APRIL 1989

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TELEVISION

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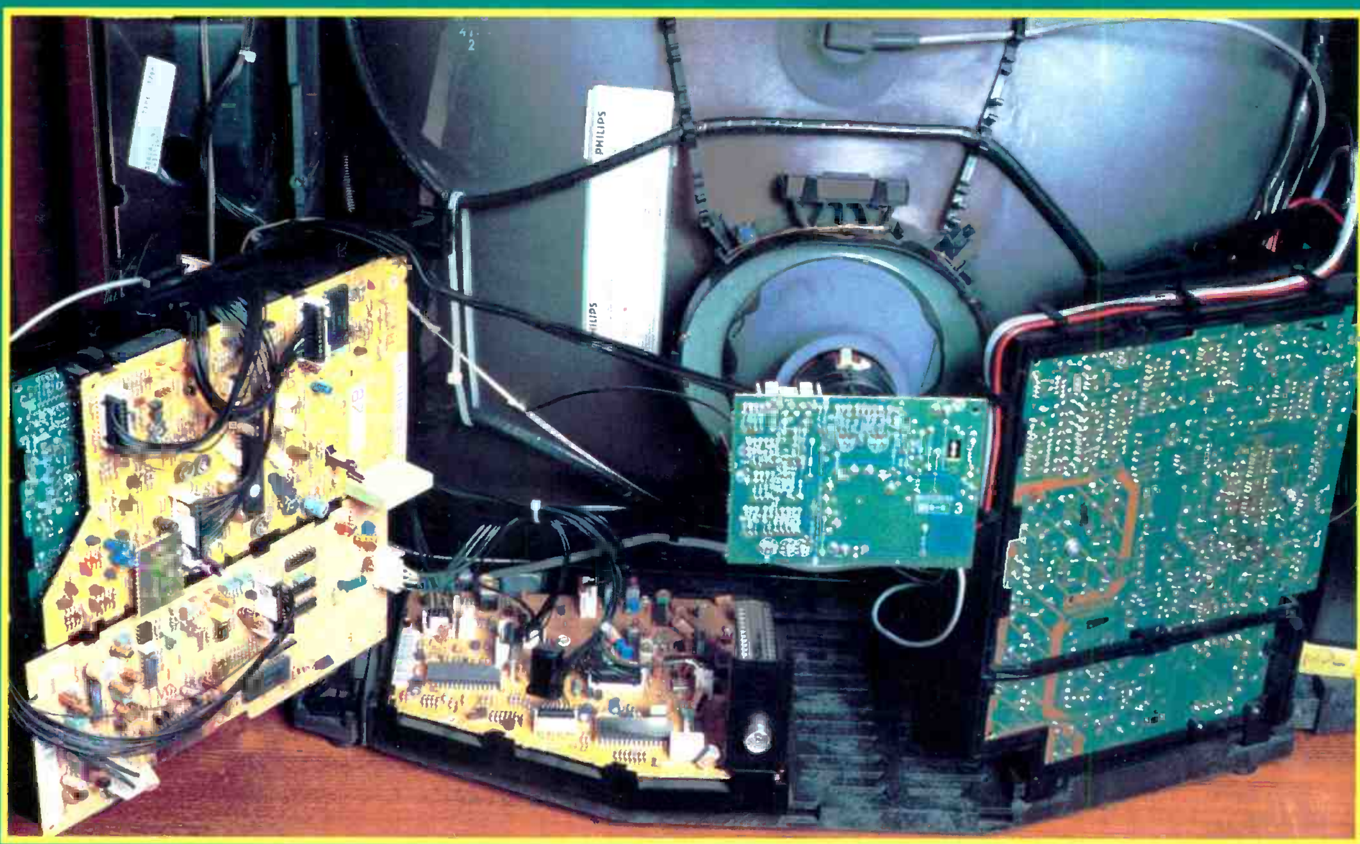

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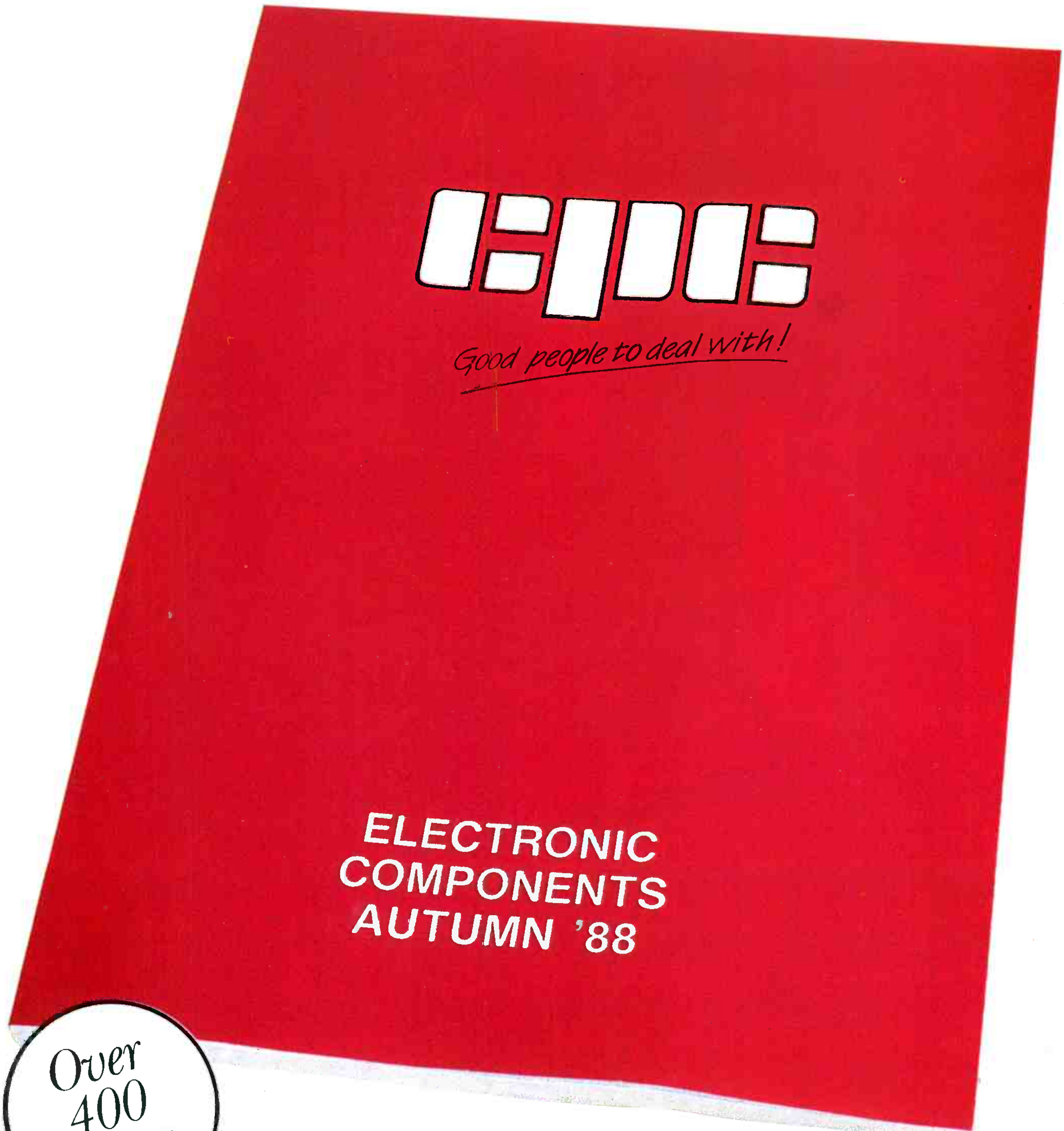

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TELEVISION

April 1989

Vol. 39, No. 6
Issue 462

On sale March 15th

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INDEXES
Indexes to Vols. 36 and 37 are available at 80p each from the Editorial Office (address above).

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

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this month

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REPLACEMENT VIDEO HEADS

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"	4600 PSF2	25.00
"	7000 SHSSR	25.00

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VS2	3HSSV	18.00
VS3	3HSSV	18.00
VS5	3HSSV	18.00
VS10	3HSSV	18.00
VS77	3HSSV	18.00
VS88	3HSSV	18.00
VS7100	3HSSV	18.00
VS7200	3HSSV	18.00
VS9300	3HSSV	18.00
VS9500	3HSSV	18.00
VS9700	3HSSV	18.00
VS9800	3HSSV	18.00

FERGUSON

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3V01	3HSSV	18.00
3V06	3HSSV	18.00
3V16	3HSSV	18.00
3V22	3HSSV	18.00
3V23	3HSSV	18.00
3V24	3HSSV	18.00
3V29	3HSSV	18.00
3V30	3HSSV	18.00
3V31	3HSSV	18.00
3V35	3HSSV	18.00
3V36	3HSSV	18.00
3V42	3HSSVA	24.00
3V43	3HSS4VD	49.00
3V45/6	3HSSVA	24.00
3V47	3HSSVA	24.00
3V48	3HSS4VC	47.00
3V52	3HSSVA	24.00
8903	3HSSV	18.00

HITACHI

VT6500	3HSSHA	25.50
VT7000	3HSSHA	25.50
VT8000	3HSSHA	25.50
VT8040	3HSSHA	25.50
VT8100	3HSSHA	25.50
VT8500	3HSSHA	25.50
VT8700	3HSSHA	25.50
VT9000E	3HSSHA	25.50
VT9300	3HSSHA	25.50
VT9500S	3HSSHA	25.50
VT9700	3HSSHA	25.50
VT9900	3HSSHA	25.50
VT4000	3HSSH	25.50
VT4200	3HSSH	25.50
VT5000	3HSSH	25.50
VT5500	3HSSH	25.50
VT11E	3HSSHB	25.50

ORION

VH1	3HSSN	18.00
VH2	3HSSN	18.00

TOSHIBA

V31	PS3BT	30.00
V33	PS3BT	30.00
V55	3HSSV	18.00
V57	3HSSV	18.00
V5470	PS3BS2	25.00
V9600	PS3BT	30.00

JVC

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HRD111	3HSSV	18.00
HRD120	3HSSV	18.00
HRD121	3HSSV	18.00
HRD220	3HSSV	18.00
HRD225	3HSSV	18.00
HR2200	3HSSV	18.00
HR3300	3HSSV	18.00
HR3320	3HSSV	18.00
HR3330	3HSSV	18.00
HR3350	3HSSV	18.00
HR3360	3HSSV	18.00
HR3660	3HSSV	18.00
HR3860	3HSSV	18.00
HR4000	3HSSV	18.00
HR4100	3HSSV	18.00
HR7200	3HSSV	18.00
HR7600	3HSSV	18.00
HR7610	3HSSV	18.00
HR7650	3HSSV	18.00
HR7700	3HSSV	18.00

NEC

PV760	PS3BS	19.00
PV764	PS3BS	19.00
PV774	PS3BS	19.00
N830	PS3BS	18.00
N831	3HSSV	18.00
N832	3HSSV	18.00
N833	3HSSV	18.00
PV2300	PS3BS	19.00
PV2400	PS3BS	19.00

SONY

SLF1	PS4B2S	29.95
SLC5	PS3BS	19.00
SLC6	PS3BS	19.00
SLC7	PS3BS	19.00
SLC8	PS5B3S	39.95
SLC9	PS5B3S	39.95
SLC20	PS4B2S	29.95
SLC24	PS4B2S	29.95
SLC30	PS4B2S	29.95
SLC33	PS4B2S	29.95
SLC40	PS4B2S	29.95
SLT50	PS5B3S	39.95
SLF60	PS5B3S	39.95
SLK95	PS5B3S	39.95
SL200	PS5B3S	39.95
SL3000	PS3BS2	25.00
SL8000	PS3BS2	25.00
SL8000	PS3BS2	25.00

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FVHP910	3HSSSF	35.00
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DV462	3HSSU1N	25.99
6460	3HSSU1N	25.99
6520	3HSSU1N	25.99
2558	6462/3/4 6560 6660	45.00

NATIONAL PANASONIC

NV100	3HSSU1N	25.99
NV230	3HSSU2N	36.97
NV250	3HSSU2N	36.97
NV270	3HSSU2N	36.97
NV280	3HSSU2N	36.97
NV300	3HSSN	18.00
NV322	3HSSN	18.00
NV330	3HSS3N	35.99
NV333	3HSSN	18.00
NV340	3HSSN	18.00
NV366	3HSS4NA	43.40
NV370	3HSSU1N	25.99
NV380	3HSSU1N	25.99
NV390	3HSSN	18.00
NV450	3HSSU2N	36.97
NV470	3HSSU2N	36.97
NV480	3HSSU2N	36.97
NV600	3HSS3N	35.99
NV730	3HSS4NB	41.95
NV777	3HSS3N	35.99
NV861	3HSSN	18.00
NV2000	3HSSN	18.00
NV3000	3HSSN	18.00
NV7000	3HSSN	18.00
NV7200	3HSSN	18.00
NV7500	3HSSN	18.00
NV7800	3HSSN	18.00
NV7850	3HSSN	18.00
NV8170	3HSSN	18.00
NV8200	3HSSN	18.00
NV8400	3HSSN	18.00
NV8600	3HSSN	18.00
NV8620	3HSSN	18.00

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381	3HSSSP	26.95
383	3HSSSP	26.95
384	3HSSSP	26.95
385	3HSSSP	26.95
386	3HSSSP	26.95
387	3HSSSP	26.95
388	3HSSSP	26.95
481	3HSSSP	26.95
482	3HSSSP	26.95
2000	3HSSSP	26.95
3300	3HSSSP	26.95
9100	3HSSSP	26.95
9300	3HSSSP	26.95
9400	3HSSSP	26.95
9500	3HSSSP	26.95
9600	3HSSSP	26.95
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Toshiba 9600 (upper assy)	14.50
Hitachi VT336 GEC 4004	35.62
Sanyo 9300/9435/9500	53.00
Philips V2000	64.00
Philips 1700	71.00
Amstrad 7000	40.00

BELT KITS

		no. of belts	
VK1	Akai VS9300/9500/9800 JVC HR3300/3320/3330/3360 TCE 6989/SV00/SV16/SV22	7	2.40
VK2	Nat. Pan. NV7000B/7200B	5	1.45
VK3	Sony SLC5/7	6	2.25
VK4	Sony SL8000/8500/8600	6	3.60
VK5	Sony SL3000UB	7	2.10
VK6	Nat. Pan. NV3000B	6	1.99
VK7	Sanyo 9300P	4	2.75
VK8	Nat. Pan. NV2000B	6	1.73
VK9	Nat. Pan NV8600B/8610/V011	7	1.50
VK10	Toshiba V8600	6	1.45
VK11	Sharp VC7300	5	1.50
VK13	Sanyo VTC5000	2	1.50
VK14	Sanyo VTC5300	5	1.85
VK15	JVC HR7650/3V31	3	2.00
VK16	Hitachi 5000		1.90
VK17	Sharp 8300	6	1.76
VK18	Sharp 9300	5	1.47
VK19	Hitachi VT8000/8300/8500	3	1.05
VK20	Hitachi VT11/33	6	1.50
VK21	Hitachi 9500	3	1.12
VK22	Sony SLC6	6	1.90
VK23	Sanyo 5500	3	1.05
VK24	Nat. Pan. NV300/NV333	6	1.55
VK25	Toshiba V7540	5	1.90
VK26	JVC/HR 7700/3V23	2	0.96
VK27	Thorn 3V29	4	1.75
VK28	Amstrad 7000	3	1.45
VK38	Amstrad 4500/9000		3.25
VK39	Amstrad 4600/5200		5.19
VK29	Nat. Pan. NU777	4	1.00
VK30	Sony T9	6	2.20
VK31	Toshiba 9600	4	1.20
VK32	Sanyo 1100-1300-1500		0.75
VK33	Ferguson 3V35-36		0.69
VK34	Ferguson 3V42-3-4-5-8		0.90
VK35	Fisher FVHP710-716-722		1.20
VK36	Panasonic NV370-430		1.20
VK37	Hitachi 9300		0.85

