratching and some tests. The old tube had been boosted by a separate heater transformer. With the rebuilt tube we'd gone back to the original 4V heater winding on the e.h.t. transformer: this winding had a leak to e.h.t. Back in went the booster transformer, nicely throttled back to 4V, and up came the picture, large as life and twice as beautiful.

We don't think that these 12in. tubes ever produced the bright, sharp pictures expected by modern standards, but you can watch the picture easily even under the normal display area lights. It doesn't go negative as you wind up the wick: it just defocuses a little, mainly at the edges.

Further Projects

We plan to rebuild some more old tubes. Next in line is one from the Vintage Wireless Museum in Dulwich, a marvellous place with over 1,500 lovingly restored radio receivers, TV sets, gramophones etc. – if you're interested, ring Gerald Wells on 01-670 3667 to make an appointment. There's lots to be done: other makes and sizes of tubes, and rescreening to get rid of ion burns (thankfully absent with the 6/6). We want to make sure we can still do it in 2036.

We're not able to offer a vintage tube rebuilding service as yet, but would like to assess the possible demand. If you might need this sort of service, please write in to the magazine.

Acknowledgements

My thanks to all those mentioned in this article for their enthusiastic co-operation in the project. Display Electronics went to unstinting effort for minimal reward. Many past and present employees of Thorn-EMI Central Research Laboratories provided encouragement and support.

An up-to-date field servicing kit

Harold B. Berkley

A few years ago I wrote an article on tool kits for TV field servicing. At the time such kits were getting smaller as valves were vanishing from the scene. The kit was designed around the use of an executive briefcase.

Many changes have taken place in the field of video and TV since then. You will be familiar with these changes but you might not have noticed the miniaturisation of test equipment that's taken place. In view of this I've taken a fresh look at the problem and have come up with a new kit that certainly works well for me. I've been using it for field servicing for some time now and find it to be a very practical arrangement.

The point from which I started is the fact that most field technicians carry far too much gear into customers' homes. Much of it is rarely used. Parkinson's or Murphy's or someone's Law seems to apply – most TV rental companies supply a massive, heavy toolcase, and if they supplied one twice as large it would still be filled.

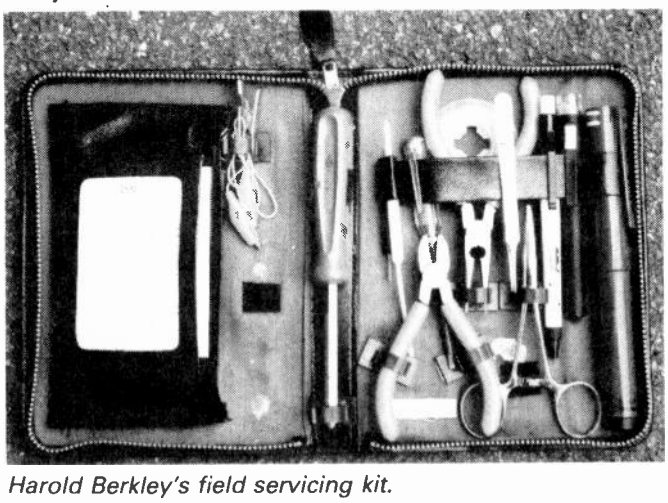
Another factor is the reluctance of many technicians to buy their own gear. It's expensive, admittedly, but you do get a tax allowance. Apart from that it's your time that's involved: if you invest in a sensible kit that's going to make life easier for you this must make sense and be worthwhile.

Don't follow the suggestions made here blindly. Use them as a basis. Think carefully about your own needs. In particular ask yourself whether you've been lugging a massive toolcase in and out of customers' homes for no good reason!

If you think about it, what a field service technician might require falls into four basic categories: (1) the tools and items initially taken into a customer's home; (2) larger items and your component stock – this will be kept in the vehicle; (3) special and unusual items that are kept at the service depot; (4) service manuals and circuit diagrams.

The transition from valve to solid-state equipment is now virtually complete. We are nevertheless called upon to service many different types of TV sets and VCRs. In general, service calls fall into various categories. Here are some of the most common ones:

(1) A simple fault calling for adjustment.
(2) Retuning.
(3) Aerial lead disconnected or aerial blown down or faulty.



Harold Berkley's field servicing kit.

(4) The customer doesn't understand the operation of his equipment – this is especially the case with teletext sets and VCRs.
(5) An elderly person needs reassurance.
(6) No fault at all.
(7) Video heads needs cleaning.
(8) The remote control unit needs new batteries.
(9) Remote control unit eaten by dog!

I could go on, but there's no need to carry a heavy box around to sort out most of these problems. Even with real faults, in view of the many models you may have to deal with it will be a hit or miss matter whether the part you need is in your massive box. To go into a customer's home with no tools at all however gives a bad impression.

The kit I've put together will deal with most situations. It's neat and efficient and impresses the customers. Here's my selection of essential equipment.

(1) A soldering iron is essential of course. How many faults are due to dry-joints? – a great many. No components are required with this sort of trouble, just your own Sherlock Holmes' way of finding the culprit and attacking it with molten solder. A bow to the satisfied customer and you're on your way.

I used rechargeable soldering irons for some time. They are useful but limited. I've found that the Oryx Portasol soldering iron is far superior. It's small and will tackle any job.

(2) Use solder wick for desoldering – suckers take up too much room.

(3) There are many miniature digital multimeters on the market now. At present I'm using a Soar 3010 autoranging meter from Marf Electronics of Cambridge. It's the same as the Tandy 22-170. A very neat product and, you guessed it, Japanese.

(4) What would we do without screwdrivers?! To save space I use a reversible Pozidrive/straight screwdriver, plus a double-ended trimming tool, a neon screwdriver (a life saver this) and a nylon hexagonal trimmer.

(5) Miniature precision cutters and pliers. There's no shortage of good makes. Treat yourself to a matching pair.

(6) A torch. Many houses seem to be lit by a 40W bulb. Good for atmosphere but not for servicing! Plenty of small pentorches and small rechargeable types are available.

(7) Any other gadgets you use. Give a new item a trial period. If you find you're not using it don't carry it around.

The case to use is again a matter of choice. I've tried various hard ones but finally opted for a soft, cheap, zip-round writing case that seems to be ideal. After throwing out the pad and envelopes I mounted the gear. A combination of self-adhesive Velcro (Woolworths) and Scotch self-adhesive Superclips (also Woolworths) was used to mount the tools. The meter is housed in one of the side compartments.

In conclusion, I'd urge you to give your kit a spring clean. It's not easy to change old methods of working, but modern technology can make your job a lot easier.

Apart from old-hands I hope that many newcomers will find some ideas amongst these suggestions.

Cable Television Techniques

Part 2

J. LeJeune

Until the arrival of high-slope valves, ferrite cores and low-loss coaxial cables large-scale TV distribution networks were the province of the h.f. multi-pair operators. The introduction of valves such as the EF80 made broadband v.h.f. amplification in Band I possible, though earlier attempts had been made using the Z77. With a single coaxial cable, any amplification used in the network to make up for the attenuation introduced by the cable has to be able to cover all the channels in use. Broadband amplification is most commonly used, though there had been earlier attempts to overcome the distortion produced by wideband amplifiers by employing channelised amplifiers with selective filtering at the input and output.

System Performance

The performance of a repeater amplifier in a network cannot be considered in isolation since, more often than not, more than one amplifier will be used in a cascaded arrangement with lengths of cable in between. The characteristics of a series of repeater amplifiers, filters, tee-units and splitters will have a cumulative effect which has to be taken into account. Cascaded filters for example produce a narrowing of the bandwidth of the system. As a result, the use of channelised repeaters is desirable only under conditions where the transmission levels of the individual channels have become too diverse to cure by passive equalisation methods. The system designer needs to know how many filters can be used in cascade before the bandwidth narrowing has an adverse effect.

Similarly the performance of a string of wideband repeater amplifiers is a vital consideration. The overall gain of the network is zero dB, the repeaters serving only to compensate for the losses introduced by the cable, equalisers, tee-units and splitters. There are three important parameters here. (1) Response flatness. Mass-produced amplifiers have very similar characteristics, but response deviations from the ideal of being flat will add up over a cascade, causing a signal level disparity that can be quite wide. (2) The noise figure, which determines the minimum input signal level. (3) Third-order distortion, which gives rise to cross-modulation and patterning from beat frequencies.

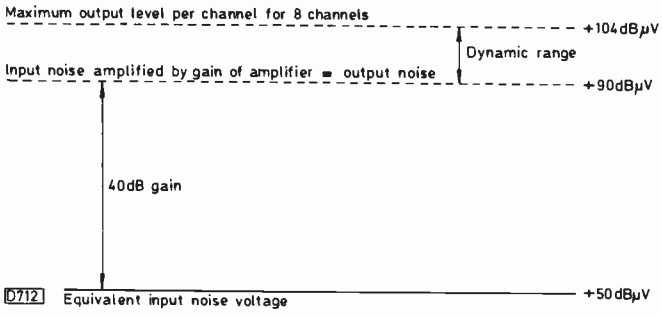


Fig. 1: The dynamic range of a poor amplifier.

In addition, repeater amplifier gain has a direct influence on the number of repeaters that can be used in cascade. High gain and a high noise figure coupled with limited output capability reduce the dynamic range – the problem is illustrated in Fig. 1. Good dynamic range is essential for a main line signal route (the trunk) even with good a.g.c. systems. Repeaters with a noise figure of 8dB, an eight-channel output capability of 300mV r.m.s. of peak and a gain of around 16dB are common. For the distribution lines (spurs) where fewer amplifiers will be required in cascade the gain can be increased to 22dB by incorporating an extra stage in the same basic amplifier design used for the trunk service.

Armed with the performance figures the network planner can calculate the trunk line performance at the various points where it's tapped to feed the distribution lines. Fig. 2 shows a practical arrangement for part of a trunk/distribution network. The aim is that the trunk line should serve the distribution network with the cleanest possible signals, free from noise, cross-modulation and patterning. The distribution network will be designed to provide the most economical use of cable and equipment, reaching the minimum acceptable signal quality only at the very end of the system. Even here the subscriber should not notice any degradation since the limits should have been set to allow for a fall-off under adverse conditions, this fall-off being such that it will not degrade the service to an extent greater than that experienced by a viewer using his own aerial.

The degradation of network performance over a long cascade of repeater amplifiers is best shown graphically. Fig. 3 shows the performance of a theoretical cascade of distribution amplifiers each having a gain of 22dB, a noise figure of 8dB and an eight-channel output capability of (singly) +110dBμV (300mV) for −46dB cross-modulation. The point where the two performance lines cross is the theoretical cascade limit. At this point however there would be no room for even minor signal level fluctuations – any increase would give rise to cross-modulation while any decrease would result in an unacceptable lowering of

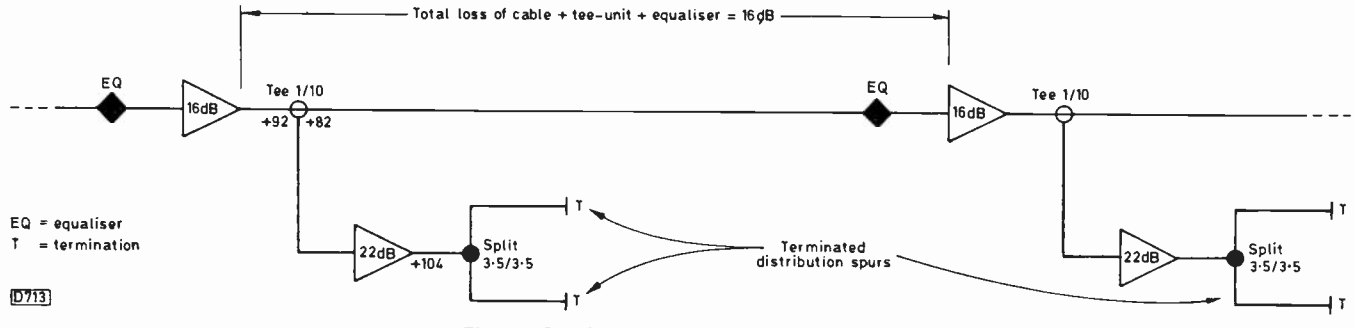


Fig. 2: Section of a distribution network.

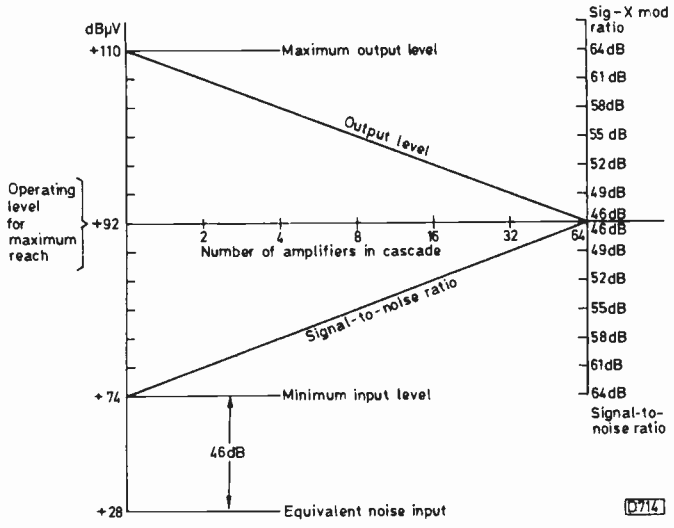
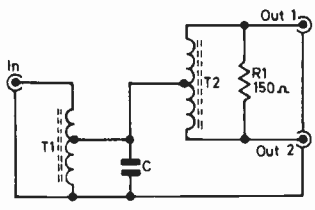


Fig. 3: Reach diagram. Repeater gain 22dB, maximum output (8 channels) 110dBμV, equivalent noise input calculated from the noise figure and Boltzmann's constant for 5MHz bandwidth.



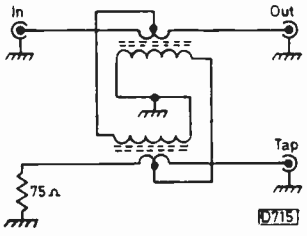


Fig. 4 (left): Two-way splitter.
Fig. 5 (right): Directional tee-unit.

the signal-to-noise ratio. A good planner will never allow the performance of the network to reach this point. Fig. 3 also assumes perfect input signals, but as the input to the distribution network will be derived from the trunk line the performance calculations have to be made with reference to the latter to determine the noise and third-order distortion levels at the tapping point. The distribution reach diagram starts with these parameters and ends where there is still a tolerance of 3dB above and below the operating level.

The reach diagram tells the network planner the operating levels for each amplifier to give the maximum distance possible or the maximum operating level for an individual cascade of amplifiers. A shorter cable run with fewer repeaters operating at a higher output level can have some short-term advantages, but it's hard luck if a new housing estate is subsequently built just beyond the reach of a network so planned, and it's as well to have a standardised set of transmission levels for each type of network – trunk and distribution. If the budget is on a shoe-string the task of the planner is not easy. Few professional planners would compromise in favour of short-term economy: the golden rule is to have plenty in hand.

Passive Devices

Discussion so far has related to active devices for maintaining a minimum signal level in the network. Just as important are the passive devices used for splitting, teeing-off and tapping the cable. Good CATV practice is never to connect a subscriber to a cable that interconnects repeaters. This avoids troubles arising within a subscriber's installation being passed onwards to the end of that branch of the network. To accomplish this ideal, signals are taken from the cable via two types of hardware, splitters and tee-units. A splitter divides the incoming line into two or more lines, supplying an equal signal level to each. A good quality two-way splitter will introduce a loss of 3·5dB in each branch, a three-way splitter will lose 5·5dB and so on. Tee-units have an unequal loss: the "through" loss is quite low while the side loss ranges from 10dB up to 26dB. Splitters and tee-units also have directional properties that give high attenuation between each of the lines fed from them. This again prevents disturbances on one branch of the network affecting another branch via the splitter or tee-unit.

A two-way splitter circuit using ferrite-cored transformers, normally toroids, is shown in Fig. 4. T1 is tapped at 70 per cent of the turns to give an impedance step-down from 75Ω to 37·5Ω. T2 is a centre-tapped choke. The signal is fed to the two 75Ω output lines via the tap: the output lines will appear to the tap to be in parallel, i.e. 37·5Ω. To a signal fed to T2's centre tap R1 will not appear to be present, due to phase cancellation. If a signal is fed in on one of the output lines it will pass through R1 to the other output line, and will also pass via T2, appearing at the other end of R1 in opposite phase. With careful construction a reverse loss of over 26dB can be obtained, giving a useful amount of isolation between outgoing lines.

A tee-unit requires a somewhat different arrangement to obtain similarly useful results. The commonly used circuit is shown in Fig. 5. The phase relationships result in the unit being transparent to signals that pass from the input to the output, and semitransparent to signals that pass from the input to the branch (tap). If a signal is fed in at the tap it will see the 75Ω resistor which will absorb most of the signal: due to the phase relationships the signal will be highly attenuated at the main output.

Subscriber Connections

Possibly the most dubious pieces of equipment connected to a well-designed, planned and installed cable network are the subscribers' television receivers. This is in no way to denigrate modern receiver designs which are on the whole excellent. But they are manufactured for a price conscious market and cannot be made to take into account minority requirements such as cable TV connections.

The main source of trouble is the tuner, which produces spurious signals at the aerial socket. Unless the system operator takes measures to prevent them doing so these unwanted signals can find their way into the cable network. The front line in the defence against such spurious signals getting into the network is the subscriber tap. This device extracts a proportion of the signal from the distribution cable, feeding it to the subscriber's receiver. The standard signal level supplied is 1mV r.m.s. of peak.

Two types of subscriber tap are used. For low attenuation values a directional transformer arrangement that's similar in principle to the tee-unit shown in Fig. 5 is used. This unit's directional properties help to reduce to a very low level any unwanted signals that, coming from the subscriber's TV receiver, could cause problems in the rest of the network. For higher attenuation values an autotransformer arrangement is commonly used (see Fig. 6), though simple resistor units are used where the performance requirements are less rigorous and economy is paramount. Resistor Rt in Fig. 6 provides back matching for the subscriber's feeder cable from the very low impedance at the tap. It also provides a further 6dB of attenuation. For values above 30dB the circuit is modified

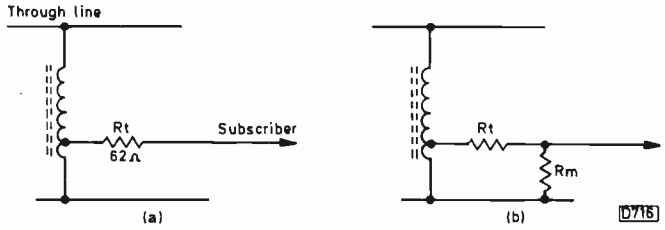


Fig. 6: Subscriber taps, (a) with 20-30dB loss, (b) with 32-40dB loss.

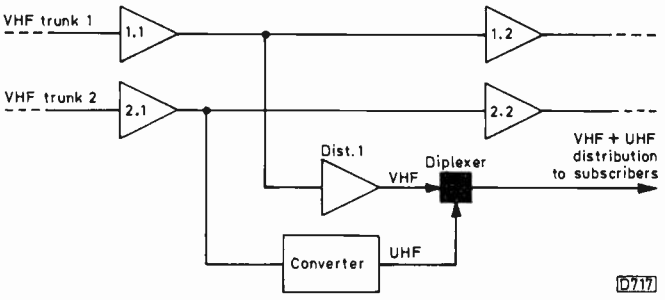


Fig. 7: Section of a hybrid CATV network. The converter consists of a v.h.f. to u.h.f. block converter and a distribution class u.h.f. amplifier.

to provide extra attenuation in the form of an L pad, as shown in (b).

The receiver end of the subscriber's feeder cable is generally terminated with an outlet socket that contains isolation components. These prevent mains voltages reaching the network from a live-chassis receiver that has faulty isolation at its own aerial socket.

The Head End

An important and complex part of the network is the head end where the off-air signals are received and processed for distribution via the cable and where other programme sources, such as recorded video and time/weather scanners, are modulated on to carriers for feeding into the network. Apart from the four main programme sources available in the UK satellite TV signals will form the major contribution to the wide variety of channels on offer. Some networks offer locally originated programmes for a few hours in the early evening: these will be produced in a small studio at or near the head end.

The choice of channel frequencies for use in the cable network has to be made very carefully in order to avoid the possibility of patterning due to beat frequencies and harmonics generated in the repeaters as a result of slight non-linearities. Nearly all the signals fed into the cable network will therefore not be the original ones.

Conversion equipment varies with the type of input signals, the simplest employing straightforward heterodyne conversion from one frequency to another. Such equipment is employed in some communal aerial or MATV systems, though for these original-channel distribution is at present more common. With large networks the signals are demodulated, cleaned up if necessary, then remodulated on to a new carrier. Standards conversion is employed in continental city networks where the received signals may have different colour and modulation-polarity standards. Scrambled satellite TV signals have to be unscrambled at the head end. The main purpose of the head end is to provide as clean a feed as possible to the trunk network. It will account for a major proportion of the network's installation and running cost, and this cost very often has to be borne before a single paying subscriber is connected to the system.

The pattern of outgoing signals from the head end is naturally determined by the number of channels in use and planned for the future. The choice of network type is governed by the same consideration.

Types of Network

The most basic form of cable TV network is the communal aerial or MATV system carrying, in the UK, the four off-air channels at present available. No frequency changing is employed, the only active equipment required at the head end being a simple wideband distribution amplifier. Where there are more than just a few outlets some repeater amplifiers will have to be used at points along the cable where the signal level would otherwise fall below a usable value. Passive equipment will follow the lines previously described. There will be no trunk system, and the subscriber taps will be on the lines between repeaters.

With a larger network a choice has to be made between u.h.f. only, v.h.f. only with up-conversion at the subscriber's receiver, or v.h.f. trunk lines with block conversion to u.h.f. for distribution. A u.h.f. only network will have to be fairly small because of the high cable loss, necessitating frequent use of repeaters. With large-diameter, low-loss cable a u.h.f.-only network could serve a small estate of say 200 houses/flats.

For anything larger one of the other two choices has to be adopted. The v.h.f. only option has the merit of allowing a very large network to be installed with relative ease. V.H.F. equipment is capable of good performance and is flexible in use, allowing the system to be modified during installation should conditions have changed since the original plan was drawn up. The major snag with a v.h.f.-only system is that up-converters are needed to feed u.h.f.-only receivers. These devices are made to a very low price, and this is reflected in the quality.

An alternative and very adaptable scheme is to employ v.h.f. trunk lines to get the good coverage these provide, converting to u.h.f. locally at the points where the trunk lines are tapped to feed the subscriber distribution part of the network. This system is capable of enormous channel capacity when twin v.h.f. trunks are used with v.h.f./u.h.f. distribution to v.h.f./u.h.f. receivers. Fig. 7 shows a basic arrangement.

Developments

Developments continue and the technology is an evolving one. Fibre-optic transmission is coming into more general use to provide very high quality trunk lines. Two-way transmission is coming into use to allow subscribers to communicate with the system head end via sub-v.h.f. upstream narrow-band channels. The latter technique has been a feature of many American city networks for a number of years but is only slowly finding favour in the UK. Frequencies from about 5MHz to 35MHz are used, with digital data transmission. To make it work the network repeaters have to be reverse bypassed using suitable filters and low-band repeaters: the subscriber taps and other network hardware also require upstream bypassing. Two-way networks permit fireside shopping, the dream of the mail-order companies (the terminal could be equipped with a credit card reader to give instant monetary transactions), also message services, "bulletin boards", emergency channels coupled to smoke and gas detectors – the possibilities are endless.