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VHS (general purpose) Thorn/JVC etc.	4.95
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Sharp 0006/GEZZ VC300/387/481/2/3 6/496/581/5/8581	2.20
Sanyo Reel Drive Pulley 143-0-662 T0202/TD1282	5.10
Hitachi F/F Idler 6886971 (UT11E/UT33E)	2.90
Philips VHS Idler 4822 522 203 34 4822 528 784 84	3.50
Fisher/Siemens 143-0-4904 00900	3.95
Fisher/Siemens 143-0-4204 00300/400	4.50
Sanyo 5000 RLR.ASS 1430741T 20001	1.85
Idler (Alba 4000 Sentra GX8000)	3.20
Idler Samsung VI 511, 520, 610, 611, 620	1.75

PINCH ROLLERS

Amstrad 4500/4600/5200/9000	3.75
Amstrad 7000	3.75
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Sanyo VTC9300/VBS7000	3.75
Sony C7/J7/SL17	3.75
JVC TCE3V00/01/06/16	3.75
JVC 23/24	3.75
JVC HR2200/3320/3330/3V22	3.75
JVC 3660/1100/7700	3.75
Akai VS9700	3.75
Hitachi VT5000	3.75
Sharp VC6300/6500	3.75
Sony T.C. General	3.75

MOTORS

VHS Drum Motor	25.50
VHS Capstan Motor	25.50
Sanyo 5000 Reel Motor	12.95
Sharp Reel Motor	19.50

VIDEO CARE

Video Cleaning Tape VHS	8.23
Universal Copying Kit	7.50
Head Cleaner	0.96
Beta Eccentricity Gauge	57.92
Chamois Cleaning Sticks	0.25

AMSTRAD SPARES

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1750	Pinch Roller (also 4500)	3.75
1226	Clutch (also 4500)	4.25
1227	Gear Holder (also 4500)	10.53
1231	RF Clutch	5.80
7593	Belt Kit	5.19
1981	Cass. Lamp (also 4500)	1.80

VIDEO RECORDER VCR 7000

MD150143	Dew Sensor	1.91
MD150148	Loading Motor	6.02
MD150293	Reel Break Unit	12.50
MD150287	Video Head (Genuine)	40.00
	Video Lamp	0.45
1759	Pinch Roller	3.75
1059	Idler	1.80
7550	Belt Kit	1.45
1950	Cass. Lamp	0.45

VIDEO RECORDER VCR 9000

1758	Pinch Roller	3.75
1225	RF Clutch (also 4500)	4.00
1226	Clutch	4.25
1227	Gear Holder	10.53
1981	Cass. Led (also 4500)	1.00
7592	Belt Kit (also 4500)	3.25
MD150821	Drive Belt	1.25
MD150820	Main Belt	1.25
	Video Head (PSFI)	25.80

NAT. PANASONIC VIDEO SPARES

VXP0243 Play Idler NV8600/8610	1.10
VXP0401 Idler Unit NV333/366	1.08
VXP0344 Idler Unit NV7000/7200/7800	1.22
VXP0331 Idler Unit NV3000	1.28
VDG0141 Cam Gear NV370/430/730/830/850	1.00
VXP0521 Idler Arm Unit NV370/430/830/850	4.08
VXP0325 Loading Gear NV333/2000/3000/7800	1.83
VXP0520 Load Gear Unit	1.36
VDG0016 Action Gear NV333/2000/3000	0.58
VDG0017 Interim Gear NV333/2000/3000	0.62
Direct Rep. Video Bulb	1.30
VXP0433 Play Idler Unit NV333/336	5.50

HITACHI/GEC SPARES

VCR GEC 4000H/HITACHI 8000

Belt Counter (122) V6354241	0.63
Belt Loading V6354921	0.58
Belt Take-up (239) V6354401	0.40
Idler FF/RWD V6413663	2.68
Lamp Tape Sensor V5762281	0.87
Play Idler Assy V6414221	5.04
Pressure Pinch Roller V6383762	6.96
Pulley FF/RWD V6383531	0.70
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Belt 312 V6355601	0.47
Belt 313 V6355591	0.40
Belt 317 V6357531	0.63
Belt 318 V6355581	0.54
Capstan Motor V5577355/6	29.94
Clutch Assembly	8.47

SERVICE MANUALS

GEC-V4004 Hitachi-VT33E	9.69
GEC-V4005H Hitachi-VT63	6.43

VCR GEC 4001H/V4002H HITACHI 9300/9500E

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Belt (289) V6355282	0.63
Belt Take-up (213) V6354231	0.40
Capstan Motor V5577324	30.00
Idler FF/Rewind V6861471	2.43
Lamp Tape Sensor V5767131	0.65
Play Idler Assy V6861482	5.02
Pulley FF/Rewind V6345173	0.40
Remote Control Handset V7084733	13.40

VCR GEC V4004/HITACHI VT33E

Belt (302) V6355561	0.40
FF/Rewind Arm V6886971 (Gen. Hitachi Idler)	2.90

SUNDRIES

Vertical Output Module GEC-C2286 Hitachi-CPT2226 GEC-2067 GEC-2069 Y2370551	6.21

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3V23 with Plug	1.59
3V29 with Plug	1.59
Amstrad 7000	0.45
Amstrad 4500/4600/5200/9000	1.00
Hitachi 9300/9500	0.65

IDLER TYRES

	O.DIA	I.DIA	WIDTH	
Sony	23.7	17.4	4.9	0.50
Sony	24.2	18	5.1	0.50
Hitachi	31.8	25	4.9	0.50
Nat. Pan.	37.0	29	3.9	0.52
Nat. Pan.	31.2	25	3.1	0.56
Akai	26.0	20	3.9	0.50
JVC	39.3	32.8	3.9	0.56
JVC	33.0	23.9	4.0	0.56

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

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SATELLITE TV

ARE YOU READY?
Please ring for prices on
Sakura Remote Controlled Satellite Dish £215

We also have
Signal Strength Meter **£45**
Compass **£6**
RG59BU Cable (for short to medium runs 100 metres) **£19.95**
TR100 Cable 100 metres (for longer runs) **£29.95**
Screw on F connectors **35p** (suitable for both types of cable)
F connectors crimp on (RG59) **24p**
F connectors crimp on (TR100) **18p**
Crimping tools **£19.95**
Top grade crimping tools **£29.95**
See 'Aerial Equipment' for Wall Brackets, Masts, etc.

NEW PRODUCTS

Nat. Pan. Service Manuals

TC261G	£3.50
TC262GA, TC275G	£3.50
TC361G, TC4816R	£3.50
TC8626	£3.50

New Ferguson Service Manuals

3V35	£29
3V38 Supp.	£1.50
3V39 Supp.	£1.50
3V48	£9.95
3V53	£9.95
3V54/5	£10.20
3V58	£10.95
3V59	£13.50
3V64/5	£13.00
FV10D	£7.95
FV11R	£3.95

VIDEO TAPES

SKC	E120 (VHS)	2.30
	E180 (VHS)	2.45
	E240 (VHS)	3.45
Scotch	E60 (VHS)	3.05
	E120 (VHS)	2.89
	E180 (VHS)	3.50
	L750 (BETA)	3.65

REMOTE HAND SETS

AMSTRAD

TV/Video – TVR-1-MD1511910	15.00
CTV 1409 – MD1409221	15.00
VCR 5200 – MD151175	17.00
VCR 7000 – MD150583	10.00
VCR 9000 – MD150878	10.00

DECCA

80/100 Non-Txt US8511	19.50
101 Series Non-Txt US 8513	23.50
Tatung 145/150	17.50

FIDELITY

CTV 20R/22R/140R	
4 Button IR8876	13.75
IS 500 12 Button FD09820	13.81
F14R 12 Button FD09156	13.81
AVS 14 Button FD09111	13.75
Txt 32 Button IR8983	15.90

G.E.C.

4001/Hitachi 9300	9.93
GC56520831/C1404H-C1658H-IR8314	31.80
GCA 512220/C1653	22.00
GCA 512230/C2086H-C2087H	
GCA 514620/C2089H-C2090H IR8823	23.50
C2290H, C2889	
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VRC 204 U.S. – TP12	13.50
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GRANADA

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I.T.T.

CVC 32 – RG15-US8573	25.00
CVC 45 – RG5-US8262	25.00
RG 305 – With Mute IR8649	29.04
RG 306 – With Fine Tune IR8650	22.65

J.V.C.

TP 843/Txt IR170	13.50

PHILIPS

G11 Txt IR8435/IR170/843	13.50
G11 Txt US 31 Button 691-17181	29.42
G11 Non Txt US 8263	21.50
G11 2 Function US 8518	18.75
KT3/K30 Non Txt IR8331	15.85
KT3/K30 Txt Ir8420	17.90
KT3/K30/K35/K40 Txt/Non Txt (Replaces RC5 Series)	13.95

SONY

SLC5 – RM 75T	29.04
SLC6 – RM 72	22.62
SLC7 – RMT 200	49.87
SLC9 – RMT 213	45.00

THORN/FERGUSON TV REMOTES

The following TV remotes are exact replacements for Thorn sets and cover a wide range of chassis inc. TX9/10 90/100. Please state model number of set or original hand set number.

Type	Order Type
T651	M739
T652	M738
T653	M737
T716	M737
T717	M737
T718	US8517
T719	M737
T720	M739
T721	M737
T723	M737
T724	M739
T725	M750
T731	M738
T732	M739
T733	M738
T734	M734
T736	M739
T737	M737
T738	M738
T739	M739
T740	M740
T742	M742
T748	M748
T750	M750
T769	M739
T770	M739
T772	M742
T773	M740
T775	M739
T778	M738

All One Price 13.00

SAME DAY DESPATCH
FAST – FAIR – EFFICIENT SERVICE

JUST ASK!!

We cannot advertise our complete range of products. Please ask if you require something which is not listed, ie: Stabonery, Styli, Axial/Radial Electrolytics, Mixed Dialectric Caps., Polyester Caps., Carbon Resistors, Wirewound Resistors, Filament Lamps, Thermistors, LEDs, IC Sockets, Floppy Discs, Computer Cassettes, Thorn New Life Tubes (collection only), New Mono Tubes, Crystals, Cables (post charges extra), Aerial Equipment, Electrical Plugs/Sockets, Components for Sinclair, Amstrad Security Products, Satellite Dishes and Accessories.

THORN VIDEO REMOTES

3V23 I.R. 8817	14.95
3V31 I.R. 8945	14.95
3V35 I.R. 8946	14.95
3V43 I.R. 8947	19.12

P.R.C. 6000

Programmable remote control unit will operate most infra-red equipment ... 60.62

REMOTE REPAIR KITS

Includes Foil/Buttons/Inst.

KT3/K30 Without Txt	8.95
KT3/K30 With Txt	8.95
RC 5352 Rar.ge	9.25

REMOTE CONTROL TESTER ... 29.24

MAGIC MIRRORS

a new device which tests infra red equipment ... 8.00

AERIAL EQUIPMENT

GENERAL LASHING KITS/ACCESSORIES

6" Pressed Bracket	0.86
6" Bracket with Kit (lashing kit)	2.18
9" Welded Bracket Chimney	2.53
9" Bracket with Kit	2.90
Double Brackets	2.77
Double Brackets with Kit	5.29
13, 5" Cradle Bracket	2.25
13, 5" Cradle Bracket with Kit	4.25
Standard Repair Pack	1.27
Double Repair Pack (2)	2.56
Corner Plates	0.08
Lashing Wire	0.85
Lead Wall Nails (100)	6.17
Rawlbolts	0.60
Cable Clips (Pk. 100)	0.91
Coax Plugs	0.18
Coax Plug Female	0.75
Line Connectors	0.16
Attenuators	1.80
Tape Sm 0.32 Lg	0.60
Wood Screws	0.08

WALL BRACKETS

6" Welded	1.30
12" T&K	3.74
9" Welded	2.41
Gutter Brackets	1.00
18" T&K	4.65
24" T&K	5.35

CLAMPS

1" × 1"	0.85
2" × 2"	1.33
1" U Bolts	0.20
J Bolts	0.20
1.25 U Bolts	0.20
2" U Bolts	0.28

UHF TV AERIALS

10 Element State Group A, B, CD, WB	2.14
18 Element	4.12
DIY Aerial Pack	
10 Ele, 3ft Mast, Coax Fittings	9.50

VHF/FM AERIALS

3 Element	6.70
4 Element	8.03
Omni Directional (Round)	8.93

MASTS

3 ft Crank L or S Shape	1.20
6 ft 1"	1.79
10 ft 1.5"	7.00
12 ft 1.5"	8.50
16 ft 2"	14.41

BACK BOXES

Plastic Single	0.68
Plastic Double	1.09
Metal Single	0.45
Metal Double	0.88

OUTLET BOXES

Surface Single	0.80
Surface Twin	1.10
Y Splitter	0.85
Flush Single	0.95
Flush Twin	1.20

LEADS

2M Fly M/M	0.60
2M Fly M/F	0.60
4M Fly M/M	1.20
10M Fly	1.90
FIG. 8 Mains Leads	0.62
Computer to TV	1.10
5 Pin Din to 5 Pin Din	0.98
TA81 Car Battery Thorn 1691	4.47
TA51 Car Battery Thorn 1615	4.35
Car Battery Philips	3.95
Scart Leads 2M (Open End)	2.50
Scart Plugs	1.95
Scart Sockets	0.85
Scart to Scart Lead	4.95
Scart Lead Kit	6.44
Test Lead Kit	3.75

CABLES

Antiference Coax 100m S540	33.70
75R Coax Cable (100m) Low Loss	13.50
75R Coax Cable (250m) Low Loss	32.75
4 Core Security Cable (100m)	5.55
6 Core Security Cable (100m)	7.94
8 Core Security Cable (100m)	10.31
4 Core Telephone Cable (100m)	9.99
6 Core Telephone Cable (100m)	13.28
3402 3 Core Round 13amp (50m)	28.21
3162 3 Core Round 3amp (100m)	15.75
2242 2 Core Round 6amp (100m)	15.47
4 Core Flat Cable (100m)	20.82
Twin Core Cable Screened (100m)	11.50
6491X Earth Cable Green/Yellow 1sq mm (100m)	7.00
46199 Single Screened Microphone (100m)	5.35
F041 2mm Loudspeaker Cable (100m)	5.53
CCPU2 Twin Pick Up 100m	9.95
81C 8 Core Ivory – All Cores Colour Coded (100m)	4.00
3183Y 3 Core 15amp upt 3kw Flexible 1.5 sq mm	49.70
3183Y 3 Core 10amp upto 2kw Flexible 1.0 sq mm	36.40
6491X Earth Green/Yellow 6mm	39.60
6181Y Lighting Red/Grey 1mm	14.50
6242Y Grey Lighting Twin/Earth 1mm	21.00
6242Y Grey Ring Main 2.5 Mil	38.20

CABLE TIES

Up to 25mm Diam. (100)	0.84
Up to 55mm Diam. (100)	2.11

TV WALL BRACKETS

P5245 Teletwist (12"-20")	24.16
P6045 Designer Twister	27.00
P6041 Little Twister	14.08
P5218 Swivel and Tilt Bracket	24.67

Heavy or bulkier items such as cable will be sent by overnight carrier at £7.50 + VAT

LABGEAR

CM7261	P.U.	12.39
CM7262	P.U.	13.50
CM7065	UHF/VHF WB	16.18
CM7066	UHF/WD	14.74
CM7260	VHF H. Gain A/B/CD	17.57
CM7253	Behind Set (Mains)	15.81
CM7243	Second Set Amp	14.73
CM7093	Three Set Amp	18.55
CM7063	Dist. Amp VHF/UHF	25.77
CM7108/7298	8+1 Dist. Amp	49.96
CM9700	27MHz CB Suppressor	4.90
CM6011	Outdoor Splitter	8.63
CM9003/00	Flush Sing. Outlet	1.95
CM9003/01	Flush Sing. Out. Isolat.	2.36
CM9010	Flush Twin Outlet	2.47
CM9034	UHF Filters A/B/CD	8.89
CM9033	6 Way Pass Split	11.72
CM7042	TV Games Combiner	3.24
CM9009	Flush TV/FM Emulator	3.88
CM9006	VHF/UHF Diplexer	4.17
CM7122	Televerta Up VHF to UHF	41.90
CM7057	Televerta Down UHF/VHF	49.70
CM7294	Dist. Amp, UHF/VHF	24.96
CM7274	4 Way Dist. Amp	26.15
CM7082	UHF/VHF Dist. Amp	74.14
CM7080/10	UHF MHA	16.89
CM7271	UHF Wideband 15 db	9.09
CM5004	4way Video Oist. Amp	60.20

ANTIFERENCE

Universal No. 1 Clamp	1.30
SB11 Splitter	2.50
CS200 Combiner/Splitter	3.94
C0811 Outlet	0.96
PU1240 Power Unit	11.65
PU1300 MHA	9.09
Diplexers	0.68
Matched Transformer	2.83
XS2 Xtraset	14.46
XS04 4 Way DA	22.50
XS 4/6	43.13
Super Set Top Aerial	6.50
Caratenna Aerial	7.20
Traveller Aerial	11.50
Silver Sensor Aerial	7.40
XG8 High Gain Aerial	21.00
Power Sensor Aerial with Amp	24.95
Mercury Set Top Aerial	2.30
Loop Aerials	1.00
Coax Cable S540 100m	33.70

TELESCOPIC AERIALS

Closed Length		
Toshiba	206mm	1.55
Toshiba	330m	1.55
NEC	252mm	1.88
Panasonic	330mm	1.88
JVC	195mm	1.67
Sanyo	150mm	1.74
Sanyo	65mm	1.62
Sony	235mm	2.18
Sony	160mm	1.55
Hitachi	237mm	1.55
Hitachi	300mm	1.67
Aiwa	65mm	1.32
Aiwa	135mm	1.26
Sharp AANTR00017CEZZ	245mm	2.17
Sharp AANTR00030CEZ	245mm	1.62

F.M. RIBBON AERIALS

Ribbon with FM plug	0.66
Ribbon with Coax plug	0.90

ELECTRICAL PLUGS/SOCKETS

Safe Block Mains	8.50
FC3W 3 Pin 10A Flex Connector	1.50
TS1 13A Single Trailing Socket	1.40
TS2 13A Twin Trailing Socket	2.65
4 Way 13A Mains Connector	6.75
13Amp Plugs	0.48
Surge Protector Plug	12.50
320A Single Gang 13A Socket	1.30
320B Single Switched 13A Socket	1.95
320C Two Gang 13A Socket	2.53
320D Two Gang Switched 13A Socket	3.92
International Travel Plug	3.50
320E One Gang/One Way Switches	0.80
320G Two Gang/Two Way Switches	1.78
3 Way Mains Adaptor	3.80
13 Amp Screwless Plug Tops	0.70

COMPUTER ACCESSORIES

DISKS

Goldstar 5.25" Floppy Disks 2DD DS/QD (Box 10)	5.66
Goldstar 3½" Diskettes HF 2DD DS/DD (Box 10)	8.30
Unbranded 3½" Diskettes DS/DD (Box 10)	7.70
Amstrad 3" Disks	20.00

STORAGE BOXES

3½" Library Case (10)	1.95
Lockable Box Holds (40 × 3½") (20 × 3")	8.50
5¼ Disk Box	9.37

COMPUTER CASSETTES

C15	0.30
C20	0.34

Special Prices on 20 or more

AUDIO CASSETTES

Altai C90	0.25
TDK D60	0.70
TDK D90	0.90

AUDIO SPARES

CASSETTE HEADS

Mono/Record/Playback	4.32
Stereo Playback	4.79
Stereo/Record/Playback	4.99
Stereo/Record/Playback/Dolby	6.90
Mono/Stereo/Erase	2.25

MOTORS

6v MD6515 (Clockwise)	4.95
9v MD6516 (Clockwise)	4.95
9v (Anti Clockwise)	4.95
12v MD12517 (Clockwise)	4.95
12v (Anti Clockwise)	4.95

EXPORT ORDERS WELCOME

INTEGRATED CIRCUITS

COMPUTER IC'S/TRANS

40028	13.45
HAL16L8CN	5.24
HN613128P	POA
LM1889	1.75
MAB8049	3.49
MC1377	1.55
MC1376	1.15
MC1488P	0.75
MC1489AP	0.77
MC68008	17.97
ZX81 Rom	4.00
Spec 48K Rom	5.00
ULA2C210E ZX81	3.95
Spec 128K+2 Rom	6.51
QL Rom 256K	12.43
QL Rom 128K	7.20
SCH92880P I/F 1 Rom	3.00
TC74HC04	0.86
TMS1000	8.95
TMM23128P-1951	10.66
ULA6C001E (Spec)	6.50
ULA2G007 (M/D)	3.24
ULA1H035E (Ram Pk)	2.58
ULAZX8302 (QL)	7.30
Z80A CPU	1.70
ZX8401/PCF1304	4.50
2N7400E	11.25
20RA043	11.25
SN7438N	2.00
74LS00	1.12
74LS32	0.90
74LS157	0.78
74LS132	0.63
74LS260	0.83
Ram 2114	2.31
251641-02	POA
2732	3.30
2764	3.75
27128	4.95
27256	5.90
Ram 4118	2.92
Ram 4116-4	1.10
Ram 4116-2	1.10
8249	3.00
8247	3.50
8271	60.00
BBC UID ULA	15.00
4164/4564-15	2.00
41256-15	8.95
6502 Commodore	3.50
6522	4.00
6264 Commodore	7.50
6510 Commodore	7.07
6526 Commodore	5.11
6561 Commodore	7.74
6569 Commodore	21.25
6581 Commodore	7.79
8360 Commodore	19.61
8701 Commodore	5.46
906114 Pla. Comm.	4.51
901225 Cha. Rom. Comm.	3.37
901226 Bas. Rom. Comm.	8.71
901227 Ker. Rom. Comm.	6.63
ZTX182/BC182	0.07
ZTX213	0.15
ZTX214	0.17
ZTX313	0.24
ZTX510	0.39
ZTX551	0.39
ZTX650/1	0.27
ZTX750	0.38
IS 2472	0.31

We have not listed our full range IC's. These are a few of our new types. Please ask for catalogue for full list of ICs and Semis.

AN5620	4.87
AN6320N	2.88
LA7800	3.75
STK5326	6.35
STK5481	6.50
STR5412	8.45
STR6020	5.80
TAD100	2.62
TBA673D	2.50
TBA2800	1.60
TDA1670	3.60
TDA1870	6.46
TDA2005	2.94
TDA2150	2.47
TDA3565	3.95
TDA3576B	3.99
TDA3651	3.50
TDA3651AQ	3.95
TDA3653AQ	3.95
TDA3654	3.95
UPC577	2.46
UPC1378	2.50
UPC5743	3.75
UPD8048	0.93

DON'T FORGET WE HAVE A FULL RANGE OF SECURITY PRODUCTS INCLUDING NEW CASTLE CONTROL PANELS.
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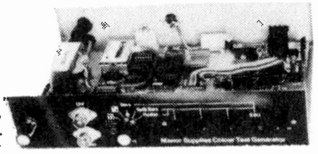
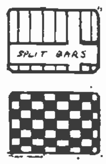
32611 answer
390936 phone
TELEX: 635562
GRIFFIN G (for P.V.)
FAX No. 0254 395361

MANOR SUPPLIES

MKV PAL COLOUR TEST GENERATOR FOR DOMESTIC TV & VCR.

TEST DEMONSTRATIONS AT 172 WEST END LANE



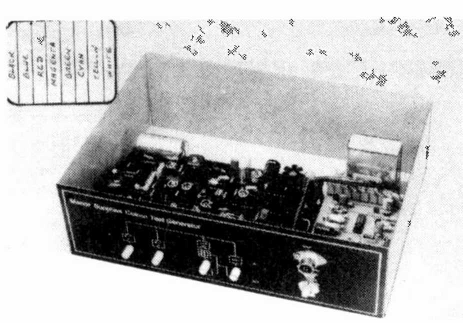


- ★ 40 different patterns and variations.
- ★ Fully interlaced sync pulses with correct picture blanking.
- ★ EBU colour bars, BBC colour bars, whole rasters & split bars (specially useful for VCR service), white, yellow, cyan, green, magenta, red, blue and black.
- ★ Chequerboard.
- ★ Mono outputs with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

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

Post/Packing £3.00
Add VAT 15% TO ALL PRICES

PAL COLOUR BAR GENERATOR (Mk4)



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

PRICE OF MK 4 COLOUR BAR GENERATOR KIT £30.00. CASE £8.60. BATT HOLDERS £4.20. MAINS SUPPLY KIT £4.20 (Combined P&P £3.00).

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

ADD VAT 15%

KITS & PROJECTS

PAL DECODER KIT (Video to RGB) for Monitors **£27.00** p.p. £1.00.
PAL ENCODER KIT (RGB to Video) **£18.50** p.p. £1.30.
CROSS HATCH UNIT KIT, Aerial Input type, incl. T.V. sync. and UHF Modulator, Battery Operated, also gives Peak White & Black Levels, can be used for any set. **£13.50** p.p. 80p. (Alum. Case **£3.20** p.p. £1.40.)
ADDITIONAL GREY SCALE Kit **£2.90** p.p. 45p.
UHF SIGNAL STRENGTH METER KIT £22.00 Alum. Case **£3.20**. De Luxe Case **£8.60** (Built & Tested **£48.00**) p.p. £2.50.
CRT TESTER & REACTIVATOR KIT For Colour & Mono complete with Case, Panel Meter Indicator – can be adapted for latest CRTs **£29.50** p.p. £3.00.

TV SERVICE SPARES

SATELLITE T.V.

ON DEMONSTRATION AT 172 WEST END LANE NOW! – ENQUIRIES WELCOME

PHILIPS SPARES

G8 PANELS (Tested) Power **£12.50**, Scan **£15.00**, Signals **£15.00** p.p. £2.50.
KT3, K30 PANELS, tested, exchange, sound, power, bridge rect, frame, RGB **£7.50** each. Decoder (Non-text) **£10.00** p.p. £1.50.
G11 PANELS (tested), frame, IF, decoder **£12.50** each. p.p. £2.00. Scan **£15.00** p.p. £2.80. Power tested exchange **£18.00** p.p. £2.80.
G11 PANELS EX-RENTAL (untested) Scan, Frame, Decoder **£2.50** p.p. £2.00.
G11 IF PANEL (new) less Tuner **£2.50** p.p. £1.30.
G11 6POS Touch Tune Channel Selector (replaces old type) incl. instructions **£20.00** p.p. £1.80
G9 POWER SUPPLY UNIT £5.00 p.p. £2.30.
G8 6 Position Channel Selector (sloping buttons) **£2.50** p.p. £1.00.
HANDSETS (new replacements) p.p. £1.50.
G11 ULTRASONIC non-text **£19.50**, infra-red text **£19.50.** Others available.
KT3 non text (RC4001), KT3, K30 Text **£19.50.**
HANDSETS EX-RENTAL, TEXT UNTESTED. KT, TEXT/VIDEO TYPE £3.50 p.p. £1.00.
MANUALS p.p. 80p, G11, K35, 2A **£3.50.** KT3 **£4.50,** CTX-E, CTX-S, CF1 **£1.50**
KT4/K40 SYSTEM 4 £3.50

THORN/FERGUSON SPARES

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

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

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

GEC SPARES: **20AX MKII** line time base **£18.00** p.p. £2.00. Power (PC778) tested exchange **£18.00** p.p. £2.00.

SONY SPARES: **ON/OFF SWITCH** 21mm or 26mm, spaced holes, universal Sony on/off **£4.20 each** p.p. 80p.
HANDSETS (New Replacement) RM-604, 606, 613, 615, 630, 632, 635 **£19.50** p.p. £1.00.
TELETEXT DECODER PANELS (tested) — Mullard VM6101 Type **£25.00,** Philips KT3, K30 **£20.00** p.p. £2.30.
MULLARD VM6230 teletext decoder (similar to VM6101) plus additional Prestel unit, VM6330 & Line Coupler **£20.00** p.p. £3.00.

VARICAP TUNERS: Grundig 8630 series **£5.00** p.p. £1.00. U321, U322/NSF204, ELC1043 (equiv), SC4, VHF NSF203 **£7.80** p.p. £1.80. UHF/VHF UV411 **£10.80** p.p. £1.00.
LOPTS New and guar. P/P **£1.50,** Bobbins **80p.**

FERG., HMV, MARCONI, ULTRA		**R.B.M.** T20, T22	**£9.80**
1590, 1591, 1612, 1613, 1712	**£4.80**	**R.B.M.** T20, T22 Bobbin	**£5.60**
FERGUSON 3787 (Normende)	**£9.80**	**DECCA** Bradford (state Mod No)	**£8.80**
THORN 1600, 1615, 1690, 1691, 1790	**£9.00**	**DECCA** 100	**£8.80**
THORN 3000/3500 SCAN, EHT	**£6.90**	**FIDELITY** ZX2000, 3000 (Not 22″)	**£15.50**
THORN 8000	**£12.80**	**GEC** 2110 series	**£10.60**
THORN 9000 to 9600	**£9.80**	**ITT** CVC 5 to 9, CVC20	**£9.80**
THORN TX9	**£12.50**	**ITT** CVC25, CVC30 series	**£8.80**
THORN TX10	**£16.50**	**ITT** CVC45	**£9.80**
SPECIAL OFFER		**PYE** 725 (90°) 731 to 741	**£9.20**
DECCA 70, 80	**£3.50**	**PHILIPS** G8	**£8.80**
ITT VC300	**£4.80**	**PHILIPS** G9	**£7.80**
GEC 2114J/Junior Fineline	**£1.00**	**PHILIPS** KT3	**£9.80**
PHILIPS 320	**£2.80**	**PHILIPS** K30, K35	**£27.00**
PHILIPS G11	**£5.00**	**PHILIPS** CTX-E	**£22.50**
GEC 2028, 2040, 2100	**£1.00**	**PHILIPS** CTX-S	**£22.50**
PYE 691-7 chassis type only	**£5.00**		

OTHERS AVAILABLE, PRICES ON REQUEST.

TRIPLERS: **THORN 9000 £8.80.**
UNIVERSAL (best quality) **£7.80.**
CONTINENTAL TVK & BG RANGE (quote exact no.) replacements **£13.80**
DECCA/TATUNG £7.80 p.p. £1.50.
THORN 1500 30R5 stick **£1.50** p.p. 80p. Others available.
6·3V CRT Boost Transformers for Colour & Mono **£5.90** p.p. £1.40.
455 CRYSTALS for Remote Control Handsets. 4 for **£1.00** p.p. 50p.
VHF to UHF Converters **£26.50** p.p. £2.50.