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £1·50 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.

HITACHI CPT1471

There's some form of intermittent internal sparking in this set. When it occurs the picture breaks up, usually for a few seconds at a time. A check on the board in a darkened room whilst probing components hasn't revealed the cause of the problem. We had a similar problem with another of these sets but with this one the fault got worse until the set finally went dead. It was repaired under guarantee.

It's important to examine the print side of the board while the fault is present, since this is where the fault is likely to be. Also inspect the line output transistor's mica washer carefully in case its insulation is breaking down. If you can find no signs of sparking or arcing there are two components which, on rare occasions, we've found can give this effect without any discharge being evident. These are IC701 (LA7801) and IC901 (STR6020). First however check R902 and R903 – both 82kΩ, 0·5W.

SHARP VC7300

The problem with this machine is tape looping after rewind. All other functions appear to be o.k. I've replaced the take-up turntable, main brake and idlers as suggested in the December 1984 VCR Clinic but the problem remains.

The usual cause of this sort of thing is imbalance of the brake pressure applied to the two reel discs or a tendency for the left-hand spool to be braked before the right-hand one. Check by inspection the timing of the brake application to both discs – ideally the right-hand brake should come on momentarily before the left-hand one. Also check the take-up main brake torque as detailed in the service manual.

SKANTIC 56612

The main problem with this set is raster distortion at the top of the screen. It's apparent only over the top two inches of the screen and gets progressively worse towards the top, peaking to the right-hand side of centre. We've also had problems with flyback lines.

Raster distortion can be caused by failure of RH08 (6·8Ω) in the EW modulator circuit – the associated diodes DH01/2/3 are also worth checking. If these are o.k. concentrate on the NS correction circuitry around transductor LK01 on the convergence panel – for a start check diode DK01 and the NS amplitude control PK01. Flyback lines are often caused by failure of blanking diode DX02 on panel X.

GRUNDIG CUC220 CHASSIS

The fault is sound but no vision. If the setting of the brightness control is advanced a faint, shadowy image can be seen in the background of a good raster. Voltage checks were made in the RGB circuits and around the TDA3561 decoder chip and it was found that pin 7 (contrast) was at 0V instead of 3·5V. The contrast control has no effect. The TDA3561 has been replaced, also transistor T2533 which is connected to pin 7, but the fault persists.

You should be able to confirm that the TDA3561 is working correctly by disconnecting the collector of T2533 and if necessary applying an external 3·5V supply to pin 7 of the i.c. If the picture doesn't come up with T2533 disconnected, check the voltages around the contrast control potentiometer. If it does there's no doubt that the problem is in the beam limiter circuit. Check the setting of potentiometer SB then R2536, C2536, D2536, D2532, etc.

SONY SLC7

The sound level with this machine's own recordings is o.k. for the first five seconds then dies to a very low level (with the TV set's volume control at maximum). Prerecorded tapes play back o.k. and the machine's recordings are all right when played back on other machines. The fault is present when the signal from another VCR is fed into the audio input socket and when audio dub is used. The audio head has been cleaned and signal tracing in the sound section whilst the machine is in the record mode has not revealed the cause of the fault. Sound from the VCR's tuner in the standby mode is o.k., so it's not the common TBA120 fault.

We've noticed that in this range of VCRs the recording bias level has a tremendous effect on the sound level of the tapes a machine records. We suggest that you check the bias oscillator, bias trap, record bias and record level adjustments as given in the manual. Do not attempt this without the full specified test gear.

NATIONAL PANASONIC TC2201

When this set is switched on there's violently pulsating sound and e.h.t. and field collapse. The symptom on the screen is three thin RGB lines with a spot of light in the centre of the screen, about half an inch in diameter, pulsating with the sound. The voltages are all on the high side but no defects have been revealed despite replacing all the transistors in the power supply and checking the diodes. Someone has fitted a BRC4443 instead of an M23C in the protection thyristor position. The field output transistors have been checked and found to be o.k.

The BRC4443 should be all right in the TR804 position. Many peculiar faults in this chassis are caused by failure through age of the reservoir and smoothing electrolytics. We suggest you replace the following: C816 220μF, C813 1μF, and C1029 10μF. Also replace the two 6V zener diodes D809 and D819, preferably with Panasonic supplied types.

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TELEVISION SEPTEMBER 1987

GEC 20AX CHASSIS Mk. I

When channel 4 or 3 is selected with the touch tuner the set reverts to channel 1. We've replaced the CBF16848N chip associated with touch contacts 1-4 but the problem remains.

Start by withdrawing PL213 from remote control panel PC701/7. If the problem is no longer present suspect IC201 (SAA1025) and IC202 (SN74141N) in that order – having first confirmed that 12V is present at the anode of zener diode D206. If the problem is still present with PL213 disconnected, check for electrical leakage in the channel selector switches and in C5 before suspecting the control sensor chip IC3 (SN16861NG).

TEST CASE

297

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.

Amongst all the VCRs, cameras and colour TV sets dealt with in recent test cases it's easy to overlook what was the mainstay of servicing work some years ago, the good old black-and-white set. There don't seem to be many of them about now, and we get very few in for repair. The one in question was a Ferguson Model 4816, a venerable portable fitted with the Thorn 1590 chassis. It has a mechanical tuner and beautifully straightforward circuitry. We expected the tube to have low emission after thirteen or more years' use, especially as the owner's complaint was of a streaky and shadowy picture.

The set was given to a junior technician to investigate, with the suggestion that he should start by checking the condition of the tube. This he did, and finding that the emission was very low he tried reactivation, which worked. With the needle of the jacker's emission meter hard over to the right he thought the repair job was as good as done. Not so, however.

With the set in operation a strange display, the like of which our technician had not seen before, was present on the screen. The left-hand side was bright, darkening towards the right-hand side. The picture, such as it was, had smears and streaks to the right. Whilst looking for further clues, the technician established that the sound was present and correct and that the tuning worked properly.

Without much idea as to where to start, our technician first checked the voltage across C87, i.e. the output from the series regulator circuit. This was found to be almost correct, and a tweak on the set h.t. voltage preset took it to exactly 11·6V. It seemed likely that the cause of the problem lay somewhere in the vision stages, most of which obtain their supply from the 25V boost rail. This was next checked and found to be correct. The video output transistor VT9 obtains its collector voltage from the line output transformer derived 95V rail however. A check at the collector revealed a large disparity between what should have been recorded and what was actually found: whilst there should have been around 45V the test meter read just over 30V. So the collector load resistor R51 (6·8kΩ) was removed and checked. It had fallen in value to around 6·1kΩ, but a replacement made virtually no difference to the display. Maybe the transistor itself was faulty? A new BF337 was fitted, again with no effect on the fault symptom.

At this point the technician came off the rails somewhat (no pun intended!) in starting to make checks on various peripheral components in the video output stage. Many of them were found to have drifted out of tolerance over the years, but none of them was responsible for the fault symptom. Perhaps the set had expired, or maybe something was wrong with the line output transformer? Our technician's girl friend, consulted during the lunch hour, said she'd had the same effect when daylight had leaked into her camera – the picture had been all bright and foggy on one side. A more suitable adviser, the Resident Workshop Sage, was found after lunch. For him the set was quite a contrast to the 3V53 VCR he'd been tackling when interrupted.

RWS had a pretty good idea as to which component was faulty at first sight of the screen, but he didn't let on. He urged the technician to use the oscilloscope and suggested a couple of key points to hook it to. Knowing that the technician would soon be coming past him on the way to the stores, Sage got ready a certain little component. What was it, and which was the crucial test point? Answer next month.

ANSWER TO TEST CASE 296
– page 705 last month –

One for the theory boys last month! A Philips TV set fitted with the KT3 chassis had a narrow bright white line superimposed across the centre of the picture.

The line was being produced by velocity modulation of the scanning spot – the same sort of phenomenon that gives rise to vertical striations when an undamped line linearity coil rings. During its downwards scan of the screen the spot was slowing down momentarily at screen centre, due to crossover distortion in the field output stage.

It's normally arranged that a small quiescent current flows in a class B complementary-symmetry field output stage to ensure a smooth transition between the operation of the transistors at the point where the sawtooth drive waveform passes through zero. This is done by connecting a resistor between the bases of the two transistors to develop a suitable "offset" voltage. In this circuit the resistor in question is R1533 (68Ω), which when removed and checked was found to be about 18Ω. Its colour coding was difficult to read, possibly because it had been heating up for some time, so we'll never know whether a wrong type had been fitted or the original had gone low in value.

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BF241 10p
BF254 15p
BF255 12p
BF256 18p
BF257 18p
BF258 18p
BF259 18p
BF262 25p
BF263 25p
BF270 18p
BF273 15p
BF311 21p
BF324 25p
BF336 20p
BF337 20p
BF338 20p
BF355 28p
BF362 30p
BF367 13p
BF371 17p
BF391 18p
BF392 18p
BF414 16p
BF420 16p
BF421 18p
BF422 21p
BF423 15p
BF440 16p
BF451 17p
BF455 14p
BF458 19p
BF459 19p
BF461 60p
BF462 62p
BF469 30p
BF470 28p
BF471 28p
BF472 28p
BF479 30p
BF493 18p
BF494 16p
BF506 25p
BF595 16p
BF596 16p
BF597 10p
BF615 30p
BF758 41p
BF869 22p
BF870 22p
BF871 22p
BF872 23p
BF960 38p
BF961 35p
BF963 40p
BF964 38p
BF966 40p
BFR40 25p
BFR51 21p
BFR62 21p
BFR79 25p
BFR90 52p
BFR91 99p
BFR94 500p
BFT37 130p
BFT42 30p
BFT43 30p
BFW84 30p
BFW92 35p
BFX29 20p
BFX84 20p
BFX85 20p
BFX87 15p
BFX88 15p
BFX89 60p
BFY17 30p
BFY18 40p
BFY41 28p
BFY50 14p
BFY51 14p
BFY52 14p
BFY56 25p
BFY57 25p
BFY64 25p
BFY90 45p
BLY48 85p
BLY49 85p

BR100 14p
BR101 43p
BR103 37p
BRY39 55p
BRY49 38p
BRY56 33p
BSS74 33p
BSX20 15p
BSX26 18p
BSX29 19p
BT100A 70p
BT106 120p
BT109 90p
BT116 80p
BT119 100p
BT120 100p
BT138 60p
BT146 99p
BT151 58p
BTY79 140p
BU100A 110p
BU104 100p
BU105 80p
BU108 100p
BU110 110p
BU111 140p
BU124 60p
BU126 70p
BU204 75p
BU205 70p
BU206 100p
BU208 75p
BU208A 80p
BU208D 100p
BU209 140p
BU225 190p
BU226 190p
BU325 85p
BU326 85p
BU406 85p
BU406D 95p
BU407 75p
BU407D 95p
BU408 85p
BU408D 95p
BU409 95p
BU426 120p
BU500 110p
BU508A 120p
BU526 80p
BU546 140p
BU801 95p
BU806 120p
BU807 95p
BUX80 180p
BUX84 65p
BUX85 65p
BUY69A 200p
BUY70C 160p

C106D 28p

J174 38p
J300 50p

MCR220 120p
MEO411 38p
MEO414 125p
ME3001 12p
ME4103 12p
ME6001 12p
ME6002 15p
ME8001 15p
ME9021 12p
MJ10012 300p
MJ15001 325p
MJ15002 300p
MJ15003 325p
MJ15004 370p
MJ15022 400p
MJ2500 100p
MJ2501 110p
MJ2955 85p
MJ3000 115p
MJ3001 115p
MJE29A 30p
MJE30A 30p
MJE340 25p
MJE350 80p
MJE520 30p
MJE2955K 90p
MP8111 40p
MP8112 45p
MP8113 55p
MP8512 50p
MPN3404 30p
MPS6571 20p
MPS9012 20p
MPS9013 20p
MPS9014 20p
MPS9015 20p
MPSA06 15p
MPSA13 15p
MPSA20 15p
MPSA65 25p
MPSA66 25p
MPSA70 15p
MPSA92 20p
MR510 35p
MR856 36p
MRF479 350p
MV1622 80p
MV209 48p
MV2209 48p