CALLERS WELCOME AT SHOP PREMISES
THOUSANDS OF ADDITIONAL ITEMS, ENQUIRIES INVITED
LARGE SELECTION TESTED COLOUR PANELS POPULAR MODELS

Goods available if in stock immediately over shop counter (Mail order between 3 days and 1 week from receipt of order). ADD VAT 15%

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172 WEST END LANE, LONDON, NW6 1SD

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WE WILL ONLY SUPPLY TOP QUALITY, BRANDED COMPONENTS. REPUTATION COUNTS WITH US

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BUY WITH Access

CAPACITORS

1UF at 250V	.20
4.7UF at 250V	.25
10UF at 250V	.35
22UF at 250V	.40
33UF at 250V	.55
47UF at 250V	.65
100UF at 250V	1.25

(All Single Ended PCB Type)

DIODES

TYPE	PRICE
BY127	.10
BY133	.20
BY179	.65
BY223	1.25
BY227	.20
BY229/800	.95
BY299	.25
BYX55/600	.30
1N4007	.07
1N5408	.20
SKE5F3/10	1.50

ZENER DIODES
BZX61C (1.3 Watt) 3V3, 4V7, 5V1, 5V6, 6V2, 6V8, 7V5, 6V2, 9V1, 10V, 11V, 12V, 13V, 15V, 18V, 20V, 24V, 27V, 30V, 33V, 36V, 47V, 56V, 62V, 75V, 100V, 110V, 120V, 130V. Pkts of 5 per value 1.00

E.H.T. TRAYS

Continental 20AX Focus	8.95
Continental 30AX Focus	8.95
DECCA 80	7.20
DECCA 100	7.35
DECCA 120/130	7.95
ITT CVC20/25/30/32	6.95
ITT CVC45	7.50
PHILIPS G8 550	7.90
PHILIPS KT3	7.95
RBM T20/22A	7.35
THORN 9000	8.00
UNIVERSAL	5.70

FUSES

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

INTEGRATED CIRCUITS

TYPE	PRICE (£)
AN303	3.75
AN305	3.50
AN318	6.95
AN5620	4.95
AN7145M	2.95
HA1339A	2.95
HA1366W	1.85
HA1366WR	1.85
HA1374	2.45
HA1377	2.95
HA1392	2.95
HA1397	3.95
HA13001	4.50
HA13008	12.95
LA1201	1.25
LA1230	2.95
LA1365	2.45
LA4440	2.75
LA4445	2.45
LA4460	2.45
LA4461	2.45
LA7800	1.95
LA7801	2.90
MC13002	3.95
MC14497P	4.50
SAA1250	3.85
SAA1251	4.95
SAA3027	3.95
SAA5000A	3.95
SAA5010	4.95
SAA5012	4.95
SAA5030	5.95
SAA5050	6.95
SAF1039P	2.75
SL470/1DP	2.95
SL480	2.85
SL490	2.90
SL1430	1.95
SL1431	1.95
SL1432	1.75
SN76660N	.65
STA471C	6.95
STK077	6.95
STK2129	11.95
STK433	5.95
STK4332	5.95
STK435	5.95
STK437	6.95
STK439	7.50
STK459	8.55
STK461	9.95
STK463	9.95
STK465	11.95

TYPE	PRICE (£)
STK5421	4.95
STK5481	8.95
STK7308	8.95
STR4090	8.95
STR40090	7.95
STR50103A	6.50
STR4211	3.95
STR441	4.95
STR451	5.35
STR454	4.95
STR5412	6.95
STR6020(KIT)	5.75
TA7193P	4.50
TA7205AP	1.40
TA7222P	1.85
TA7227	2.95
TA7270	3.25
TA7609	3.35
TBA120AS	1.00
TBA120U	1.00
TBA800P	.85
TBA810S	1.25
TBA820	1.50
TBA820M	1.25
TBA920S	1.95
TBA950/2X	2.25
TBA1440G	2.95
TDA440	2.95
TDA1020	2.75
TDA1035T	2.40
TDA1037	1.95
TDA1044	2.95
TDA1151	1.25
TDA1170S	1.80
TDA1180P	2.65
TDA1190Z	2.85
TDA1470	3.25
TDA1506	4.35
TDA1510	3.80
TDA1512	3.50
TDA1515	4.50
TDA1670A	4.20
TDA1770A	3.70
TDA1870	6.95
TDA1908A	1.95
TDA1950A	3.95
TDA2002	1.50
TDA2003	1.55
TDA2004	2.90
TDA2005	2.55
TDA2020	3.20
TDA2030	1.80
TDA2170	2.95
TDA2270	2.95
TDA2525	2.95

TYPE	PRICE (£)
TDA2530	2.00
TDA2532	2.10
TDA2540	1.70
TDA2541	2.70
TDA2560	1.95
TDA2576A	3.25
TDA2577	2.95
TDA2578A	2.95
TDA2579	3.75
TDA2581	2.00
TDA2582	1.95
TDA2591/3	1.95
TDA2594	2.95
TDA2595	4.95
TDA2600	6.35
TDA2611A	1.50
TDA2653A	3.50
TDA2655B	5.95
TDA3190	1.95
TDA3330	3.95
TDA3540	2.95
TDA3541	2.95
TDA3560	4.95
TDA3561A	4.95
TDA3562A	5.50
TDA3565	4.95
TDA3571 B/Q	3.95
TDA3650	4.75
TDA3651	1.95
TDA3651AQ	3.80
TDA3652	2.95
TDA3653AQ	4.95
TDA3654AQ	4.75
TDA4500	3.95
TDA4503	4.65
TDA4600/2	2.85
TDA4600/2D	3.30
TDA7270	3.35
TDA8180	6.95
TDA8190	2.80
TDA9503	2.95
UPC1031H	2.60
UPC1181H	1.70
UPC1182H	1.70
UPC1185H	2.50
UPC1230H	4.35
UPC1365C	4.20
UPC1378H	3.70
UPC1382	4.35
UPC1394C	2.95
Z80ACPU	1.75

I C SOCKETS

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

LINE O/P TRANS

DECCA 100	8.30
FERGUSON 1690/1	9.95
FERGUSON 1790/1	7.95
FERGUSON TX9	23.50
FERGUSON TX90 (14")	19.75
FERGUSON TX90 (20")	19.75
FERGUSON TX100 90	20.95
FERGUSON TX100 110	20.95
FIDELITY ZX2000 14"/20" (Inc. Mod.)	12.50
FIDELITY ZX3000 14"/20"	11.50
FIDELITY ZX 22"/26"	22.95
HINARI CT4/5	21.95
ITT CVC20	8.50
ITT CVC25/30/32	8.50
ITT Compact 80	21.95
PHILIPS G8	9.95
PHILIPS G11	18.95
PHILIPS KT3	12.95
PHILIPS K30	19.95
PHILIPS CTX 14"/16"	17.95
PHILIPS CTX 20"	17.95
RBM T20/22A	9.95
SHARP C1410	23.95

ON/OFF SWITCHES

Decca 80/100	1.00
Ferguson TX9/10 (Rem)	1.75
Ferguson TX90 (Rem)	1.75
Fidelity AVS Series	1.50
Fidelity CTV140	1.50
Fidelity CTV14R	2.95
Fidelity CTV14S	2.95
Grundig CUC731	3.50
Hitachi CPT2650	1.95
Philips G8	1.35
Philips G11	1.35
Philips G11 (Rem)	1.75
Philips KT3	1.50
Philips KT/CTX (Rem)	1.75
Pye G11 (Rem)	1.75
RBM T20/22A 3K3 Vol	2.45
Sony KV1612 (Rem)	3.95
Sony KV2022 (Rem)	3.95
Tatung 160/161	1.75
Tatung 165	1.75
Thorn Universal	1.00

TRANSISTORS

TYPE	PRICE
BC107	.15
BC147	.10
BC148	.10
BC307	.12
BC327	.11
BC328	.12
BC337	.11
BC338	.12
BC360	.35
BC546	.10
BC547	.10
BC548	.10
BC557	.10
BC558	.10
BC639	.25
BC640	.25
BD131	.50
BD132	.50
BD222	.50
BD225	.50
BD237	.40
BD238	.40
BD278A	.70
BD437	.40
BD438	.40
BD677	.65
BD701	.95
BD707	.95
BD807	.95
BF337	.28
BF338	.30
BF422	.35
BF423	.35
BF458	.35
BF460	.95
BF470	.50
BF757	.70
BF871	.80
BR103	.75
BR303	1.95
BT151/800	1.15
BU126	1.50
BU205	1.40
BU208A	1.45
BU208D	1.95
BU326A	1.45
BU407	1.25
BU407D	1.50
BU426A	1.35
BU500	1.95
BU508A	1.75
BU508D	1.95
BU526A	2.50
BU536	2.75
BU705	3.95

TYPE	PRICE (£)
BU807	1.30
BU826A	2.25
BU907	2.95
BU908	1.95
BUT11AF	2.95
BUW81A	3.95
BUX84	.80
R2540	2.35
R4050	1.38
SG613	8.95
SG264A	5.95
T6071V(KIT)	5.75
T9053V	3.50
T9054V	3.50
T9064V	1.95
TIP29E	.70
TIP31C	.45
TIP32C	.45
TIP41C	.45
TIP42C	.45
TIP112H	.75
15/80H	2.45
15/85R	2.45
2SC867A	3.20
2SC1034	3.95
2SC1114	5.95
2SC1413A	2.95
2SC1942	2.90
2SC3156	3.50
2SD725	4.95
2SD870	6.50
2SD1398	2.35
2SD1453	2.95
7805	.50
7812	.50
7815	.70
7824	.70

TUNERS

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

TV ELECTROLYTICS

DECCA 80 (400/800)	4.50
FIDELITY ZX(220/385)	3.95
PHILIPS G8(600/300)	3.95
PHILIPS G11(470/250)	2.20
RBM T20A(220/400)	2.50
THORN 1690 (4700/25)	1.35
THORN 9000(400/400)	2.90

FERGUSON TV SPARES

TX9/10

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

TX90/100

Line O/P Trans TX90 14"	19.75
Line O/P Trans TX90 20"	19.75
Line O/P Trans TX100 90°	19.95
Line O/P Trans TX100 110°	20.95
Mains Trans. (TX90)	17.95
On/Off Switch (Remote)	1.75
Push Button TX90	12.95
Tuner	14.35

FERGUSON VIDEO SPARES

3V00/16/22

Capstan Motor	24.95
Drum Motor	24.95
Pinch Roller	3.95
Take-Up Clutch (Small)	5.65
Take-Up Clutch (Large)	5.95
Video Head	17.95

3V29/30

Capstan Motor	37.95
Loading Motor	8.70
Pinch Roller	4.50
Pilot Lamp	.80
Reel Idler	2.85
Take-Up Clutch	2.45
Take-Up Idler	1.40
Video Head	17.95

3V35/36

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

3V44/45

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

GEC/HITACHI SPARES

HM3232	5.95
HM6251	4.70
HM9032	5.95

VIDEO SPARES

V4000/VT8000

Capstan Motor	31.95
FF/Rew Idler	2.65
FF/Rew Pulley	.85
Pinch Roller	3.95
Play Idler	4.50
Video Head	22.95

V4001/VT9300/9500

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

V4100/VT11E/VT33E

Capstan Motor (VT11E)	23.95
Capstan Motor (VT33E)	29.95
Clutch Assy	7.95
FF/Rew Idler (Genuine)	2.50
Pinch Roller	3.95
Video Head	22.95

V4005/VT63E

Capstan Motor	15.95
End Sensors (Pair)	1.95
Pinch Roller	4.95
Video Head	49.95

PANASONIC VIDEO SPARES

NV333/366

Complete Maintenance Kit (Genuine)	13.75
Cassette LED	1.95
Pinch Roller	3.95
Play Idler (Genuine)	4.95
Reel Idler (Genuine)	1.25
Reel Motor (Genuine)	14.95
Video Head	17.95

NV370/380

Complete Maintenance Kit (Genuine)	12.95
Pinch Roller	3.95
Reel Idler (Genuine)	2.95
Video Head	21.95

NV730/770

Complete Maintenance Kit (Genuine)	12.95

NV2000/2010

Complete Maintenance Kit (Genuine)	21.50
Cassette Lamp	.70
Pinch Roller	3.95
Play Idler (Genuine)	1.25
Reel Idler (Genuine)	1.25
Video Head	17.95

NV7000/7200

Complete Maintenance Kit (Genuine)	14.95
Cassette Lamp	.70
Pinch Roller	3.95
Play Clutch (Genuine)	4.95
Reel Idler (Genuine)	1.25
Video Head	17.95

REMOTE CONTROLS

Ferguson TX9 U/S Basic	14.50
Ferguson TX9/10 N/Text	12.95
Ferguson TX9/10 Text	12.95
Ferguson TX Stereo Text	12.95
Ferguson TX100 Text	15.95
Ferguson 3V23 Video	14.95
Ferguson 3V31 Video	16.95
Ferguson 3V35 Video	16.95
Fidelity CTV14R/S	12.95
Grundig TP200	12.95
Grundig TP400TT	12.95
ITT FS9/FS10 Text	15.95
ITT RG301/305 Text	14.50
ITT RG306 Text	14.50
Panasonic NV7200 Video	15.95
Philips G11 U/S Full Rem.	15.95
Philips G11 U/S Text	15.95
Philips G11 I/R Full Rem.	12.95
Philips G11 I/R Text	12.95
Philips KT3/30 N/Text	12.95
Philips KT3/30 Text	12.95
Philips RC5 (Genuine)	12.50
Philips AV5600 Video	15.95
Redifusion Mk.4 Text	15.95
Sony RM604/605/606	14.50
Sony RM613/615	14.50
Sony RM630/632/635	14.50
Tatung RTP40/43/45	15.95

REPAIR KITS

Philips KT3/30 N/Text	6.50
Philips KT3/30 Text	6.50

SANYO/FISHER VIDEO SPARES

VTC5000/5300

Loading Roller	1.25
Pinch Roller	8.50
Reel Idler (Genuine)	5.70
Reel Motor (Genuine)	7.95
Video Head	35.00

FVHP615

Gear Idler Assembly	5.95
Pinch Roller	4.50
Reel Idler	5.95
Video Head	24.95

SERVICE MANUALS

(All Genuine)

Ferguson TX9 Complete	27.95
Ferguson TX10 Complete	38.95
Ferguson TX85	9.95
Ferguson TX90	14.95
Ferguson TX100	18.95
Ferguson 1790/1	1.95
Fidelity AVS1600	5.95
Fidelity AVS2000	5.95
Fidelity CTV14R	5.95
Fidelity CTV20R	5.95
Fidelity CTV20T	5.95
Philips CF1	6.95
Philips CTX-E	2.50
Philips CTX-S	2.50
Philips G11	4.50
Philips KT3	4.50
Philips K35	3.50
Philips KT4/40	5.95
Philips 2A	6.95

VIDEO RECORDERS

Ferguson 3V35/36	28.95
Ferguson 3V44/45	11.95
Ferguson 3V46/47/52	11.95
Ferguson 3V54/55	11.95
Ferguson 3V59	11.95
Ferguson 3V65	11.95
Ferguson FV11	9.95
Ferguson FV12	9.95
Philips VR6460	6.50
Philips VR6462	6.50
Philips VR6467	6.50
Philips VR6520	6.50
Philips VR6542	6.50
Philips VR6560	6.50
Philips VR6660	6.50
Philips VR6760	8.95

SHARP VIDEO SPARES

VC8300

Cassette Lamp	.70
Channel Bank	7.95
Pinch Roller	3.95
Rewind Idler	3.50

VC9300/381

Capstan Motor	29.95
Cassette Lamp	1.95
Pinch Roller	3.95
Reel Idler (Genuine)	3.95
Reel Motor (Genuine)	17.50
Unlock Assembly	.35
Video Head	23.95

VC481

Capstan Motor	22.95
Pinch Roller	3.95
Reel Idler (Genuine)	3.95
Reel Motor (Genuine)	18.50
Video Head	23.95

SONY SPARES

Capstan Motor C7	27.95
Pinch Roller C5/6/7	3.95
Pinch Roller C9	5.95
Rewind Kit C5/7	4.65
Rewind Kit C6	3.45
Video Head C5/6/7	19.50

VIDEO BELT KITS

Akai VS1/2/3/5	1.95
Amstrad VCR4500	1.95
Amstrad VCR7000	1.50
Ferguson 3V00/16/22	2.50
Ferguson 3V23	1.75
Ferguson 3V29/30	1.80
Ferguson 3V35/39	1.95
Ferguson 3V44/45	1.95
Fisher FVH520/615	1.95
Panasonic NV333	1.95
Panasonic NV370	1.95
Panasonic NV730	1.95
Panasonic NV777	1.95
Panasonic NV2000/2010	1.95
Panasonic NV7000/7200	1.95
Sanyo VTC5000	1.00
Sanyo VTC5300	1.95
Sharp VC7300	2.50
Sharp VC8300	2.45
Sharp VC9300	2.45
Sony C5/7	2.50
Sony C6	1.95

VIDEO PILOT LAMPS

Ferguson 3V23 (Plug)	.80
Ferguson 3V29 (Plug)	.80
Panasonic NV2000/7200	.70
Sharp VC8300	.70
Sharp VC9300	1.95
Universal	.50

VIDEO HEADS

Alba 4000	24.95
Amstrad VCR4500	22.95
Amstrad VCR4600	23.50
Amstrad VCR7000	24.95
Amstrad VCR9000	24.95
Ferguson 3V00/22/29/39	17.95
Ferguson 3V32	47.50
Ferguson 3V42/44/45/55	26.95
Fisher FVH520/615/720	24.95
Hitachi 8000/9300/9500	22.95
Hitachi VT11/33E	22.95
Panasonic NV230	29.95
Panasonic NV333	17.95
Panasonic NV366	39.95
Panasonic NV370/380	21.95
Panasonic NV430	24.95
Panasonic NV730	39.95
Panasonic NV777	29.95
Panasonic NV2000/7000	17.95
Panasonic NVG7/9	24.95
Panasonic NVG10/11/15	29.95
Panasonic NVG20/21/25	39.95
Philips VCR6460/6520	21.95
Philips VCR6462/6560	37.50
Sanyo VHR1100/1300	29.95
Sanyo VHR1500	42.95
Sanyo VTC5000/5500	35.00
Sentra 8000	24.95
Sharp VC9300/381/481	23.95
Sharp VC581/583/682	27.50
Solavox 1000	24.95
Sony C5/6/7	19.50
Sony C20/30	22.95
Toshiba V9600/V31B	24.95
Toshiba V55/57	17.95

ORDERING

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

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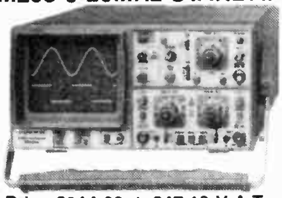
HAMEG are Europe's top selling DUAL TRACE OSCILLOSCOPES. Select from four superb models. All, with the exception of the HM 1005, incorporates a useful COMPONENT TESTER. Size – all models – 285mm x 145mm x 380mm. Clear display 8 x 10cm. Mains supply: 110/125/220/240V AC 50/60Hz.
All supplied with 2 PROBES, a COMPREHENSIVE MANUAL and a 2 YEAR WARRANTY.