OC28 150p
OC29 80p
OC35 100p
OC36 120p
OC45 50p
OC71 30p
OC72 50p
OC200 180p
OT121 90p

R2008B 100p
R2010B 100p
R2030 100p
R2306 55p

S2800D 52p
S2800M 72p

T2800D 52p
T2800M 72p
TAG4442 76p
TAG4443 76p
TAG4444 76p
TIP29 15p
TIP29A 22p
TIP29C 25p
TIP30 25p
TIP30C 30p
TIP31A 24p
TIP31C 30p
TIP32 24p
TIP32A 24p
TIP32C 28p
TIP33 50p
TIP34 50p
TIP41A 22p
TIP41C 25p
TIP42A 22p
TIP42C 25p
TIP47 40p
TIP48 40p
TIP50 60p
TIP51 120p
TIP52 120p
TIP53 120p

TIP54 140p
TIP105 65p
TIP106 65p
TIP107 65p
TIP110 47p
TIP111 50p
TIP112 40p
TIP115 45p
TIP116 45p
TIP117 50p
TIP120 43p
TIP121 46p
TIP122 47p
TIP125 47p
TIP126 56p
TIP127 56p
TIP141 90p
TIP142 90p
TIP145 65p
TIP146 90p
TIP147 100p
TIP2955 42p
TIP3054 45p
TIP3055 42p
TIS43 45p
TIS44 40p
TIS61 15p
TIS88A 45p
TIS90 15p
TIS91 18p
TIS93 20p

VK1010 88p
VN.10KM 60p
VN.46AF 88p
VN.66AF 100p
VN.88AF 115p
VN.89AF 110p

Y723 75p
Y827 75p
Y860 22p
Y969 65p

ZTX107 11p
ZTX108 11p
ZTX109 12p
ZTX212 27p
ZTX300 13p
ZTX301 16p
ZTX302 16p
ZTX303 24p
ZTX304 17p
ZTX320 29p
ZTX326 29p
ZTX500 13p
ZTX501 13p
ZTX502 18p
ZTX503 18p
ZTX504 25p
ZTX550 24p

2N.696 26p
2N.697 22p
2N.698 40p
2N.699 45p
2N.706 22p
2N.708 22p
2N.914 28p
2N.918 36p
2N.930 16p
2N.1131 28p
2N.1132 28p
2N.1613 24p
2N.1711 24p
2N.1893 30p
2N.2102 50p
2N.2160 300p
2N.2218A 24p
2N.2219 24p
2N.2221 23p
2N.2222 23p
2N.2369 15p
2N.2484 20p
2N.2646 40p
2N.2904 20p
2N.2905 20p
2N.2906 18p
2N.2907 18p
2N.2926 8p
2N.3019 28p
2N.3053 18p
2N.3054 40p
2N.3055 38p
2N.3055H 50p
2N.3440 58p
2N.3442 85p
2N.3525 150p
2N.3583 90p
2N.3585 120p
2N.3702 9p
2N.3703 9p
2N.3704 9p
2N.3705 9p
2N.3706 9p
2N.3707 9p
2N.3708 9p
2N.3710 12p
2N.3711 12p
2N.3771 85p
2N.3772 90p
2N.3773 110p
2N.3799 18p
2N.3819 29p
2N.3866 68p
2N.3903 11p
2N.3904 11p
2N.3905 11p
2N.3906 11p
2N.4031 25p
2N.4036 25p
2N.4037 25p
2N.4058 13p
2N.4058 13p
2N.4062 12p
2N.4064 100p
2N.4240 150p
2N.4248 130p
2N.4401 12p
2N.4403 12p
2N.4443 76p
2N.4444 76p
2N.4904 76p
2N.5061 20p
2N.5062 28p
2N.5088 20p
2N.5163 45p
2N.5192 50p
2N.5241 500p
2N.5245 45p
2N.5294 30p
2N.5296 30p
2N.5303 200p
2N.5320 90p
2N.5321 60p
2N.5366 25p
2N.5401 12p
2N.5448 12p
2N.5496 80p
2N.5777 40p
2N.6106 40p
2N.6107 40p
2N.6109 40p
2N.6254 110p
2N.6292 40p
2N.6384 120p
2N.6385 120p
2N.6403 160p
2N.6649 140p

3N.128 55p
3N.143 65p

DIODES
AA119 9p
BY100 40p
BY103 32p
BY126 6p
BY127 8p
BY133 8p
BY164 40p
BY176 85p
BY179 35p
BY182 32p
BY184 32p
BY187 32p
BY196 20p
BY206 11p
BY207 11p
BY208 18p
BY210 22p
BY223 72p
BY225 120p
BY226 18p
BY227 19p
BY228 32p
BY296 20p
BY298 26p
BY299 28p
BY476 90p
BYX10 15p
BYX55/350 30p
BYX55/600 30p
BYX55/800 32p
BYX70/300 29p
BYX70/500 32p
BYX70/800 36p
BYX71/600 80p
OA47 6p
OA90 6p
OA91 8p
OA200 7p
OA202 7p
IN.914 2p
IN.4001 4p
IN.4002 4p
IN.4003 4p
IN.4004 4p
IN.4005 4p
IN.4006 4p
IN.4007 5p
IN.4148 2p
IN.5400 9p
IN.5401 10p
IN.5402 10p
IN.5403 11p
IN.5404 11p
IN.5405 12p
IN.5406 13p
IN.5407 13p
IN.5408 13p

LOW PROFILE SOCKETS
8pin 6p
14pin 8p
16pin 9p
18pin 12p
20pin 14p
22pin 16p
24pin 18p
28pin 20p
40pin 25p

ZENERS
400MV
BYZ88 RANGE
2V7 to 39V 6p
1.3W
BZX61 RANGE
2V7 to 39V 12p

VOLTAGE REGULATORS
7805 35p
7812 35p
7815 35p
7818 35p
7824 35p
7905 35p
7912 40p
7915 40p
7918 40p
7924 40p
78L05 28p
78L12 28p
78L15 28p
78L18 28p
78L24 28p
79L05 40p
79L12 45p
79L15 48p
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 50p
DF96 50p
DL92 60p
DY86 50p
DY87 60p
DY802 55p
EABC80 60p
E891 44p
EBF80 45p
EBF89 50p
ECC82 55p
ECC83 65p
ECC84 50p
ECC85 50p
ECH81 65p
ECH84 65p
ECL80 57p
ECL82 59p
ECL84 57p
ECL85 57p
ECL86 70p
EF80 50p
EF85 50p
EF89 70p
EF183 60p
EF184 65p
EL34 210p
EL36 60p
EL84 50p
EL95 60p
EL500 80p
EL504 100p
EY86 31p
EY87 31p
EY88 42p
EZ35 45p
EZ80 50p
EZ81 55p
GZ34 180p
PC97 100p
PCC85 42p
PCF80 65p

PCF200 135p
PCF801 110p
PCF802 60p
PCF806 115p
PCH200 100p
PCL81 62p
PCL82 63p
PCL84 50p
PCL85 65p
PCL86 65p
PCL805 65p
PFL200 85p
PL36 80p
PL82 45p
PL83 32p
PL84 50p
PL95 140p
PL500 110p
PL504 95p
PL508 170p
PL519 450p
PY81 70p
PY88 57p
PY500A 160p

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-7118 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 350p
AY3-8912 400p
AY5-3600 570p
BA-301 65p
BA-302 90p
BA-308 100p
BA-311 80p
BA-313 50p
BA-314 100p
BA-318 120p
BA-333 100p
BA-340 150p
BA-401 60p
BA-402 60p
BA-501 450p
BA-511 160p
BA-514 160p
BA-516 150p
BA-521 180p
BA-524 240p
BA-526 220p
BA-527 140p
BA-532 140p
BA-534 290p
BA-535 600p
BA-536 210p
BA-612 160p
BA-658 350p
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-5402 250p
BA-5406 280p
BA-6104 250p

BA-6135 250p
BA-6208 250p
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-3089Q 250p
CA-3130E 80p
CA-3130S 100p
CA-3134E 38p
CA-3160 86p
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 160p
HA-1144 380p
HA-1156 110p
HA-1197 150p
HA-1199 160p
HA-1306W 170p
HA-1319 240p
HA-1338 300p
HA-1339A 170p
HA-1342 170p
HA-1366WR 160p
HA-1367 300p
HA-1368 160p
HA-1371 300p
HA-1372 300p
HA-1374 230p
HA-1377 210p
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-11221 210p
HA-11223 340p
HA-11225 170p
HA-11226 410p
HA-11235 210p
HA-11701 310p
HA-11703 390p
HA-11705 620p
HA-11710 340p
HA-11715 560p
HA-11724 800p
HA-13001 260p
HA-13008 800p

ICL-7016 650p
ICL-7017 960p
ICL-7611 90p
ICL-7660 240p
ICM-7555 60p
ICM-7556 130p

LA-1111 180p
LA-1150 150p
LA-1201 80p
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 150p
LA-3120 125p
LA-3155 100p
LA-3160 120p
LA-3201 80p
LA-3210 65p
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-4100 100p
LA-4101 90p
LA-4102 120p
LA-4110 160p
LA-4112 160p
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-4261 300p
LA-4400 190p
LA-4420 140p
LA-4422 130p
LA-4430 130p
LA-4440 230p
LA-4445 260p
LA-4450 160p
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-5112 120p
LA-5700 300p
LA-7520 500p
LA-7800 180p
LA-7801 280p
LA-7802 300p
LA-7803 400p
LA-7805 400p
LA-7806 260p
LA-7820 250p
LA-7910 150p
LAP-512 310p
LAG-552 200p
LAG-652 200p
LAG-600 200p
LAG-634D 30p
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-513168 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 670p
MC-1495 285p
MC-1496 65p
MC-1569 210p
MC-3302 70p
MC-3401 45p
MC-3403 60p
MC-3423 75p
MF-10 295p
ML-920 480p
ML-922 380p

NE-531 115p
NE-544 170p
NE-555 20p
NE-556 40p
NE-564 380p
NE-565 110p
NE-566 130p
NE-567 115p
NE-570 360p
NE-571 290p
NE-592 85p
NE-5532P 140p
NE-5533P 150p
NE-5534P 110p

SAS-560 110p
SAS-570 110p
STK-011 370p
STK-013 700p
STK-014 700p
STK-015 490p
STK-016 800p
STK-020 540p
STK-022 700p
STK-025 700p
STK-041 700p
STK-043 980p
STK-050 1450p
STK-077 800p
STK-078 820p
STK-080 710p
STK-082 720p
STK-086 910p
STK-430 500p
STK-433 490p

STK-435 510p
STK-436 490p
STK-437 600p
STK-439 550p
STK-441 740p
STK-443 740p
STK-457 580p
STK-459 610p
STK-460 720p
STK-461 720p
STK-463 780p
STK-465 800p
STK-501 580p
STK-563 480p
STK-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-1039 550p
STK-1040 700p
STK-1049 800p
STK-1070 1200p
STK-2025 800p
STK-2028 650p
STK-2029 500p
STK-2129 610p
STK-2139 800p
STK-2230 580p
STK-3041 600p
STK-3042 580p
STK-3062 600p
STK-3082 700p
STK-4026 800p
STK-4060 580p
STK-4211 800p
STK-4141 700p
STK-4332 500p
STK-4352 700p
STK-5315 650p
STK-7308 800p
STK-8250 700p
STK-4833 1200p
STR-440 520p
STR-441 480p
STR-451 500p
STR-6020 600p

T2800D 52p
TA-7054 190p
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 60p
TA-7137 83p
TA-7140 130p
TA-7142 220p
TA-7145 220p
TA-7146 400p
TA-7148 350p
TA-7157 140p
TA-7162 300p
TA-7169 420p
TA-7176 240p
TA-7193 400p
TA-7200 200p
TA-7201 200p
TA-7203 180p
TA-7204 140p
TA-7205 80p
TA-7207 150p
TA-7208 145p
TA-7210 200p
TA-7212 300p
TA-7213 200p
TA-7214 260p
TA-7215 215p
TA-7217 145p
TA-7220 220p
TA-7222 120p
TA-7223 210p
TA-7224 270p
TA-7225 300p
TA-7226 290p
TA-7227 190p
TA-7229 300p
TA-7230 170p
TA-7232 250p
TA-7233 250p
TA-7237 400p
TA-7238 400p
TA-7240 260p
TA-7241 260p
TA-7245 450p
TA-7247 800p
TA-7269 850p
TA-7270 250p
TA-7271 400p
TA-7299 400p
TA-7310 100p
TA-7312 120p
TA-7313 110p
TA-7314 210p
TA-7315 200p
TA-7320 300p
TA-7324 200p
TA-7325 90p
TA-7328 200p
TA-7335 200p
TA-7357 400p
TA-7358 200p
TA-7401 400p
TA-7607 270p
TA-7608 360p
TA-7609 270p
TA-7611 280p
TA-7614 230p
TA-7621 520p
TA-7628 240p
TA-7640 150p
TA-7641 170p
TA-7658 130p
TA-7668 160p
TA-7688 250p
TAA 550 20p
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TDA-2010 100p
TDA-2020 140p
TDA-2030 140p
TDA-2532 120p
TDA-2540 100p
TDA-2560 120p
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ULN-2003 69p
ULN-2004 69p
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ULN-2803 130p
ULN-2804 170p
UPC16C 160p
UPC20C 220p
UPC30C 190p
UPC358 150p
UPC554 130p
UPC555 60p
UPC556H 80p
UPC558 200p
UPC566 60p
UPC571 220p
UPC572 200p
UPC574 60p
UPC575C2 90p
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UPC592 95p
UPC595 190p
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UPC1018 170p
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UPC1021 200p
UPC1023 60p
UPC1025 230p
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UPC1191 100p
UPC1197 140p
UPC1216 120p
UPC1222 130p
UPC1230 210p
UPC1238 120p
UPC1263 230p
UPC1277 240p
UPC1278 240p
UPC1350 115p
UPC1353 160p
UPC1363 190p
UPC1365 320p
UPC1373 85p
UPC1378 210p
UPC1380 450p
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2SA-1102 200p
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2SA-1104 220p
2SA-1105 250p
2SA-1106 250p
2SB-022 80p
2SB-324 55p
2SB-370 45p
2SB-616 190p
2SB-705 200p
2SB-754 80p
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2SC-828 25p
2SC-945 40p
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2SC-1114 415p
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2SC-1161 110p
2SC-1172 150p
2SC-1173 80p
2SC-1213 70p
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2SC-1306 90p
2SC-1308K 350p
2SC-1317 32p
2SC-1342 130p
2SC-1383 75p
2SC-1384 70p
2SC-1398 80p
2SC-1505 80p
2SC-1507 140p
2SC-1509 110p
2SC-1675 100p
2SC-1678 120p
2SC-1758 30p
2SC-1815 30p
2SC-1826 60p
2SC-1865 120p
2SC-1875 260p
2SC-1881 210p
2SC-1906 75p
2SC-1909 250p
2SC-1942 290p
2SC-1945 350p
2SC-1946 1500p
2SC-1947 450p
2SC-1957 70p
2SC-1969 180p
2SC-1972 600p
2SC-2001 60p
2SC-2026 60p
2SC-2028 75p
2SC-2029 120p
2SC-2075 80p
2SC-2078 95p
2SC-2086 60p
2SC-2166 90p
2SC-2238 70p
2SC-2240 45p
2SC-2314 70p
2SC-2335 120p
2SC-2458 40p
2SC-2547 65p
2SC-2570 60p
2SC-2577 150p
2SC-2578 220p
2SC-2579 240p
2SC-2580 240p
2SC-2581 290p
2SC-2611 65p
2SC-3150 200p
2SC-3293 85p
2SC-3156 400p
2SC-1413 265p
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2SD-325 60p
2SD-348 460p
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2A/200V 33p
2A/400V 37p
2A/600V 43p
2A/800V 43p
3A/200V 43p
3A/400V 43p
3A/600V 44p
6A/200V 80p
6A/400V 72p
25A/100V 150p
25A/200V 165p
25A/400V 185p
25A/600V 200p
25A/800V 240p
35A/100V 185p
35A/200V 200p
35A/400V 220p
35A/600V 230p
35A/800V 260p
1.5A/100V 40p
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6545 880p
6551 530p
6800 210p
6802 220p
6803 800p
6808 500p
6809 600p
6810 150p
6818 380p
6820 140p
6821 140p
6840 310p
6845 620p
6850 110p
8080A 400p
8085A 300p
8155 360p
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81LS95 120p
81LS96 130p
81LS97 130p
81LS98 130p
8224 270p
8226 270p
8228 270p
8243 250p
8250 850p
8087 £110.00
8251 300p
8253 320p
8255 310p
8256 1200p
8257 350p
8259 360p
8271 3400p
8272 1200p
8279 450p
8282 300p
8283 400p
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8287 360p
8288 650p
8748 1100p
8755 1400Pp

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AY5-3600 570p
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Z80BPIO 480p
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74S189 210p
74S201 240p
74S287 190p
74S288 160p
74S289 180p
74S387 200p

75107 80p
75108 80p
75109 110p
75110 80p
75112 140p
75113 105p
75114 130p
75115 130p
75121 125p
75122 125p
75150 110p
75154 110p
75158 140p
75159 200p
75160 400p
75161 400p
75162 700p
75172 720p
75182 100p
75183 100p
75188 60p
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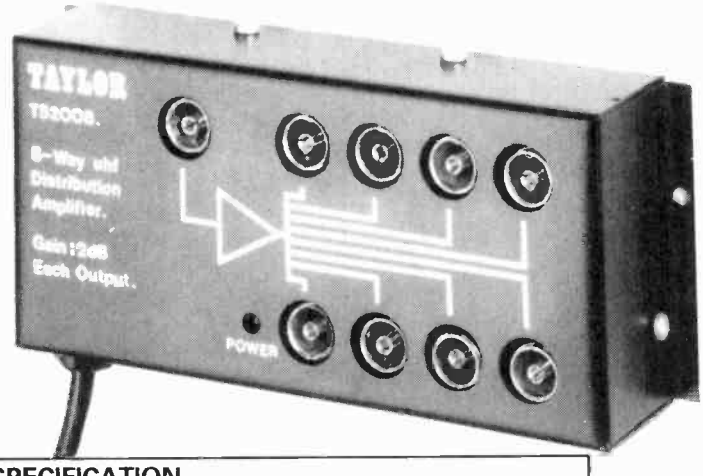

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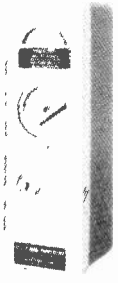

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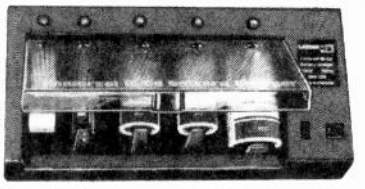

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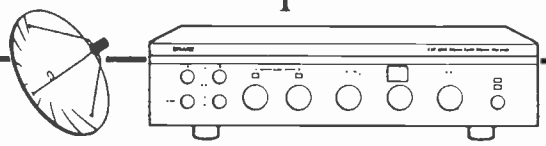