HM203-6 20MHz STANDARD

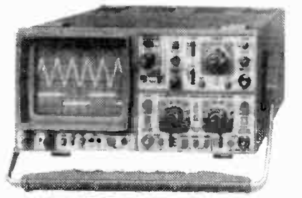


SPECIFICATION
* 2 Channels
* Bandwidth: DC-20MHz
* Sens: Ch1., Ch2., 2mV/cm
* Timebase: 0.2s–20ms/cm
* Triggering: DC-40MHz
* Active TV-Sync-Separator
* Variable hold-off
* Trigger LED indicator
* Calibrator: 1KHz Square wave
* Component tester
* Plus many features

Price £314.00 + £47.10 V.A.T. FREE Securicor Delivery

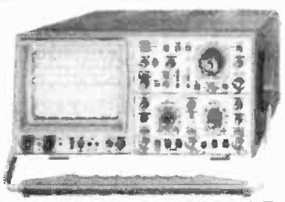
HM604 60MHz UNIVERSAL

SPECIFICATION
* 2 Channels
* Bandwidth: DC-60MHz
* Sens: Ch1., Ch2., 1mV/cm
* Timebase: 2.5s-5ns/cm
* Triggering: DC-80MHz
* Active TV-Sync-Separator
* After delay trigger
* Sweep delay * Delay line
* Trigger LED indicator
* Calibrator: 1KHz & 1MHz Sq. Wave
* Component tester
* Plus many more superb features



Price £575.00 + £86.25 V.A.T. FREE Securicor Delivery

HM1005 100MHz UNIVERSAL



3 CHANNELS-UP TO 6 TRACES

SPECIFICATION
* 3 Channels
* Bandwidth: DC-100MHz
* Sens: Ch1., Ch2., Ch3., 1mV/cm
* Timebase A: 2.5s-5ns/cm
* Timebase B: 0.2s-5ns/cm
* Triggering: DC-130MHz
* After delay trigger * Delay line
* Trigger LED indicator
* Overescan LED indicator
* Active TV-Sync-Separator
* Calibrator: 1KHz & 1MHz Sq. Wave
* Plus many more excellent features

Price £726.00 + £108.90 V.A.T. FREE Securicor Delivery

HM205-2 20MHz DIGITAL STORAGE

SPECIFICATION
* Digital Storage
* Analogue real time (Same as 203-6)
* Bandwidth: DC-20MHz
* Sens: Ch1., Ch2., 2mV/cm
* Timebase Analogue: 0.2s-20ns/cm
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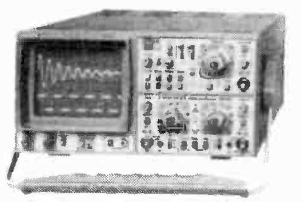

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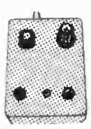

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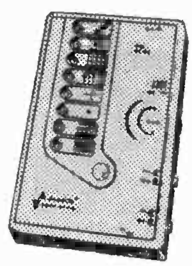

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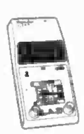

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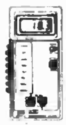

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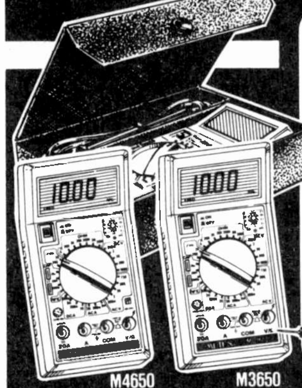

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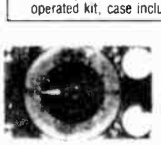
BD196	1	in flex simmerstat – keeps your soldering iron etc always at the ready
BD199	1	mains solenoid very powerful has 1" pull or could push if modified
BD201	8	keyboard switches – made for computers but have many other applications
BD210	4	transistors type 2N3055 probably the most useful power transistor
BD211	1	electric clock mains operated put this in a box and you need never be late
BD221	5	12v alarms make a noise about as loud as a car horn. Slightly soild but OK
BD242	2	6" × 4" speakers 4 ohm made from Radiomobile so very good quality
BD252	[illegible]	panostat, controls output of boiling ring from simmer to boil
BD259	50	leads with push on ¼" tags – a must for hook ups – mains connections etc
BD263	2	oblong push switches for bell or chimes, these can mains up to 5 amps so could be foot switch if fitted into pattress
BD268	1	mini 1 watt amp for record player. Will also change speed of record player motor
BD283	3	mild steel boxes approximately 3" × 3" × 1" deep – standard electrical
BD293	50	mixed silicon diodes
BD305	1	tubular dynamic mic with optional table rest
BD667	2	4.7uf, non-polarised block capacitors, pcb mounting
BD400	4	Books. Useful for beginners. Describes amplifiers, test equipment and kit sets
BD653	2	Miniature driver transformers. Ref LT44. 20k to 1k, centre tapped
BD553a	2	3.5 volt operated relays, each with two pairs CO contacts

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

POWERFUL IONISER

Generates approx. 10 times more IONS than the ETI and similar circuits. Will refresh your home, office, shop workroom etc. Makes you feel better and work harder – a complete mains operated kit, case included **£12.50 + £2 P&P**. Our ref 12P5/1.



25A ELECTRICAL PROGRAMMER

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

ULTRA SONIC INTRUDER ALARM. Small, nicely cased, will detect movement in a room up to 10m × 10m. Ingenious construction makes it independent of the mains; cannot be switched off, even with its on/off switch, until you know the secret; has delayed action enabling you to switch it on and leave the room; it has an inbuilt piezo sounder which is very penetrating and high pitched and would frighten away most intruders. Has internal switching and could be coupled to an outdoor alarm if required. It is the basis of a very efficient burglar alarm, or has other uses. For instance: you could disconnect the internal sounder and using the internal switches you would know when somebody arrives without that person being aware that you know. Similarly, the unit could be used to operate other equipment ultra-sonically. It is brand new, guaranteed OK, complete but less battery (PP3 alkaline type). Price is **£20 plus £3 insured delivery.** Our ref 20P11.

110 DECIBEL HORN. For use with the ultra sonic intruder detector. Ideal for external positioning to attract the attention of neighbours should you have an intruder. This unit has its own mounting bracket and comes complete with good length of lead. **Price £7.** Our ref 7P9. Incidentally, this could also be used as a loud speaker.

ATARI 65XE COMPUTER At 64K this is most powerful and suitable for home and business. Brand new, complete with PSU, TV lead, owner's manual and six games. Can be yours for only **£45 plus £3 insured delivery.**

DATA RECORDERS. ACORN for Acorn Electron, etc., reference number ALF03, with TV lead, manual and PSU. Brand new. Price **£10 plus £1.50 post**. Order ref 10P44.
ATARI XC12 for all their home computers. With leads and handbook. Brand new. Price **£15 plus £2 post.** Order ref 15P20.

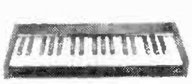
JOYSTICK FOR ATARI OR COMMODORE for all all Atari and Commodore 64 and Vic20. New Price **£5.** Order **ref** 5P126.

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

WALKMAN TYPE PERSONAL STEREO CASSETTE PLAYERS. These are not second-hand but are slightly reject and may need some attention. All are complete with stereo headphones and are famous makes: Sanyo, Panasonic, Sony, etc. Stereo cassette type, no radio, £5 each. Our ref 5P132.

SPECIAL OFFER is ten of the cassette only version, our ref 5P132, for **£40.** This offer is our ref 40P3.

PANEL METERS. Beautifully made moving coil instruments in heavy duty casings, much superior to those coming from the Far East. Meter face size is 72mm × 86mm, fixing hole size is 70mm. Price is **£5 each.** The following models are in stock: 0-5amp. Our ref 5P133/5A. 0-10amp. Our ref 5P133/10A. 0-40volt DC. Our ref 5P133/40V. 0-50volt DC. Our ref 5P133/50V. 0-80volt DC. Our ref 5P133/80V. 0-160volt DC. Our ref 5P133/160V. 0-200volts DC. Our ref 5P133/200V.



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

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

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

HAND-HELD VIDEO LAMP. Mains operated and will enable you to take professional standard videos. Made by the famous Ferguson Company, this uses a 1000w halogen lamp in a fan cooled, hand-held and hand-switched metal housing. Comes complete with optional barn-door assembly and camera bar. Obviously intended to retail at over £60, we offer these at £30 **each plus £3 insured delivery.** Our ref 30P3.

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

PHILIPS LASER

This is helium-neon and has a power rating of 1.6mW. Completely safe so long as you do not look directly into the beam when eye damage could result. Brand new, full spec, £30 plus £3 insured delivery. Mains operated power supply for this tube gives 8kv striking and 1.25kv at 5mA running. Complete kit with case £15. No extra for post if ordered with tube. Battery PSU also available £15.

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

12 VOLT BRUSHLESS FAN. Japanese made. The popular square shape (4½in × 4½in × 1¾in). The electronically run fans not only consume very little current but also they do not cause interference as the brush type motors do. Ideal for cooling computers, etc., or for a caravan. **£8 each.** Our ref 8P26.

FDD BARGAIN

3½in made by Chinon of Japan. Single sided, 80 track, Shugart compatible interface, interchangeable with most other 3½in and 5¼in drives. Completely cased with 4 pin power lead and 34 pin computer lead. **£40.** Our ref 40P1.

OUR ALADDIN'S CAVE. You may be a new reader and not know that we have a shop at 12 Boundary Road, Hove, where you can go and have a browse around at our assortment of 'goodies'. Unfortunately, because of staff shortages, we cannot be open on Saturdays yet, so the hours are 9.30am to 5.00pm, Monday to Friday. We of course still serve callers at 250 but request that you bring a completed order form as 250 is really the mail order depot.

Generous discounts for quantities

J & N BULL ELECTRICAL

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

MAIL ORDER TERMS: Cash, P.O. or cheque with order. Orders under £20 add £1.50 service charge. Monthly account orders accept from schools and public companies. Access & B card orders are accepted – minimum £5. Brighton (0273) 734648 or 203500.

BARGAINS STILL AVAILABLE

DOUBLE MICRODRIVES. We are pleased to advise you that the Double Microdrives which we were offering at about this time last year as being suitable for the 'QL', 'OPD' and several other computers are again available, same price as before namely **£5.** Our ref 5P113.

NOISE FILTERS – MAINS INPUT PLUG TYPE. Japanese made, this is a chassis mounting block with a built in noise filter to cut out surges and voltage peaks which could interfere with and possibly even damage your equipment. These are easy to mount and have a flange with two fixing holes. They take the standard 3 flat pin plug, 2amp model. Price £3 each. Our ref 3P50.

LEAD LAMP. Motorists' Special. Normal hand-grip type holder, with glass cover to protect the lamp and further protection in the form of a wire guard with a hook for hanging. Ideal as loft light or for car repairs, etc. Takes 60w lamp. Has good length flex. Price £4. Our ref 4P31.

PHONE LEADS. 3 metres long, correctly colour coded, one end has flat plug which fits standard BT socket, other end has tag connectors. 2 for £1. Our ref BD639.

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

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

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

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

SOFTWARE FOR REMAKING. Just arrived. Large quantity of mainly games. All are on normal tape spool in cassette holders and should be suitable for wiping out and re-making into games or programmes of your own design. We offer 5 different for £2 or 100 assorted for £20. Important note: We cannot say which titles you will get nor accept orders for specified titles or 'so many, all different', etc., so only order if you can take them as they come. Order ref 5 for £5 is 2P224, 100 assorted is 20P10.

VERY USEFUL MAGNETS. Flat, about 1in long, ½in wide and ¼in thick. These are polarised on their faces which makes them ideal to operate reed switches in doors and windows or to hold papers or labels, etc., to metal cabinets, or even to keep cupboard doors firmly closed. Very powerful. 6 for £1. Our ref BD274(a).

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

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

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

TELEPHONES – We have just received a consignment of desk telephones, rotary dial type, in good working order and in a new condition. We offer these at £5 each plus £2 special packing and postage. This model would have the connecting lead with four tags for going into the old type junction box. Our ref 5P134. Or for £6 you can have the same telephone but with the new flat BT type plug fitted. Our ref 6P10.

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

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

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

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

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

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

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

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

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

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

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

20v – 0 – 20v – Mains transformers 2½ amp (100 watt) loading, tapped primary 200-245 upright mountings £4. Order Ref. 4P24.

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

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

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

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

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

EAST CORNWALL COMPONENTS

BARCLAYCARD VISA

NEW, LARGER, MORE VARIED CATALOGUE NOW READY (includes Credit Tickets (3), Special Offer sheets, Order Form & Pre-Paid envelope) only £1.00 or free on application with any order over £15.
Prices in new catalogue and advertisement may vary as material for advertisement is prepared 6/8 weeks before issue of Television.

PRIORITY CATALOGUE ORDER
Name ....
Address ....
I enclose £1.00 cheque/P.O./cash for catalogue

SPECIAL OFFER APRIL

TV ANTENNA AMPLIFIER

T100 1-WAY KU700

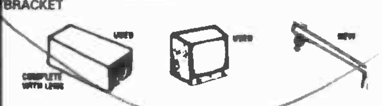
1 in 1 out antenna amplifier for colour and black and white TV. White plastic case with on-off switch, LED indicator and 1m lead.

Band width	300MHz-890MHz
Gain	7dB ± 1dB
Impedance	75Ω
Power	240Vac 50Hz
Dims	125 x 79 x 50mm

PRICE: £7.99

"CLOSED-CIRCUIT" TELEVISION SYSTEM

PRICE £150.00
Comprising: 1 × CAMERA 1x MONITOR 1 × CAMERA BRACKET



Illustrations not to scale. For guidance only — actual Items supplied may vary from those illustrated.

QUARTZ-HALOGEN SPOTLIGHT

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

£5.99

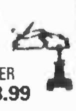
NI-CAD BATTERY CHARGER

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

NI-CAD BATTERIES

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

HELPING HANDS WITH MAGNIFIER £3.99



LOGIC PROBE

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

T.V. AERIAL ACCESSORIES

	1+	10+
Co-Ax Cable 75 Ohm 100 Metre Reel £11.00		
Co-Ax Metal Plug	20p	18p
Co-Ax Line Socket	25p	22p
Co-Ax Line Connector	12p	10p
Multiway Splitters		
In-line	85p	
Surface Mounting	50p	
Socket Splitter/Combiner	95p	
Socket Splitter/Combiner Switched	£1.25	
3-way	£1.40	
4-way	£1.75	
6-way	£2.40	
8-way	£2.55	
8-way Ideal for small hotels etc	£10.10	
Single Flush Mounting Outlet	.75	
Double Flush Mounting Outlet	.95	
Co-Ax Leads – 2 metres – PL/PL	.98	
Co-Ax Leads – 2 metres – PL/Socket	.98	
TV/Video/Computer Combiner 7042	£4.05	
TV Indoor Amplifier 7253 Improves signal 3 times	£16.95	
Second Set Amplifier 7243 Improves signal to 2 sets 50%	£15.75	
CB Interference Suppressor 9700 Minimises CB interference on TV	£5.55	
TV/FM Diplexer 9006 Separates UHF TV signals from FM radio signals	£4.95	

SOLDERING SECTION

Soldering Station complete with 30W or 40W Iron (state which)	72.50	Antex 15W iron	5.40
XS25 W Iron kit/complete with stand, 1m lead & plug attached	8.20	Antex 18W iron	5.80
		Antex 25W iron	5.80
CS17 Iron Kit	7.99	Antex elements	3.20
C15 Iron Kit	8.30	Antex bits	1.15
XS25 W Iron kit/complete with steel & plug attached	11.00	Antex stands	2.20
		Soldersucker	2.99
CS 18W, as above	10.90	Spare nozzles for Soldersucker	0.80

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

SOLDER: 60% TIN 40% ALLOY

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

20mm FUSES

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

1" DOMESTIC MAINS FUSES

2A, 3A, 5A, 13A — £1.00/10

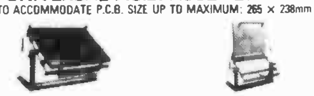
1¼" QUICK FUSES

500mA, 1A 1.25A, 2A, 12A — 50p/10

ANOTHER SPECIAL OFFER

UNIVERSAL P.C.B. ASSEMBLY JIG

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



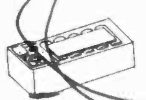
OUR PRICE £15.00 (NORMAL PRICE OVER £50.00)

12V Twin Fluorescent Lamp

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

	1+	10+	50+
PRICE	~~£5.99~~	£4.99	£4.50

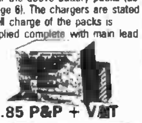
12 VOLT RECHARGEABLE UNIT



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

CHARGING UNIT FOR THE ABOVE 12V UNIT

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



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

OSCILLOSCOPES

COSSOR CDU150. Dual Trace. 35MHz. Delay Sweep. Dual State. Portable 8 × 10 Display with Manual.
Price £165.00 each
Carriage £10.00 each Plus V.A.T.
Other types of Oscilloscopes arriving all the time — telephone for info' on latest stock.

SIGNAL GENERATORS.

Marconi TF2002AS	72MHz, A.M. & F.M.	£120.00
Marconi TF2002B	88MHz, A.M. & F.M.	£120.00

CARRIAGE £10.00 + VAT

RESISTORS CARBON FILM 5%

¼W 1R0 to 10M (E12 Range)	2p each. 15p/10. 75p/100
½W 2R2 to 10M (E24 Range)	2p each. 15p/10. 75p/100
1W 10R to 2M2 (E12 Range)	5p each. 40p/10. 3.00/100
2W 10R to 2M2 (E6 Range)	8p each. 60p/10. 5.00/100

RESISTOR KITS – each value individually packed

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

ADDITIONAL KITS

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

SERVICE AIDS

Goldklene Degreasing Solvent	1.78	Aero Duster	1.56
Switch Cleaner Lubri	1.18	Super 40	1.94
Supa Freeze-it	1.46	Rapid Fire Extinguisher	3.46
Foam Cleanser	1.14	Silicone Grease Tube	1.82
Video/Tape Head Cleaner	1.40	Silicone Grease Spray	1.48
Plastic-Seal		Heat Sink Compound	1.20
Aero-Klene	1.16	Solda-Mop	
Anti-Static Spray ellist	1.28	Light guage 0.08mm	0.80
Excel Polish	1.24	Standatd gauge1.2mm	0.78
		Industrial reel 1.2mm	2.96

BT APPROVED EQUIPMENT

Master Socket (Flush)	£2.90	Extension Lead 5 Mtr	£2.90
Master Socket (Surface)	£2.75	Wiring Tool	36p
Secondary Socket (Flush)	£1.90	Plug – 431A	25p
Secondary Socket (Surface)	£1.70	Slimtel Phone	£17.35
B.T. Cable (per metre)	15p	Viscount Phone	£26.84
Per 100 metres	£12.00	Conversion Kit & Wiring Diagram	£6.90
Line Jack Cord with Plug	£1.25		

FM TRANSMITTER

Very High Quality 'MINI-BUG' – Ideal for Baby Alarm etc.!
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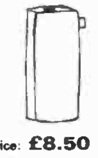

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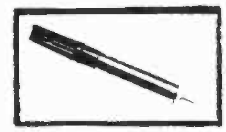

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See note on page 419.

COVER PHOTO
This month's cover photograph shows the panel layout in the B and O L/LX2500/2800 chassis. See article on page 424.

The Spares Business

The TV/VCR Spares Guide that comes with this issue is the fourth we've produced. When we compiled the first one in 1986 we thought that most of the spadework had been done. Just a matter, we felt, of a bit of checking and a few revisions next time. How wrong we were! We continue to be surprised at the extent of the changes in this section of the industry year by year. Each year we have had to reset the Guide completely – there just hasn't been enough of the old one left unaltered to make it worthwhile to preserve anything. It makes us wonder for how long the Guide continues to be useful once published? Maybe we should update it at six monthly intervals? Many of the important changes are included in the Teletopics column as they occur of course, and provided a listing of this sort doesn't get too out of date – yearly publication ensures that – it at any rate serves as a starting point: directory enquiries or someone at the other end will tell you about any changes that have taken place, though it's all very time consuming.

There have been deeper influences at work behind the mere changes of address, telephone number and franchises. For a start the role of the specialist component distributor has increased considerably in recent years. As far as manufacturers are concerned, spares have become an increasing headache. For a forward looking management concerned with the chassis after next and the way in which the market is evolving, the idea of having to devote time to the problems of yesterday's sets, many ten or twenty years old, is not looked upon favourably. Of far greater concern than management time however is the money locked up in stocks, the cost of storage and the expense of handling orders for lots of small items and lots of small (relatively) payments. Simpler by far to sell TVs and videos by the lorryload. There is too the hassle factor. Why isn't this item available and so on? Really the supply of spares is probably not logically a part of running a modern mass production operation – which is not to say that many firms don't continue to make a very good job of it.

The pressure on costs and profits in a highly competitive industry is probably the main factor that has led to so many major manufacturers deciding to contract out their spares operations. In-guarantee commitments to appointed dealers have to be serviced of course – and those dealers get a better service when the manufacturer isn't struggling under a mountain of orders for bits and pieces for items of every sort produced over an ever extending time span. For many, perhaps most, in the servicing industry today the first call for spares will be to a distributor rather than to a manufacturer's service department. It helps in many ways. Orders for a wide variety of items for different brands can be obtained from a single source, and the distributor knows perfectly well which bits are common to a number of manufacturers' models and can stock, supply and advise accordingly. Such firms are well placed to judge the needs of the servicing industry and to cater for a wide range of different equipment.

So CHG, CPC, HRS, SEME, Willow Vale and one or two others are playing an increasing role in the spares supply industry – and in the supply of accessories, service equipment and other items. It's a logical development, since separating the provision of spares from the manufacture and marketing of products for the mass consumer electronics market is a natural step. We have long wondered why a similar split hasn't occurred at the retail end, with the public buying from one type of outlet and getting its repairs done at another. This was common in the States at one time, though we don't know the exact position today. The disadvantage is that the service shop can miss out on a potential sale when an item obviously at the end of its life is brought in. But a nice little line in reconditioned sets can take care of that.

When the specialist distributors first started to take a larger share of the spares trade we wondered how they could make a go of something the manufacturers found so unprofitable? There seem to be several answers to this. First by buying in quantity at good prices, secondly in making use of modern order handling techniques, i.e. computerisation, and thirdly in aiming to provide a first rate, same day service to a large number of known customers with accounts.

All this leaves the dabbler and the individual customer increasingly out in the cold. Most distributors will not accept individual orders and few manufacturers will supply anything other than say a few cosmetic items to keep individual customers happy. You won't find that many shops are willing to go to the trouble of obtaining the odd spare part, especially for a make or item that's the least bit obscure. Maybe there's an opening for a small orders service of some sort?

A further major factor that has led to many manufacturers reducing their after sales service to the public is consumer legislation and the threat of litigation. Modern consumer electronics products are inherently safe, especially if manufactured to BEAB approved standards. This safety can however easily be nullified by the inexperienced operator. What then if an accident occurs? Could a manufacturer who has supplied parts in good faith be held partly responsible when a bodged repair results in an accident? This possibility has concentrated the minds of more than a few manufacturers and has led to a clamp down on the supply of parts by many of them, though it must be said that many others continue to take a very relaxed attitude – if you know exactly what you want and its part number and supply payment with order you will get your spare part. It's difficult to decide on the balance of public benefit in this respect.

The spares industry is a complex one that has been changing rapidly in recent times. Bona fide repairers have benefitted from this, but there are still possibly some unsatisfied areas of demand.

The Sony Trinitron Tube

Nick Beer

The Trinitron colour tube, designed by and used exclusively by Sony in all its colour receivers, was the first to have an in-line gun arrangement. It has a single gun assembly with three cathodes mounted in line horizontally, a striped-phosphor screen, an aperture grill with vertical slots instead of the traditional type of shadowmask, and a faceplate with cylindrical rather than parabolic curvature. The Trinitron tube produces a very good display – some people, including the author, would say the best. There are sound technical reasons for making this claim, for example the design of the large electron lens which provides excellent resolution. An advantage of the cylindrical in comparison with the traditional parabolic faceplate is the fact that most of the external light that falls on it is reflected away from instead of towards the viewer, thus improving the contrast and reducing eye strain. The Black Trinitron introduced a couple of years ago gives a further improvement in this respect (the faceplate has been darkened to a black colour).

Since the first Trinitron tubes appeared in the UK in the late sixties there has not been a great deal of change in the design, though a number of improvements have been introduced. More recently we have had the Black Trinitron mentioned above and the Pan-focus gun which gives uniform focusing over the entire screen area, eliminating any need for dynamic focusing.

The Trinitron Gun

Fig. 1 shows the basic Trinitron gun arrangement. Note that the beams cross over during their passage through the electron lens system. We have used the traditional UK A1, 2, 3 etc. system of electrode identification though Sony prefers G1, G2 (A1) etc. which is really more logical. Conventional tubes generally employ what is referred to as bipotential focusing, i.e. the first anode (A1, G2) is at about 800V while the focus electrode is at around 20 per cent of the final anode voltage (e.h.t.). With the Trinitron the A1 (G2) voltage is about 200-800V, the focus electrode (A3, G4) is at around 350-800V while A2 and A4 are internally connected to the e.h.t. voltage. The convergence electrodes act as an electron prism, deflecting the beams after their cross-over in the electron lens to ensure convergence at the aperture grill. This is where the horizontal static convergence voltage is applied. Most of you will have seen the large H stat controls in Sony TV sets. By adjusting this control well away from its correct setting you can see the effects of incorrect RGB beam convergence.

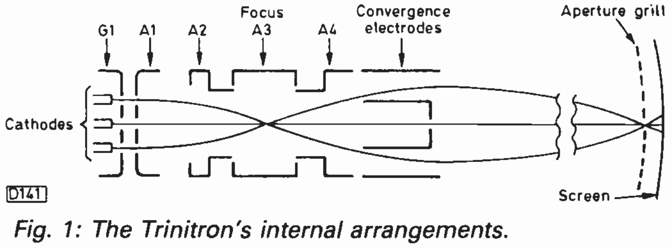


Fig. 1: The Trinitron's internal arrangements.

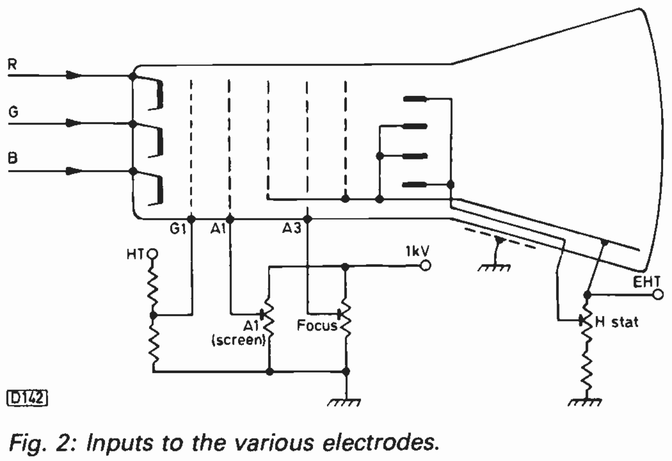


Fig. 2: Inputs to the various electrodes.

In the earliest Trinitron tubes the convergence voltage was applied via a connection on the tube's neck – you may recall the rubber boots on the neck of the tube in the KV1300! Subsequently connection was made by means of a two connection e.h.t. cap. In the latest tubes an external connection is not required at this end. Instead the arrangement is as follows. A high resistance (IBR) is incorporated in the neck of the tube, between the final anode and the convergence electrode. The potentiometer to control the horizontal static convergence voltage is connected to the earthy end of the IBR, enabling the connection to be made through a pin at the tube's base.

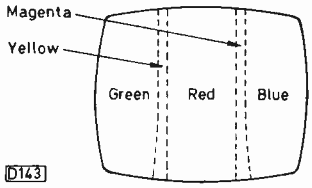
To improve corner focusing a "double astigmatic" lens is now used. What this means is that the holes in the G1 plate, which provides prefocusing, are now oval instead of circular. To improve the focus from the centre to the edge with large-screen tubes the Pan-focus system has been introduced. This involves a change in the position and angles of the cathodes and makes it unnecessary to apply a parabolic dynamic focus waveform to the focus electrode.

Tube flashovers can destroy costly devices in the associated circuitry, though they don't usually damage the tube itself. They tend to occur during only the first 100 hours or so of tube use. A flashover consists of a discharge from one of the high-voltage electrodes to one at a lower potential. To protect the external circuits the latest tubes employ Peak Current Elements (PCEs), which are basically high-impedance resistors, within the tube. There are two of these, one from A4 to A2 and the other in series with A3. In the event of a flashover a very high voltage will be developed across these PCEs, as a result of which the charge cannot reach the c.r.t. connections and external circuitry.

As with other types of tube the degaussing shield is now incorporated within the tube. It's made of low-carbon steel which has low permeability and a thickness of only 0·15mm. This reduces the size and weight of the receiver and also greatly simplifies tube replacement.

Setting up a Trinitron

Many readers will probably be more interested in the alignment of Trinitron tubes. In common with the conventional shadowmask tube in its modern form, i.e. with FS screen etc., the corner convergence and focusing are not



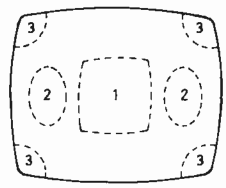


Fig. 3 (left): Display produced with the yoke pushed forward for purity adjustment. Complementary colours will be present between the primary colour areas. Adjust the purity rings to centralise the red area.

Fig. 4 (right): Areas affected by the methods of adjusting the purity. (1) Affected by the rings, (2) affected by yoke positioning, (3) corrected by using disc magnets.

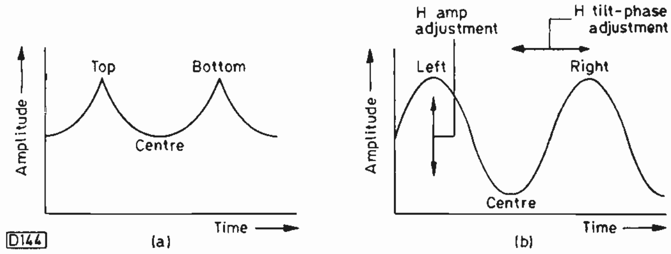


Fig. 5: Waveforms present at the dynamic convergence coils, (a) for vertical axis correction (field rate parabola), (b) for horizontal axis correction (line rate sinewave).

perfect. This is probably a side effect of the struggle to produce lower cost receivers, with more extras piled in for the same price. With the Trinitron tube however quite a lot of twiddling is possible to try to make the picture as good as possible. We've had our fair share of faulty (usually not worn out) Trinitron tubes in recent months. Reliability doesn't seem to be as good as with earlier versions. Some seem to set up quickly and accurately while others can take hours to get right. The following notes are based on Sony's recommendations plus our practical experience.

The usual reason for alignment is tube replacement. The deflection yoke will have been removed from the old glass, as will the three rubber bungs that stabilize the yoke.

While you are about this it's a good idea to dust out and clean the cabinet after removing the old glass. The chassis should also be cleaned – this is much easier when it's out of the set. Also clean the e.h.t. cap and lead thoroughly. Standard precautions when handling c.r.t.s should be observed: wear goggles at all times; discharge the tube before removal; do not lift the tube by the neck etc.

Transfer the degaussing coils, Aquadag braid etc. to the new tube, ensuring correct routing and securing of these items. Then fit the yoke, after first ensuring that the strip of adhesive fabric under the yoke's securing clamp has been fitted to the new tube – the new c.r.t. usually comes without this.