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2SA-564	£0.15	2SD-850	£2.66	HA-1151	£1.25	TA-7229	£2.50	BC-307A	£0.055	BDX-53B	£0.42	TDA-2060	£2.20	L-165V	£2.80	*SANYO*		REPLACEMENT		RW-317	£0.52
2SA-673	£0.20	2SD-869	£3.20	HA-1156	£1.30	TA-7230	£1.30	BC-307B	£0.055	BDX-54B	£0.42	TDA-2020	£1.40	L-200CH	£1.50	VTC-5500	£0.98	STYLI		RW-320	£0.36
2SA-683	£0.20	2SD-880	£0.50	HA-1367	£3.60	TA-7240	£2.50	BC-308	£0.055	BF-173	£0.65	TDA-2030AH	£1.80	L-2605CV	£1.80	VTC-9300	£2.50	*WE HAVE FULL*		RW-321	£0.52
2SA-684	£0.20	2SD-882	£4.50	HA-1392	£2.50	TA-7248	£4.00	BC-308A	£0.055	BF-257	£0.30	TDA-2030AV	£2.48	MC-1458CP	£0.50			*RANGE OF THE*		RW-327	£0.54
2SA-748	£1.00	2SD-1135	£0.85	HA-1406	£0.75	TA-7310	£1.25	BC-308B	£0.055	BF-258	£0.30	TDA-2030H	£1.60	MC-1488P	£0.45	*SHARP*		*STYLUS MOSTLY*		RW-328	£0.81
2SA-765	£3.00	AN-203	£1.00	HA-11227	£1.00	TA-7313	£0.80	BC-309	£0.055	BF-259	£0.30	TDA-2040H	£2.20	MC-1489P	£0.45	VC-7000	£1.40	*JAPANESE*		RW-329	£0.45
2SA-769	£1.50	AN-210	£0.90	HA-11423	£2.10	TA-7314	£1.35	BC-309B	£0.055	BF-272S	£0.75	TDA-2040V	£2.20	2N-2219A	£0.30	VC-6000	£1.55	*MODELS: PLS*		RW-51	£0.51
2SA-771	£1.50	AN-214	£1.50	HA-12017	£1.30	TA-7315	£1.35	BC-327-16	£0.055	BF-457	£0.51	TDA-2530	£2.70	2N-2369A	£0.35	VC-9300	£0.98	*ASK FOR FULL*		RW-52	£0.36
2SA-794	£0.60	AN-272U	£2.90	HA-12413	£1.30	TA-7317	£1.00	BC-327-40	£0.055	BF-458	£0.54	TDA-2822	£0.90	2N-3055	£0.38	VC-6300	£1.65	*LIST THE UNIT*		RW-54	£0.36
2SA-798	£0.60	AN-301	£2.35	HA-12411	£1.60	TA-7323	£1.20	BC-328	£0.055	BFY-52	£0.30	TDA-2822M	£0.90	2N-3866	£0.90	VC-6100	£1.40	*PRICE: £2.60.*		RW-56	£0.36
2SA-850	£0.30	AN-302	£2.50	LA-1365	£1.20	TA-7324	£1.10	BC-337	£0.055	BFY-76	£0.37	TDA-3410	£1.60	CD4009UBE	£0.60	VC-8300	£1.40			RW-57	£0.36
2SA-893	£0.30	AN-303	£3.20	LA-3161	£1.20	TA-7325	£0.75	BC-337-16	£0.055	BFY-50	£0.40	TDA-3569	£3.10	MJE-371	£0.40	*SONY*		CARTRIDGES		RW-58	£0.36
2SA-958	£0.75	AN-315	£1.00	LA-3220	£1.00	TA-7326	£1.35	BC-337-25	£0.055	BFY-51	£0.41	TDA-3590	£2.80	MJE-521	£0.35	SL-C5/C7	£1.30	*WE HAVE 9*		*LITHIUM (Cion Cell)*	
2SA-968	£0.75	AN-318	£5.75	LA-3365	£1.20	TA-7328	£1.40	BC-337-40	£0.055	BFY-90	£1.08	CA-3401E	£0.92	KC-581	£4.20	SL-8000	£2.40	*MODELS OF*		BR-1225	£0.75
2SA-985	£1.20	AN-360	£0.75	LA-4100	£0.85	TA-7331	£1.00	BC-338	£0.055	BFR-36	£1.10	CA-3065	£2.75	LM-3900	£0.52			*CARTRIDGES*		BR-1616	£0.75
2SA-992	£0.30	AN-5010	£2.50	LA-4125	£1.90	TA-7628	£1.60	BC-377	£0.20	BFR-38	£3.90	CA-3410E	£2.40	LM-723CN	£0.52	*TOSHIBA*		*UNIT PRICES IS:*		BR-2016	£0.75
2SA-1060	£1.50	AN-5431	£2.20	LA-4183	£1.50	TA-7658	£1.20	BC-393	£0.48	BU-104	£3.90	CA-3420AE	£3.05	CA-3140E	£0.50	V-5250	£2.20	*£6.00*		BR-2020	£0.75
2SA-1106	£1.50	AN-5435	£1.80	LA-4190	£1.50	UPC-575	£1.05	BC-546	£0.055	BU-205	£0.68	TIP-29A	£0.20	CA-3089	£1.15	V-5480	£1.55			BR-2320	£0.75
2SA-1141	£2.90	AN-5440	£2.15	LA-4195	£1.70	UPC-1031	£1.30	BC-546	£0.055	BU-208	£0.68	TIP-29A,B	£0.23			V-7450	£1.30			BR-2325	£0.75
2SA-1303	£1.50	AN-5510	£2.50	LA-4422	£1.50	UPC-1181	£1.05	BC-547	£0.055	BU-126	£0.80	TIP-30A,B	£0.27	**VIDEO BELT KITS**		V-8600	£1.20	ORTOFON		CR-1220	£0.75
2SB-527	£0.60	AN-5612	£2.80	LA-4430	£1.30	UPC-1182	£1.05	BC-547A,B,C	£0.055	BU-500	£1.00	TIP-30C	£0.27	*AKAI:*		V-5475	£1.45	W/HEADSHELL		CR-1620	£0.75
2SB-544	£0.40	AN-5720	£1.25	LA-4440	£2.10	UPC-1185	£1.72	BC-548	£0.055	BU-326A	£0.95	TIP-31	£0.22	VS-10	£0.78			*CARTRIDGES*		CR-2025	£0.75
2SB-557	£2.25	AN-5722	£1.25	LA-4445	£2.20	UPC-1212	£1.10	BC-548A,B	£0.055	BU-508A	£1.30	TIP-31A,B	£0.22	VS-2EG/5EG	£0.93	*FERGUSON*		VMS-3U	£7.50	CR-2032	£0.75
2SB-562	£0.30	AN-5730	£1.35	LA-4508	£1.70	UPC-1213	£1.05	BC-549	£0.055	BU-508D	£1.40	TIP-31C	£0.22	VS-7300	£1.35	3V00	£2.55	VMS-3S	£7.50	CR-2316	£0.75
2SB-681	£2.50	AN-5732	£1.25	M-51102L	£2.50	UPC-1277	£2.00	BC-549B	£0.055	BDY-20	£1.20	TIP-32	£0.22	VS-9700	£1.60	3V16	£1.95			CR-2420	£0.75
2SB-688	£1.25	AN-5738	£1.00	M-51515L	£2.80	UPC-1230	£1.99	BC-557	£0.055	TBA-120S	£0.60	TIP-32A,B	£0.22	*FISHER*		3V22	£2.00			CR-2430	£0.75
2SB-718	£0.75	AN-5900	£1.50	MB-3712	£1.50	UPC-1353	£2.45	BC-557A,B,C	£0.055	TBA-231A	£1.05	TIP-32C	£0.22	VBS-7000	£2.40	3V23	£0.77				
2SB-772	£0.50	AN-6249	£1.20	MB-3713	£2.00	AC-187	£0.15	BC-558	£0.055	TBA-331	£0.60	TIP-33A	£0.50	VBS-9000	£0.80	3V29	£0.75	WATCH &			
2SC-497	£1.50	AN-6250	£0.40	MB-3730	£2.50	AC-187K	£0.20	BC-558B	£0.055	TBA-520	£1.00	TIP-41	£0.22					CALCULATOR			
2SC-681	£1.95	AN-6320	£2.00	NE-646	£2.50	AC-188	£0.15	BC-559B,C	£0.055	TBA-540	£1.00	TIP-41B,C	£0.23	*HITACHI*		DRIVE BELTS *FOR*		*MICRO*			
2SC-710	£0.20	AN-6332	£5.00	STK-011	£5.98	AC-188K	£0.22	BCY-70	£0.25	TBA-800	£0.45	TIP-42	£0.25	VT-5000E	£1.55	*AUDIO CASSETTE*		*BATTERIES*			
2SC-738	£0.25	AN-6341	£2.80	STK-015	£5.25	AU-113	£2.40	BCY-72	£0.19	TBA-810S	£0.60	TIP-42A,B	£0.22			*RECORDERS/*		RW-40	£0.48		
2SC-741	£1.95	AN-6342	£1.50	STK-016	£5.80	AD-149	£0.45	BD-135	£0.20	TBA-810P	£1.00	TIP-42C	£0.24	*JVC*		*TURNTABLES*		RW-42	£0.50		
2SC-790	£0.90	AN-6360	£2.80	STK-032	£12.45	AD-166	£1.80	BD-136	£0.20	TBA-810AS	£0.90	TIP-48	£0.37	HR-3330	£2.00			RW-44	£0.53		
2SC-828	£0.15	AN-6551	£1.00	STK-035	£8.00	BC-171C	£0.055	BD-140	£0.40	TBA-810AP	£1.20	TIP-102	£0.50	HR-7200	£0.75	*SQUARE*		RW-47	£0.25		
2SC-829	£0.15	AN-6884	£0.90	STK-043	£7.50	BC-172A	£0.055	BD-201	£0.40	TBA-820	£0.68	TIP-105	£0.48	HR-3360	£1.95	68×1.2 to		RW-48	£0.42		
2SC-945	£0.15	AN-6912	£1.25	STK-080	£6.50	BC-172C	£0.055	BD-239A	£0.30	TBA-820M	£0.60	TIP-121	£0.40	HR-4100	£1.95	86×1.2	£0.12	RW-49	£0.45		
2SC-1018	£0.75	AN-7060	£1.25	STK-082	£10.05	BC-177B	£0.19	BD-240A	£0.30	TBA-950	£1.90	TIP-125	£0.40	HR-6500	£2.25	120×1.25	£0.12	RW-410	£0.45		
2SC-1061	£0.75	AN-7105	£1.60	STK-0029	£4.10	BC-179B	£0.22	BD-243C	£0.50	TBA-1441	£1.05	TIP-126	£0.40	HR-3300	£2.55	135×1.25	£0.12	RW-411	£0.45		
2SC-1173	£0.40	AN-7110	£1.20	STK-0060	£8.70	BC-182	£0.055	BD-244B	£0.45	TCA-660	£2.50	HCF4001BE	£0.18	HR-7700	£0.77			RW-412	£0.45		
2SC-1383	£0.25	AN-7116	£0.90	STK-435	£4.50	BC-182A	£0.055	BD-244C	£0.40	TCA-750	£3.00	HCF4008BE	£0.50	HR-7650	£0.77	*FLAT*		RW-413	£0.45		
2SC-1384	£0.25	AN-7117	£0.80	STK-436	£5.80	BC-182B	£0.055	BD-278	£0.70	TCA-760	£2.00	HCF4017BE	£0.52			68×0.5×4		RW-414	£0.45		
2SC-1413AH	£3.00	AN-7120	£1.25	STK-439	£7.45	BC-182C	£0.055	BD-233	£0.30	TCA-900	£0.75	HCF4025BE	£0.25	*NATIONAL*		to	£0.25	RW-415	£0.45		
2SC-1454	£3.50	AN-7140	£1.50	STK-441	£9.80	BC-183	£0.055	BD-234	£0.30	TCA-940N	£0.60	HCF4028BE	£0.48	NV-333	£1.35	88×0.5×4	£	RW-418	£0.91		
2SC-1567	£0.50	AN-7143	£1.50	STK-457	£7.90	BC-183B	£0.055	BD-237	£0.30	TCA-3089	£1.65	HCF4050BE	£0.32	NV-8600	£1.65	88×0.5×5	£	RW-30	£0.38		
2SC-1775	£0.15	AN-7145	£2.20	STK-459	£8.50	BC-183C	£0.055	BD-238	£0.30	TDA-440	£1.45	HCF4011BE	£0.99	NV-777	£0.95	122×0.5×5	£0.60	RW-33	£0.45		
2SC-1815	£0.15	AN-7146	£2.20	STK-460	£8.70	BC-184	£0.055	BD-379	£0.24	TDA-1011	£1.15	HCF4013BE	£0.35	NV-7200	£0.84	189×0.5×5	£0.60	RW-36	£0.48		
2SC-1845	£0.15	AN-7156	£2.80	STK-1030	£4.95	BC-184A	£0.055	BD-433	£0.28	TDA-1012	£1.65	L-123CTB	£1.30	NV-7000	£0.95	195×0.5×5	£0.60	RW-37	£0.31		
2SC-1913	£0.90	AN-7161	£2.50	STK-2029	£7.55	BC-184B	£0.055	BD-434	£0.28	TDA-1054	£1.10			NV-600	£1.45	205×0.5×5	£0.60	RW-39	£0.52		
2SC-2240	£0.15	AN-7168	£2.60	STK-2125	£7.45	BC-184C	£0.055	BD-436	£0.28	TDA-1059	£0.85							RW-300	£0.52		
2SC-2320	£0.15	AN-7213	£1.00	STK-2129	£8.10	BC-212B	£0.055	BD-437	£0.30	TDA-1151	£0.75					*CASSETTE HEADS*		RW-310	£0.38		
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2SC-2577	£1.25	AN-7220	£1.60	STR-4090	£8.00	BC-213	£0.055	BD-442	£0.30	TDA-1180	£1.45					STEREO	£1.50	RW-313	£0.44		
2SC-2581	£1.50	AN-7223	£1.40	TA-7061	£1.00	BC-213A	£0.055	BD-535	£0.30	TDA-1220	£1.20							RW-315	£0.42		
2SC-3284	£1.50	AN-7224	£1.25	TA-7137	£1.00	BC-213B	£0.055	BD-536	£0.35	TDA-1510	£4.10							RW-316	£0.51		
2SC-3298	£1.50	AN-7311	£0.90	TA-7140	£1.00	BC-213C	£0.055	BD-550B	£4.50	TDA-1905	£0.99										
2SC-3519	£1.50	AN-7410	£1.50	TA-7157	£1.20	BC-214	£0.055	BD-675A	£0.28	TDA-1908	£1.20										
2SD-288	£0.75	AN-7812	£1.50	TA-7204	£1.20	BC-214B	£0.055	BD-678	£0.28	TDA-1670	£2.70										
2SD-381	£0.90	BA-301	£1.00	TA-7205	£1.20	BC-214C	£0.055	BD-679	£0.28	TDA-2002H	£0.80										
2SD-525	£0.75	BA-308	£1.00	TA-7207	£1.35	BC-237B	£0.055	BD-680A	£0.30	TDA-2002V	£0.80										
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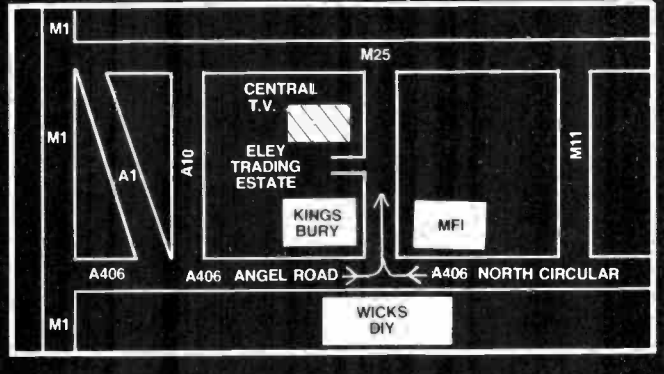

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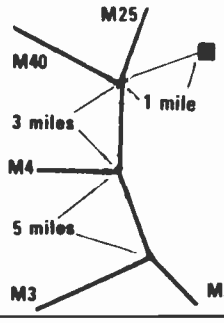

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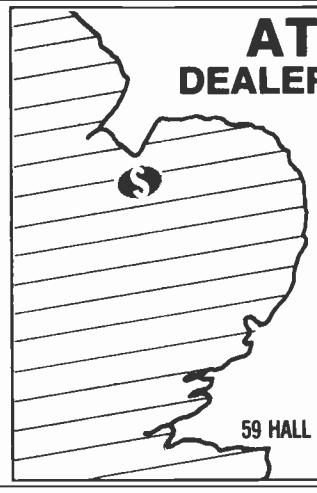

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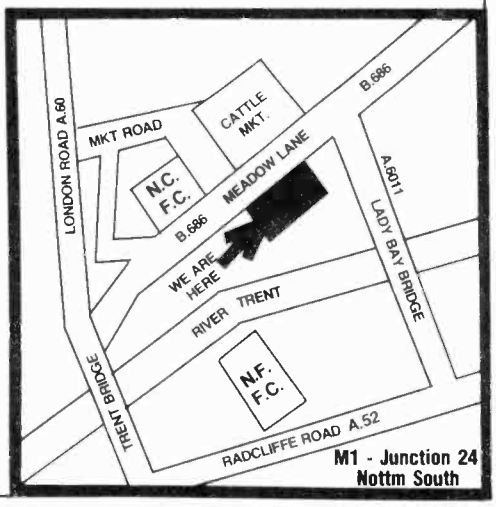

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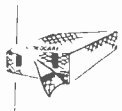


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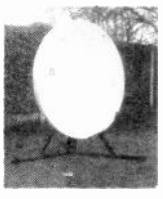

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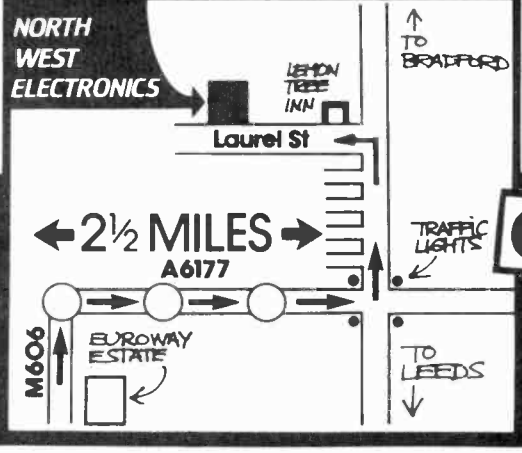

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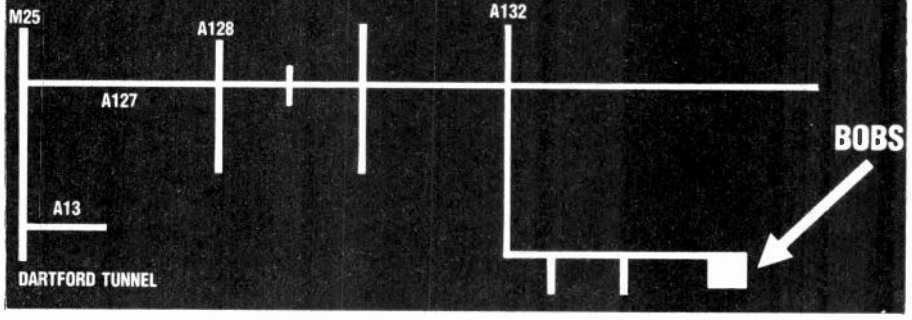

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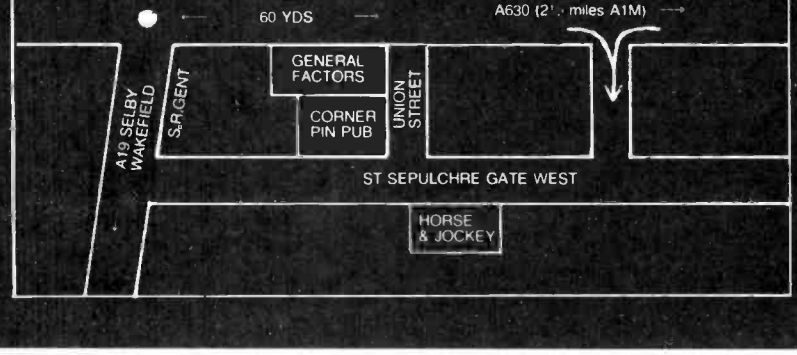

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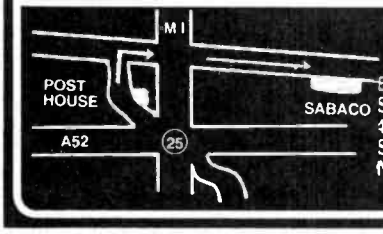

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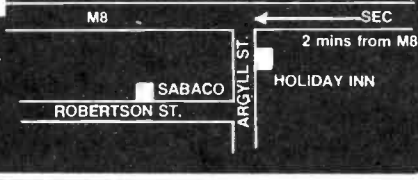

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7×3	16 ohm	£1.00
5" dia	16 ohm	£1.00
5" dia	8 ohm	£1.50
6½" dia	4 ohm	£1.50
6½" dia	3 ohm	£1.50
2¾" dia	8 ohm	75p
3" dia	8 ohm	75p
4½" sq	15 ohm	75p
KT3 speaker	K30	75p
3" dia	15 ohm	60p
1600 5×3	12 ohm	£1
K45 Philip	15 ohm	75p
K30 15 watt		£1

KT3 K30

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

DIODES

BY 126	10p
BY 127	10p
BY 133	10p
BY 134	10p
BY 164	50p
BY 176	25p
BY 179	40p
BY 184	25p
BY 187	10p
BY 190	40p
BY 196	30p
BY 198	10p
BY 204/4	8p
BY 206	8p
BY 208/800	8p
BY 210/400	5p
BY 210/800	10p
BY 223	60p
BY 224/600 4 8A/600R bridge	50p
BY 226	15p
BY 227	15p
BY 228 1500v	20p
Hat BY 229 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 527	60p
BY 602	10p
F 247	10p
GP20G	5p
NK 3102	50p
BYV 28/200	20p
800v/2 75 amps	10p
International Rectifier EHT Diodes G770/HV34 6KV	3 for 8p
6A/600V Stud Diodes	20p
6A/1000V Stud Diodes	20p

K35 Decoder	£8.00
K35 Sound OP	£4.00
K35 Split Diode 3122-138-35930	£10.00
Thick Film Daughter KT3 3122-127-43891	£3
12 C H K30 Tex Rec Front Panel with I C	£5
K35 IF	£5.00

Fidelity Tube Base with transitor & focus pot £1.50

Bush Tube Base on panel £1.00

Line Transformers

Line O P Trans Mono T X 12"-14" Philips	
27482	£10
4822	£10
10273	£10
Thorn 1690 LOPT	£6.50
2 I Pots 3,500 I 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
1690 Thorn I HT over-wind with diode lead & anode cap	£2.50
GEC 2040	£3.00
GEC 2110	£7.00
Mullard A1 2036	£1.50
Pye 369 Line Trans	£3.00
Pye mono	£3.00
Rank mono 1704A	£3.50
Split Diode Trans	£7.00
GEC 20 AX Rank Z522	£3.00
Rank L O P T Z970	£3.00
CVC32	£6.00
A12080 15	£5.00
CVC 30 ITT	£5.00
CVC 32 Line Tran	£7.00
CVC800 Line Trans	£6.00
CVC40 Ship/Diode	£12.00
CVC 45	£5.00
GEC Portable GLO [2041]	£3.00
GEC Portable GLO [2046	£3.00
EHT Split Diode Leads ITT	£1.00
3800 L O P T & HT Trans each	£2.00
LOPT Rank Z763	£5.00
K35 Split Diode 3122/138/35930	£10.00

Black Triplers

KT3 Triplers	£6.00
S E C Universal Tripler	£5.00
11 EHT	£2.50
11 EGA	£2.00
EHT CVC 5-8-9	£3.50
Rank 125E Tripler	£2.00
Rank 111CP A823	£3.50
TU 25 30k Rank	£3.00
11 HZ Rank	£3.00
G9 Philips	£4.00
GEC 2110	£4.00
3500 Thorn	£3.00
8500 Thorn	£4.00
9000 Thorn	£6.00
9500 Thorn	£4.50
9600 Thorn	£4.00
2040 GEC	£3.50
GEC TVM28 Tripler	£2.00
Universal Tripler	£5.00
G8 Tripler	£5.00
CVC20-32	£5.00
Decca 80/100	£4.50
Grundig TVK 52	£2.50
11 HBQ Pye 731	£3.00
11 HHY	£4.00
D22 for Pye 18" colour portable	£4.00
EP 1193 63	£4.00
BG 100/41	£3.25
ERO Tripler print type with fuses P07 BG20N7	£5
Tetext ultrasonic tect 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 F W Transformer	50p
G11 F W coils	£1.00
G11 Transient Suppressors 245V	20p
G11 Scan Coils	£5.00
G11 100K tuner pots	12 for £1
KT3 IF panel	£6.00
KT3 line OSC transformer	£1
KT3 K30 infra-red receiver head	£1
K30 drawer unit with IC's (home)	£10
K30 drawer unit with IC's (export)	£10
KT3 AF Sockets	50p
KT3 receiver panel	£8
KT3 line driver transformer	50p
Pye, K30, G1 C, etc Pre-mains stand-by switch	£1
Decca 80/100 II panel	£5
NPN PNP 80V 6 Amp T066 O P Trans pair	25p
5 button touch tuner BBC1 2 ITV1/2 video with ic SAS 560/5701	£7.00
Control panel 5 sliders + mains lead	£1.50
G11 8 touch button unit replaces old 6 P B U	£24
G11 6 touch unit replacement with dat	£14.00
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 30 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
BTW 92/800R	£3
25A473 PNP C/P	10p

G11 Chroma Panel	£5.00
Rank T20 Z136 Panel	£6.00
NEW 1617 THORN Chassis with ICs & AU113	£5.00
NEW GEC 20AX Power Supply Switch Mode	£12.00
Complete new GEC portable chassis M120TH/M150TH with P.B U./ v cap/LOPT	£10.00
Field + Jungle panel for GEC 3133/3135	£1.50
GEC 2110 line panel with transformer	£7.00
GEC 2110 tuner unit + IF Panel	£12.00
Pye/Chelsea Line op panel	£12.00
Pye 205 T/unit	£3.90
Pye 205 Line op panel	£7.50
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
Pye CDA/205 panel	£6.00
GEC portable chassis + LOPTI 2114 New	£4.00
Thorn 1613/1713 chassis	9.75
G9 Power Panel	£6.00
Mono RANK Chassis 127A NEW	£10.00
NEW G9 Frame Panel	£4.00
NEW G11 II Panel	£10.00

25% OFF ALL PANELS

G8 Tuner Unit + Panel	£4.00
G8 Power Supply	£5.00
G8 6 Sloping PBU	£12.00
G8 IF & Chroma	£10.00
G8 Chroma	£3.00