Once the receiver has been restored to operation, display a red raster from a pattern generator and degauss the tube. To be sure about this you may prefer to place the receiver looking west so that there is minimal interference from the Earth's magnetic field. Another point worth making here for the uninitiated is to make sure that no extraneous sources of magnetism are present near the set. Sources can include a loudspeaker, a screwdriver or an isolation transformer under the bench. Another factor that can cause problems is a metal-framed bench that has become magnetised – this is quite often the case. The effect produced by these sources of magnetism is a purity error that cannot be shifted.

Purity Adjustment

The next factor to deal with is beam landing. With the red raster still displayed, square up the display as far as you can then push the yoke as far forward as possible to produce the display shown in Fig. 3 – red in the middle with green and blue on either side. This effect is present because the deflection angle is incorrect. The red section of the display should be at the centre of the screen. If it isn't, use the purity magnets to move it to the correct position. Move the two purity rings together in a scissor action. Once the red area has been centred, move the yoke backwards until a full red raster is obtained. In practice small purity errors will still be present. Position the yoke for optimum purity then correct these small purity errors by using disc magnets that stick on the back of the c.r.t. – these magnets are available from Sony under part number 1-452-032-00. They are self-adhesive. Also available are disc magnets that can be rotated with a screwdriver to give fine adjustment – part number 1-452-094-00. Fig. 4 shows the effects produced by these three methods of purity correction. Secure the yoke in position with the three rubber wedges.

Convergence Adjustment

Finally we come to convergence. Display a crosshatch pattern from a pattern generator to show the convergence errors present. The aim of convergence is to superimpose the red, green and blue rasters correctly. Thus errors show up as red, blue and green edges to the crosshatch pattern. As with purity adjustment there are three stages.

First comes static convergence. Horizontal static convergence is carried out by adjusting the voltage applied to the convergence electrodes in the c.r.t. This affects the outer blue and red beams, not the centre green beam. Adjust the H stat control so that the vertical crosshatch lines are correctly converged at the centre of the screen – red and blue on green to give white lines with no colour separation. Two ring magnets are provided on the tube neck for vertical static convergence. Adjust the rings simultaneously for optimum convergence of the horizontal crosshatch lines at the centre of the raster.

You may find that in addition to the ring magnets there is an extra magnet, or maybe two extra magnets, at the base end of the neck. These are known as BMC magnets. The usual one is mounted horizontally to give a wider range of H stat adjustment. Move it in or out. In older sets a second BMC magnet may be mounted vertically to assist with V stat adjustment. You may find it necessary to add a BMC magnet when a new c.r.t. has been fitted. If you do, recheck the purity as a BMC magnet can have quite an effect on this. Part numbers for BMC magnets are quoted in the Sony service manuals.

Dynamic convergence corrects errors at the edges of the screen. With modern flat, square screens corner convergence is particularly difficult. Dynamic convergence correction coils are mounted on the yoke, behind the deflection coils. By altering the amplitude and phase of the waveforms fed to these coils (see Fig. 5) the beam deflection angles in these difficult areas can be altered. Vertical and horizontal correction waveforms are fed to the coils.

For vertical correction at the top and bottom of the screen an inverse parabola is used. Its amplitude is adjusted by means of the Y bow control. When this control is incorrectly set there will be separation of the red and blue horizontal lines to one side at the top and bottom of the screen.

Horizontal axis correction affects the vertical lines at the left and right of the screen. The drive waveform is this time sinusoidal, produced by an *LC* circuit from a line frequency pulse. The H tilt control balances the effect of the correction between the right- and left-hand sides of the screen by phase shifting the sinewave. The H amp control adjusts the amount of correction at both sides by altering the amplitude of the sinewave. The effects are fairly obvious. Misadjustment of the H amp control shows up as separation of the RGB lines vertically, at each side. If the effect is different at each side of the screen the H tilt control is incorrectly adjusted.

Corner errors, which can be stubborn and particularly annoying with teletext, can be corrected to some degree by using Permalloy stick-on magnets (part number X-4308-815-0). These are self-adhesive magnets on long strips of plastic. They are slid under the scan coils and stuck to the back of the tube. If after fine movement of these magnets you still have minute errors you will have to resign yourself to the fact that that's it. Don't waste hours trying with no evident improvement. Some tubes give perfect results, others don't – that's modern tubes.

Servicing Compact Disc Players

Part 2: Laser Assemblies

Joe Cieszynski

The optical assembly in a CD player incorporates a gallium arsenide laser diode, a laser power control circuit, a complex lens assembly and the photodetectors that provide output voltages corresponding to the recorded digital information and any focus and tracking errors. From the servicing point of view it's probably only necessary to be aware of the safety precautions required when handling the laser, to know how to set the laser power (this is not adjustable in later machines) and to know how to diagnose a faulty laser. A more thorough understanding of the optical assembly does however help you to understand the functions of the focus and tracking servos, helps you to interpret the waveforms in these servos and to decide where the fault lies when these waveforms are incorrect.

As CD players have evolved, several types of laser assembly have been developed and come into use. They can be divided into two basic categories however: three-beam and single-beam arrangements. There is not a lot of difference between them, but the single-beam type uses a unique method of obtaining a tracking error signal.

Three-beam Optical Units

Fig. 1 shows the basic elements contained in a three-beam optical unit. The various components are as follows.

The laser diode can be considered as a LED that operates in the infra-red region, at a wavelength of around 790nm. Unlike a LED however a laser diode is very sensitive to temperature and current changes. If the current increases fractionally as a result of a change of temperature the light output will rise very sharply. Because of the laser action this increased light output will produce a further current increase leading to additional light output and so on. The cycle of events can be likened to thermal runaway in a transistor. Because of this the laser's light output must be carefully controlled. An automatic photo output control (APC) circuit is used for this purpose. An example is shown in Fig. 2. Its operation is as follows.

The light output is monitored by a photosensitive device mounted next to the laser diode. This device's output voltage is then used to control a simple current regulator. In the Mitsubishi circuit shown VR991 sets the laser's power output at approximately 400μW, measured using a laser power meter. The output depends on the manufacturer and varies over a range of 250-400μW. Regulation is carried out by Q993 which is in series with the laser. The feedback from the monitoring device is applied to the base of Q991 which, via Q992, controls the current flowing through Q993. Once set the circuit will continuously correct variations caused by temperature changes and, in the long term, will compensate for the reduced output as the laser diode ages.

Intermittent jumping, failure to play certain discs or failure to play any disc can be caused by the laser's output having fallen to such an extent that the APC circuit can no longer provide compensation. Readjustment of the laser's output is sometimes all that's required, but with a well used machine it's unlikely that this cure will be long lived. A word of warning here. When resetting the power output take care to ensure that it's not turned up too high – this would greatly reduce the laser's life (rather like operating a colour tube for a long period of time with the first anode voltages set too high – the tube ages more rapidly). In fact in some machines it's possible to blow the laser instantly if the control is turned too far. We'll discuss the various ways of carrying out this adjustment later on.

In all later machines the APC circuit is capable of compensating for diode ageing right up to the point where the diode has virtually failed. This does away with the need for power output adjustment.

The next item is the diffraction grating. This consists of a plate with a number of slits. As the single beam from the diode passes through these slits it's split (by diffraction) into three, the power in each side beam being about 25 per cent of that in the main beam.

The polarising prism is used to separate the emitted and reflected beams. As shown in Fig. 1, the polarising plate allows the emitted beam to pass straight through the prism. By the time the beam has travelled through the prism and the quarter-wave plate, been reflected off the disc and then travelled back through the quarter-wave plate it will have been subjected to a 90° phase shift. When it reaches the polarising plate once more it will be reflected (bent) towards the pickup detectors.

By the time the laser's beam reaches the collimator lens it's elliptical in shape and is diverging. The collimator lens is used to correct the divergence, adjust the beam diameter and shape it into a circle. The principle of the collimator lens is shown in Fig. 3.

The quarter-wave plate is a crystal which has been cut

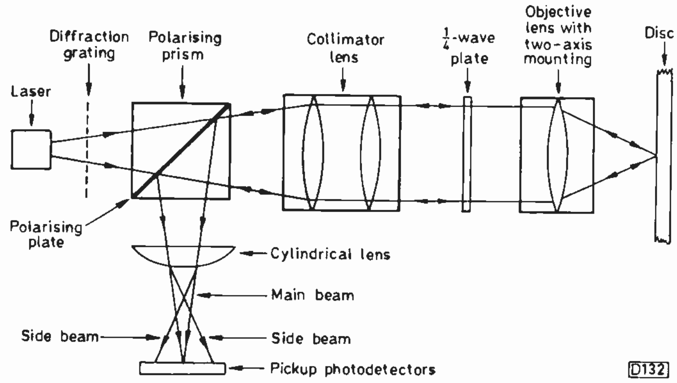


Fig. 1: Arrangement of the various items that comprise the T-type three-beam laser optical unit.

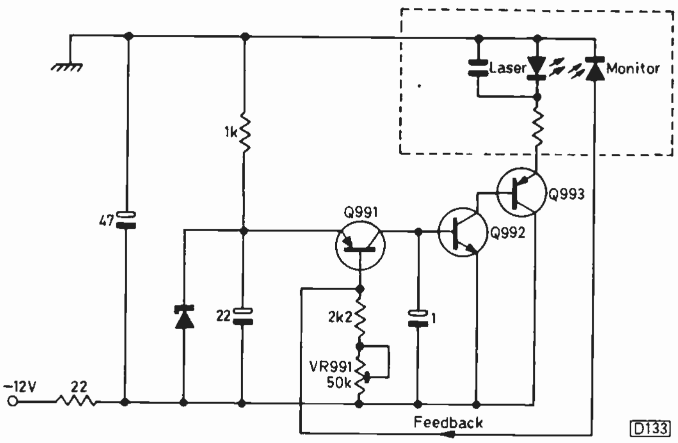


Fig. 2: Laser current stabilising circuit used in an early Mitsubishi CD player.

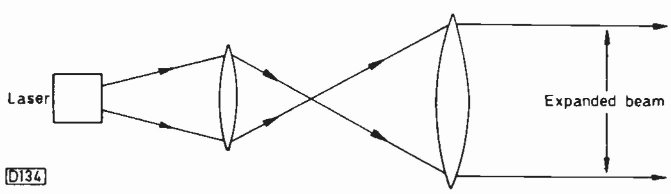


Fig. 3: Principle of the collimator lens.

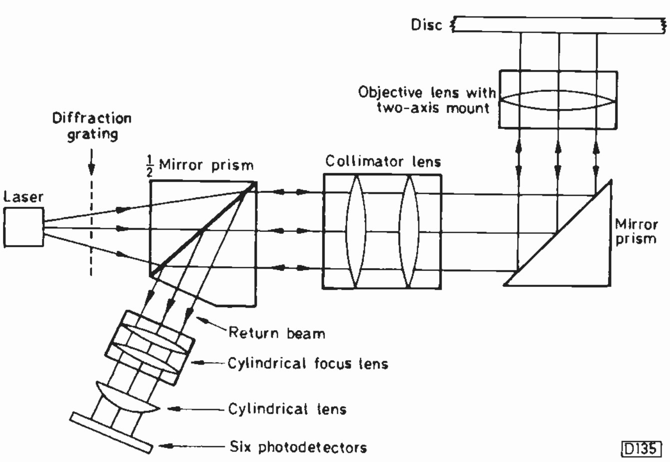


Fig. 4: Arrangement of the flat optical pickup (FOP).

so that light passing through it will be subjected to a 45° phase shift. Because the reflected beam in a CD player laser assembly passes through the quarter-wave plate twice it's subjected to a total phase shift of 90°.

The objective lens focuses the beam so that the spot diameter at the disc's reflective surface (not the outer surface of the disc) is 1·7μm. The diameter is set by moving the lens towards the disc until the pickup detectors give a reading corresponding to a 1·7μm circle. This lens is also used to focus the reflected beam.

Like the objective lens the cylindrical lens is an ordinary ground lens. It's used to focus the reflected beam on to the pickup detector diodes.

The T-type laser optical assembly shown in Fig. 1 was the first type to be used. With this type the laser beam is split into three, a main beam which is picked up by the four main photodetectors to give data and focus error outputs and two side beams which fall on two further photodetectors at either side to produce the tracking error signal.

The main problem with the T-type assembly is its comparatively large size. To reduce the deck size, and make possible the introduction of personal CD systems, a smaller laser assembly was required. For this reason Sony developed the single-beam assembly. It still left player manufacturers with some design problems which we'll go into later. A better solution was found in what is called the flat optical pickup (FOP). This is illustrated in Fig. 4: you will see that the polarising prism and quarter-wavelength plate have been replaced by a half mirror prism.

When light meets a half mirror prism fifty per cent of it passes straight through and the other fifty per cent is reflected. In the arrangement shown in Fig. 4 fifty per cent of the light emitted by the laser is reflected back and lost, the other fifty per cent passing through to the disc. Although the light reaching the photodetectors is only 25 per cent of the original beam it's still sufficient for accurate detection.

The advantage of this assembly lies not only in its small size. In the event of a disc having a minute mirror impurity the phase of the reflected light may alter slightly. With the T-type assembly this means that the phase of the light in the return beam is not at 90° to that of the emitted beam, resulting in incorrect reflection at the polarising prism and thus a dropout. With the FOP assembly the phase of the light is irrelevant. This type of assembly is thus not affected by such mirror impurities.

Single-beam Optical Units

We'll now take a more detailed look at the single-beam assembly, which was introduced a few years ago by Sony and Philips in an attempt to reduce the size of CD players. We've seen that the two additional beams in a three-beam assembly are used to produce a tracking error signal. The single-beam assembly has only four photodetectors which have to produce the data signal, the focus error signal and the tracking error signal. Although the Philips and Sony assemblies differ in the way in which they achieve this multiple use of a single reflected beam, in both cases the three signals must be separated from each other and this

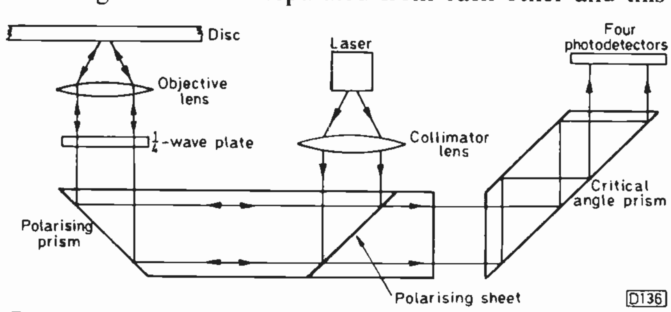


Fig. 5: Arrangement of the single-beam laser assembly used in some Sony CD players.

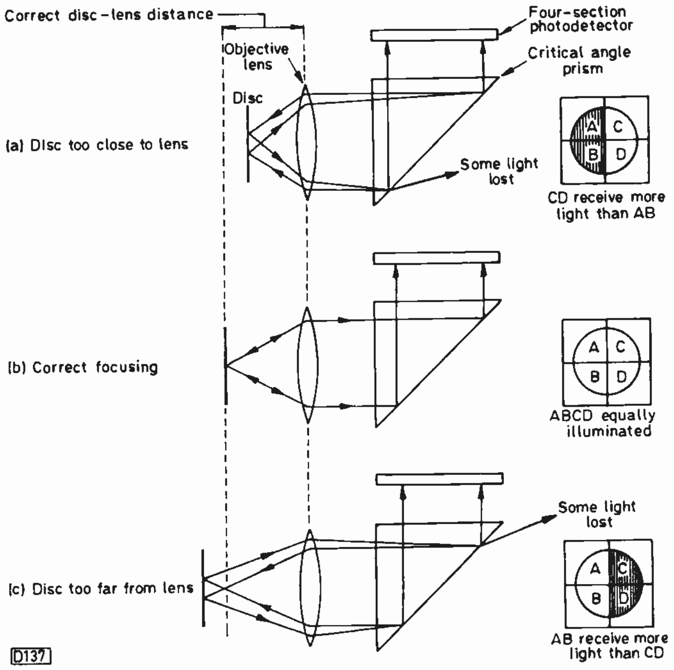


Fig. 6: Use of a critical-angle prism to obtain a focus error signal with a single-beam assembly.

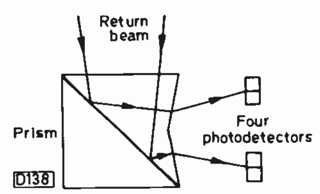


Fig. 7 (left): The Philips single-beam assembly uses a prism with a V cut at one side instead of a critical-angle prism.