Philips Batteries

U2	25p
U11	20p
PP3	40p

Duracell A.A.A. 10p

AEC V/Cap Resistor Unit UHF with IC	
SAS660 SAS670	£3.00
Z714 RANK IF Panels 6MHz I I.C.	
SL437F	£3.00
Z909B RANK IF Panels	
Export 5.5MHz 2 I.C's	
TBA120SB 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 and 12 button units	£9.00
CVC9 slider pots panel	50p
CVC 5 Mains on/off + 5 pots	£2
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	£7.00
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
TV11	50p
Remo TV12SP	50p
1600 Thorn EHT Rec and Lead	50p
TV13	50p
TV14	50p
TV18	60p
TV20	£1.00
TV45	50p
Thorn 14/1500 rec stick	5p

G11 drawer ASS 3 pots Mains switch and lead	£2.00
K30 Drawer Ass with pots cable forme	£1.00
Line O/P panel GEC 2217/2218/2213/ 2214/2226/2227/2228	£10

PHILIPS BATTERIES (Small Types) HAND SETS

SR41	40p
SR43	40p
SR44	40p
SR54	40p
LR43	40p
LR44	40p
LR54	40p
CR2032	40p

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 Mains Remote Switch 2865 ohm	£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
THORN Rotary Mains Switch	50p
G11 Preh 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
Thorn 12 or 24 volt battery convertor for portable colour T/V	£6.00
2000 Chassis Fidelity Mains Switch (4 TAG)	60p
250V/4A White Torlin Mains Switch	60p
KT3-K30-K35 Full Remote Mains Switch (6 TAG)	£1
Teletext Adaptor Kit TY-500 Panasonic	£12

22/1000	20p
1/250AC	20p
.1/100	5p
IMFD-250/AC	25p
1/100 × 10	30p
22/100	10p
4.7M/100	5p
470/100	20p
4700/100	75p
47/160	10p
3000 300/300V	80p
800/160	50p
.1/250 Pulse	5p
2.2/250v	10p
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
GEC 6600/250	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
100/375	10p
22/375	15p
220/385 (ITT)	75p
330/385 CVC 820 ITT	60p
0.1/400	15p
KT3 E/W .39/400	15p
.56/K-400v	20p
470pf/400	10p
.22/400	10p
8/400	15p
33/400	20p
400/400	30p
394K-400V	20p
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
.0047/600	15p
0.047/1000	10p
0.01/1000	10p
0.47/1000	10p
.47/1000v	65p
.47/250V A.C.	10p
.001K 1250	10p
0.0047/1500	10p
.005/1500	10p
.0105/1500	15p
1n8/1500	15p
2n0/1500	10p
2n2/1500	15p
.01/1600 10N 2,000V	15p
G11 8200/2KV	15p
0.1/2KV	20p
3n9/2KV	15p
0.0015/2KV	10p
6n2/2KV	10p
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
1.5/3500	10p
1800/4KV	5p
4.7nf/5KV	10p
1.70/8KV	10p
1.80/8KV	10p
2.10/8KV	10p
1800/10KV	10p
.47/100V	80p

Tube Thermpath 167	£1.00
Rank Secam Decoder Panel UHF & VHF T115A	£13.00
10 off .91 CAP G11	£2
Philips K4 CAP 150M/385V	50p

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
200+200+75+25M 325V	£1.00
300+300+150+100+50MFD 350V	£2
G11 CAP 470/250	£2
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 325V	£1
Thorn TX9 Caps 500+500M 175V	£1.75
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	£8.00
CMC 303 front panel	£8.00
CMD 800 Chassis. No tuner	£20.00
CMD 800 Decoder	£8.00
CMD 800 IF/Tuner	£20.00
UPC 574	30p
BSS 38	30p
G11	£1.50
I I.C. Receiver Panel	
3 I.C. Power Supply G11 Full Remote Receiver Panel	£3
FET Power VN88AF	50p

PHILIPS SBC 469 Stereo Microphone £23.00

Meters Hills 520	£17.00
Meters Hills 420	£15.00
Hills HDS000 Digital Meter 1000V DC	
750AC 10 Amp 20 MRG Rangers	£28
HTT100 Multimeter	£6.75
HT300 Multimeter	£7.75
HTS00 Multimeter	£9.00
HD10000 Digital	£20.00
HD30000 Digital	£25.00
HD50000 Digital	£25.00
HD60000 Digital	£32.00
HD8000 Digital	£37.00

Infra Red Hanset Tester

Works at 24 feet – Sound repeater	
Works off 9 volt battery	£8.00
Fits in top pocket.	

Repaired Handsets

Philips K4-K35, RC5350-RC5300, RC5370, RC5375, repaired same day	£10.00
RC4001 Full Remote KT3 K30 Teletext Handsets exchanged	£9.00
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
Large type ITT TV and V C.R Handset	£15.00
GEC Ultrasonic 8CH Full Remote	£15.00
G11 Full Remote Ultrasonic	£32
G11 Touch Unit Full Remote	£13
G11 Ultrasonic Teletext Handset	£24.00
8 C.H. Ultrasonic GEC Full Remote C20141I/C22191I	£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	£24.00
Dynatron-Full remote CTV 62, 63, 64	£19.00
Hitachi infra red handset	£18
Philips full remote KT3, 16C928/20C934; 7228/7324, K12 26C 797/1ST 56K 1826	£12.00
G11, Full remote top button assy.	£12.00
G11, Full remote repair service (exchange unit)	£18.00
G11, Full remote new ultrasonic	£32.00
GEC infra red full remote 8 channel (I C.SAA1250)	£14.00
Philips infra red full remote * channel for 60 CP2605	£6.00
Philips infra red full remote 2 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-K33 chassis. No RC5150-RC5176-RC517 -LC5177.	
Special Price	£13.00
RC4001 KT3 and Teletex	£14.00
I I.C VC 32 handset repaired	£15.00

PHILIPS UNIVERSAL HAND SET £16.00
KT3 – K45
We have all parts for Philips Handsets

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Tuner Units

VHF-UHF with Data Tuner MEC1-F51	£3
Thorn FX10 Export V/Cap UHF-VHF	£6
G8 Tuner V/Cap. New	£2
G8 6 Button Unit	£9
V/Cap Rank UHF Z7761/Unit	£6
V/Cap Rank VHF Z7731/Unit	£5
NEW G8 Tuner V/Cap	£3.50
T20 6 Push Button Unit	£7
ELC2000 on Panel	£2.50
GEC 6 Push Button Unit	£6
ITT 6 Push Button Unit	£6
DECCA 6 Push Button Unit	£6
GEC or Hitachi 6 push button unit 2110 Conversion	£8
GEC 2110 V/Cap	£5
ELC1043 (Ex Panel)	£3.75
ELC1042 NEW	£5.50
ELC2000 NEW	£4.00
ELC2004 NEW	£8.00
ELC2006 NEW	£4.00
GEC Tuner V/Cap Hitachi After 1979 ET548, ET547, ET541B	£8.00
ASTEC UM1183	£10.00
V314 (VHF) ,,	£5.00
V317 (VHF)	£7.00
V334 (VHF)	£5.00
U321	£6.00
U341 UHF	£7.00
U342 (UHF)	£5.00
U411 UHF	£7.00
U.V. 411 Tuner	£10.00
U.V. 415	£7.00
U.V. 417	£7.00
Fidelity and Amstrad 2000 V/Cap Tuner	£5.00
Small V/Cap Mitsumi UHF ,,	£4.00
VHF ,,	£3.00
VHF & UHF ET598P Tuner	£6.00
Portable & rotary Tuners Sanyo & Mitsumi UHF	£5.00
NSF-UHF/VHF Varicap (old type)	£8.00
Mosfit UHF/VHF (new type)	£8.00
UF2-B31 Fidelity V/Cap T/Unit	£6
UHF-VHF V/Caps on panel	£3.00
HITACHI 20 Turn Pot	40p
U321 on panel	£6.00
Tuner unit VHS Sylvania GTR Videon MTS 900	£2.50
Toshiba VHF-UHF EG522F	£5.00

Mullard Video Modulator. Application, video tape recorders, TV cameras, video games, closed circuit T/V, C.C.I.R. system. Data supplied. £10.00

UHF Tuner GTR Sylvania F4714A £2

VHF Tuner GTR Sylvania F3720B £2

Sylvania UHF F4720B	£6.00
Sylvania VHF 900	£6.00
Small Tuner DX 175-220MHz	
Auto Changeover	£5.00
9000 Thorn Tuner on Panel	£7.00
THORN 1400 4P.B. Mech. Tuner	
THORN 1500 4P.B. Mech. Tuner	
THORN 1590 4P.B. Mech. Tuner	
THORN 3500 4P.B. Mech. Tuner	
All new & boxed.	£4.00 each

TDK T9006A	50p
Delay Lines	
DL700	£1.00
KT 3 Luminence	75p
Luminance Delay Line (CVC 45)	
Co-Ax Joint	15p
Co-Ax Belling Lee Plug	12p
Co-Ax Splitter	£1.00
UHF Modulator CCIR	£3.00
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NE286H Small Neon Lamps GEC & Philips	5p
Mullard 5 Watt Amps. LP1162 New	75p

T.V. Tubes
12"/110° 31/510 with coils
Post £2.50 £5
12" A31/300 Hitachi £5

S.W. Filters		S.W. Filters	
HW2013	50p	SW185	£1
SW453	50p	SW153	50p
SW150	£1	SW154	50p

BF694	10p	2SC2229	15p	BC349b	10p
BF758	30p	2SC2688	20p	BC350	20p
BF760	30p	2SC3795	30p	BC365	10p
BFT34	15p	2SC7350	15p	BC368	10p
BFT43	10p	2SD180 TO3 80v/6A	15p	BC384	10p
BFT84	8p	2SD200	£2.00	BC394	10p
BFW11	20p	2SD401	£1.00	BC413	10p
BFX29	30p	2SD716	£1.00	BC414	10p
BFX84	25p	2SD787	30p	BC416	10p
BFY50	15p	2SD811	£2.00	BC440	30p
BFY52	20p	2SD820	£1.00	BC454	10p
BFY90	25p	2SD868	75p	BC455	10p
BLY49	25p	2SD870	£1.00	BC456	10p
BPW41	25p	2SD880	30p	BC460	25p
BRC116	25p	2SD1266	£1.00	BC462	10p
BRX43	15p	2SD1415	£1.00	BC463	10p
BRX48X	10p	2SD1432	£1.00	BC478	10p
BRY56	30p	2SD1576	£1.00	BC527	10p
BSS68	10p	2SK30A	10p	BC532	10p
BSY79	10p	BC107	10p	BC546	10p
BSY95a	10p	BC108	10p	BC547	10p
BTY80	20p	BC109	5p	BC548	10p
BSX19	17p	BC113	10p	BC556	10p
BSX20	17p	BC114	10p	BC557	10p
FT3055	30p	BC115	10p	BC558	10p
TCE82	30p	BC116	10p	BC559	10p
TCE520	30p	BC117	20p	BC635	10p
2N930	5p	BC119	20p	BCX31	25p
2N2221	8p	BC125	10p	BCX32/36 Pair	75p
2N2222	8p	BC126	10p	BCX32	25p
2N2906	10p	BC139	10p	BD116	25p
2N3055	40p	BC140	30p	BD124	30p
2N3566	10p	BC141	25p	BD124 (metal)	30p
2N3702	10p	BC143	25p	BD130Y	25p
2N3711	10p	BC147	10p	BD131	30p
2N3583	50p	BC148	10p	BD132/238	30p
2N3904	15p	BC149	10p	BD135	25p
2N4355	10p	BC153	10p	BD136	30p
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BF181	20p
BF182	20p
BF184	20p
BF194	10p
BF195	10p
BF196	10p
BF197	12p
BF198	10p
BF199	10p
BF200	20p
BF222	10p
BF224	15p
BF238	20p
BF240	16p
BF244	40p
BF245b	20p
BF255	20p
BF256	20p
BF257	20p
BF258	25p
BF262	25p
BF263p	25p
BF264	15p
BF271	10p
BF273	10p
BF274	10p
BF324	25p
BF337	50p
BF355	30p
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