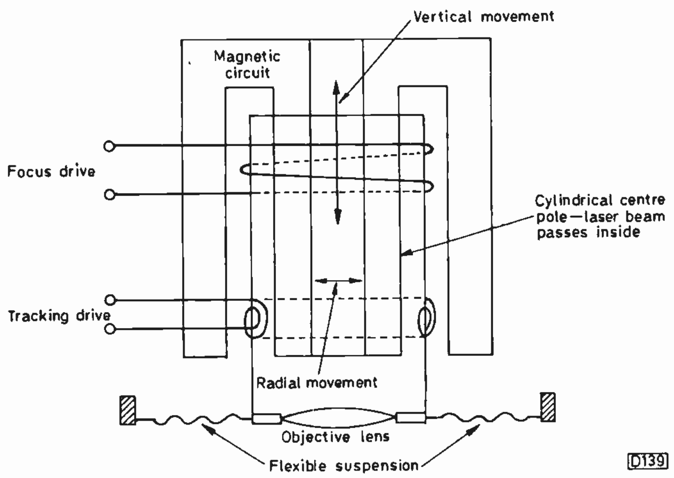


Fig. 8: Basic arrangement of the two-axis mounting for the objective lens, giving focus and fine tracking adjustment.

requires more complex circuitry in the laser preamplifier. This, coupled with the fact that the single-beam assembly still uses a polarising prism and is thus susceptible to mirror impurity effects, caused other manufacturers to opt instead for the three-beam FOP assembly. This trend has continued ever since. Whether or not an improved single-beam device will come to replace three-beam arrangements remains to be seen.

Fig. 5 shows the arrangement of the Sony single-beam assembly. If you compare this with the arrangement shown in Fig. 1 you will see that they are in many respects the same. The main differences consist of the omission of the diffraction grating, the changed position of the collimator lens and the inclusion of the critical angle prism.

The critical angle prism does far more than bend the beam through 90° and focus it on to the photodetectors. A brief description of its effect is called for. The prism is cut at a critical angle, 42°. Only when light enters at this angle will maximum output be obtained at the other end. Light entering at any angle other than 42° will not achieve a 90° turn, so the output will be reduced. In the Sony assembly – see Fig. 6 – the reflected beam strikes the prism at the critical angle only when it's a parallel beam, and this occurs only when the disc focus is correct. When the objective lens is too close to or too far from the disc the return beam will be either convergent or divergent. In either case part of the beam will be lost at the prism so that the light falling on two of the four pickup photodetectors will be reduced. From this the focus servo can determine the position of the object lens with respect to the disc. Fig. 6 illustrates the principle.

The Philips single-beam assembly differs from the Sony version in not using a critical-angle prism. Instead the prism is cut to a V shape at the side where the light emerges – see Fig. 7. As a result the beam is split in two. The four photodetectors are mounted in two pairs and are arranged so that the three signals (data, focus error and tracking error) can be separated. We will discuss this in greater detail when we come to servo systems.

The Two-axis Lens Mounting

To achieve correct focusing and tracking the objective lens is mounted on a two-axis arrangement with rubber supports, as a result of which it's free to move both vertically (for focusing) and radially (for tracking). Two sets of coils are wound on a former at the centre of which the lens is mounted. There are four permanent magnets in close proximity to these coils. The coil/lens assembly is suspended between the magnets, on rubber suspension mounts. See Fig. 8.

When a focus error is detected the servo alters the current in the focus drive coils, moving the lens towards or away from the disc until correct focus has been re-established. When the machine is in the stop mode, i.e. there's no current in the coils, the lens will be centrally positioned. When a disc is inserted the focus servo initially pulls the lens fully inwards (away from the disc) then moves the lens progressively outwards until correct focus is achieved.

The tracking servo keeps the beam on the correct track section – as shown in Fig. 3 last month, the track pitch is only 1·6μm. Those familiar with CD players will be aware that in most cases the laser assembly is carried across the disc on a motor-driven sled. This arrangement is sufficient for coarse tracking, but the motor and gear assembly cannot possibly work to a precision of 1·6μm. In addition the disc may be slightly eccentric on its axis, making the track "wobble" as the disc rotates. The tracking servo therefore controls not only the sled motor but also the current in the tracking coils. The current flowing in these coils produces radial movement of the lens assembly. Radial lens movement of typically $\pm 70\mu$m is achieved by the coils: once this movement is at its extreme the sled motor operates briefly, restoring the lens to its central position. This joint action of the sled motor and the radial drive can be likened to the operation of a linear tracking tone arm on a conventional audio disc player.

Having taken a detailed look at the different types of laser assemblies in use, next month we'll deal with more practical matters – laser handling, adjustment and fault diagnosis.

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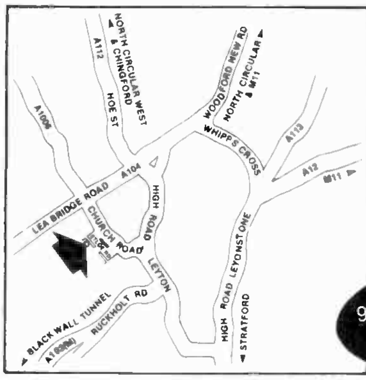

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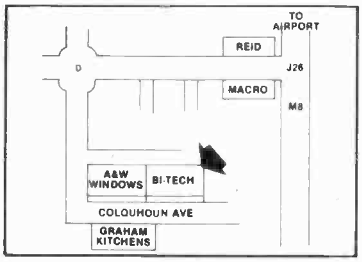

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Long-distance Television

Roger Bunney

1989 certainly got off to an encouraging start, with January providing four weeks of good reception conditions. Tropospheric propagation was present almost throughout the period, thanks to a stationary high-pressure system that loitered over Western Europe. The frequent tropospheric openings provided excellent signals, ducting, reception of numerous u.h.f. Danish TV2 transmitters, even Austrian Band III/u.h.f. signals in the Midlands. There were also F2 and SpE signals – a fine start to the year.

The first F2 reception was on the 5th, when a distant Russian ch. R1 signal was present at around 0830 for an hour. The 13th produced Arabic text and programming on ch. E2, at 0805-0903. The 15th was perhaps the most interesting day for F2 reception however: a ch. E2 signal that almost certainly came from Malaysia was received by both Tim Anderson (St. Leonards) and Garry Smith (Derby) between 0850-0920. Tim thinks it was a programme about knitting, with a multiburst test pattern as a floater. Garry logged Arabic captions and a programme about aircraft. He noted a clock at 1715, which strongly suggests Malaysia since this country is at +8 hours with respect to GMT. On the same afternoon Chris Howells (Lichfield) noted weak ch. A2 (525-line) signals for about two hours. At 0830 a Russian ch. R1 signal was seen. A further Russian signal was received at 1230, which is unusual since this is rather late – it's likely to have been a minimum hop distance signal, possibly from the Moscow region. The maximum sunspot count (273) occurred on the 13th.

With such a high level of sunspot activity it was not unexpected that auroral openings occurred. The dates here were the 11th, 13th, 15th, 16th and 17th, with a major event on the 20th and 22nd and the promise of a repeat performance on the 27th day of the solar cycle, during February.

SpE produced several minor openings and reception of isolated signals from time to time. The log is as follows.

5/1/89 YLE (Finland) ch. E3; NRK (Norway) ch. E2.
7/1/89 TVE (Spain) E2.
8/1/89 TVE E2, 3.
9/1/89 SVT (Sweden) E2; NRK E2; DR (Denmark) E3; RUV (Iceland) E4.
10/1/89 TVE E2, 3; ORF (Austria) E2a; ARD (W. Germany) E2; TSS (USSR) R1.
11/1/89 RAI (Italy) IA.
13/1/89 TVE E2.
14/1/89 TVE E2.
20/1/89 TVE E3.
21/1/89 YLE E3, 4; TVE E2, 3; TSS R1.
22/1/89 NRK E3.
27/1/89 TVE E2, 3.
29/1/89 TVE E2; SVT-1 E2 via auroral reflection.

The spectacular tropospheric conditions are still present as I write this at the beginning of February. Here in my valley location at Romsey, Hants RTL (Luxembourg) ch. E7 has been a fairly strong signal for much of the month. Following excellent signals during the first week the first major spell of activity was between the 15th-25th. Propagation was both conventional and via ducting. Highlights were ORF chs. E7, 8 and 24 (under Sandy Heath!), numerous W/E German signals, Denmark including the new TV2 stations, plus NRK and SVT in Band III and at u.h.f. There was classic ducting on the evening of the 18th with very strong W. German Band III signals here at Romsey along with signals from nearer co-channel transmitters. On the 20th Cyril Willis received TVP (Poland) chs. R7 and 8.

The excellent conditions continued up to the 25th. The mass of logs received detailing reception at particular locations make it very difficult to give an overall picture. Sufficient to say that on the 24th Simon Hamer in North Wales received Luxembourg ch. E7, Belgium chs. E3, 8, 10, 11, 28, 43, 44, 46, 49, 55, 62 and 63, Holland chs. E4, 5, 6, 7, 27, 29, 30, 31, 32, 34, 35, 39, 42, 45, 47, 50, 53 and 54, all the French Band III channels plus L22, 25, 28, 34, 35, 37, 40, 48, 52, 56 and 63, East Germany ch. E12, AFN (Holland) ch. A80, all the W. German Band III channels plus chs. E21, 27, 30, 34, 35, 37, 40, 48, 53 and 57, Denmark chs. E5, 8, 10 and 30, and NRK ch. E5. Tim Anderson's log at St. Leonards on the south coast tells much the same story but with more W. German signals (most channels in fact), more Danish signals plus Swiss Band III/u.h.f. signals and Austria ch. E8. On the 25th Mark Baldwin logged NRK Gausta ch. E8 at 3kW!

Reception opened up again on the 30/31st and on into February, with much the same story. Several DXers have reported reception of the Luxembourg ch. E36 transmitter. This is the Dusseldorf/ Burscheid outlet at only 20kW. It has been causing problems for VCR owners in that

Reception of a Saudi Arabian identification card by Ian Waller in Lincoln, via the 4GHz Arabsat satellite at 26°E.

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● **GRUNDIG'S SATELLITE TV RECEIVER**
For the coming of Astra Steve Beeching obtained a Grundig offset dish and STR20 tuner, one of the most widely available TVRO combinations, to see how they performed. He compared them with an earlier tuner and some larger dishes and found that they gave just as good results – except when the chicken got in the way . . .

● **OPERATIONAL AMPLIFIERS**
In Part 2 of his article on the subject Keith Cummins describes the basic practical uses for operational amplifiers, goes through a typical circuit design problem and also mentions some fault-finding pitfalls.

● **SOLID-STATE IMAGE SENSORS**
The next item to be covered in Camcorder Servicing is the solid-state CCD image sensor used in the latest generation of cameras and camcorders. How it works and the symptoms that arise under fault conditions.

● **TEST REPORT: LASER POWER METER**
Now that CD players regularly appear in the workshop a means of measuring the output from laser optical units is required. Nick Beer reports on the Leader LPM8000.

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area. We also have a report of the new NDR "Nordtext" being seen.

A letter from Ryn Muntjewerff reports similar reception conditions in Holland, but with signals from transmitters farther to the east – Czechoslovakia, Austria, Poland, "many" E. German stations, a Russian ch. R45 relay and signals from Grunten in the deep south of Germany on chs. 43/46. Ryn also reports seeing a new Czechoslovakian test pattern based on the PM5544 but with the identification "1 SR-P". On the 3rd Dutch DXers received Satander, Spain, chs. 40 and 56, a very good catch. On that day Tim Anderson logged the Basque ETB-1 ch. 35 and ETB-2 ch. 38 outlets.

Anthony Mann (Perth, Western Australia) comments on the excellent F2 conditions in his part of the world during late December. On the 23rd the Australian amateur VK3OT had two-way contact at 50MHz with OH2BA in Finland. On the same day Anthony received various ch. E2/R1/C1 Malaysian and Chinese stations via SpE/F2. On the previous day he received 50MHz amateur signals via double-hop SpE from New Caledonia, a distance of over 3,000 miles. Incidentally the Australian ch. 0 TV transmitter DDQ-0 now has a negative 80kHz offset, vision being 46·172MHz and sound 51·67MHz – ABMN-0 remains at 46·24/51·74MHz. Useful should you hear them on a scanner if F2 is that good!

R. Bengal in Bangalore, India, reports that he's been receiving many F2/TE and SpE signals, particularly from the Gulf area, using a 13-element ch. E5 aerial. We've suggested a wideband Band I aerial to improve his reception.

My thanks to the following for sending in comments and reception reports: Tim Anderson (St. Leonards), Garry Smith (Derby), Peter Schubert (Rainham), Cyril Willis (King's Lynn), Roger Fussell (Torpoint), Iain Menzies (Aberdeen), Simon Hamer (Powys), David Oliver (Birmingham), Mark Baldwin (Northants) and Ryn Muntjewerff (Holland).

Perhaps the main event of the period was the coming on air of Astra at 19·2°E. Over the space of a few days an increasing number of channels became available, doubling the choice of signals for suitably equipped viewers. Interesting that from the start of TV transmissions after the end of World War Two it took over thirty years for four channels to become available in most parts of the UK. Within perhaps two years from planning to transmissions via the Astra satellite we now have over eight channels and by the year's end there should be nearly twelve. I recall the lines "never mind the quality, look at the width" . . .

News Items

Finland: Relays transmitting the Swedish SVT-1 service are now operational in Helsinki. Further relays covering the greater part of the south/south west of the country will be opened during the next two years.

Spain: Regional broadcaster RTV Madrid is due to start test transmissions in April, with programmes from May 2nd. Another regional broadcaster due to come on air is Canal Sur, in Andalusia, based in Seville.

Italy: The mystery ch. E2 transmissions of the US originated CNN have been identified as coming from Telemarket. The UK Super Channel was also transmitted at times. These two offerings were transmitted during periods when Telemarket was not producing its own material.

Uganda: TV coverage is to be extended to nearly seventy per cent of the country via transmitters that are being commissioned by NEC at Lira, Mbarara, Masaka and Mbale. The equipment had been delivered some years previously but due to the turbulent political situation had never been brought into operation.

Nigeria: The broadcasting authority NTA has requested funds to update its radio/TV broadcasting equipment, much of which is now over twenty years old.

Poland: The Italian RAI-1 service is now being transmitted from Krakow on ch. R50, covering a radius of 70km.

Norway: NRK Rogaland (Stavanger) regional broadcasts are now being transmitted by Bjerkreim on ch. E6 and Bokn on ch. E8.

Shetlands: It's rumoured that the Shetlands Islands Broadcasting Company is transmitting Sky Television. Reception is apparently from a dish atop the studio building at Lerwick. Can anyone confirm this and provide further details?

Satellite TV Book

A second edition has been published of John Breeds' "Satellite Television – Installation Guide". I'd thoroughly recommend it for engineers, aerial installers and satellite enthusiasts. It's well produced with high-quality paper and clear text and layout and covers the essentials of signal propagation, satellite position (elevation/azimuth) with maps for various craft, dishes, mounts, electronic equipment, how to erect and align aerials, how to fit LNBs/polarotors, cabling, footprints, plugs – even how to calculate wall bolts/plugs for a mounting bracket. It clears up many of the questions a newcomer always asks. I wish the book had been available when I started with my first 90cm patio mount – even this humble system is dealt with. If you're in the trade or, like me, a satellite receiving enthusiast, this is the book you need! It's available at £11·95, including post and packing, from Swift Television Publications, 17 Pittsfield, Cricklade, Swindon, Wilts SN6 6AN.

Test Card Video

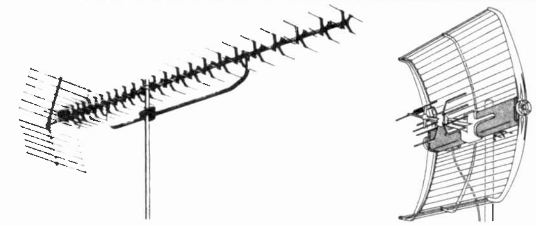
If you're into test cards, the new British Amateur Telvision Club video "The Development of the TV Test Card" will be essential viewing. In this one-hour video George Hersee, designer of BBC test cards, talks on the development of and different types of test cards that have been used, going back as far as Test Card A. He's interviewed by Andy Emmerson. The video is recorded on a three-hour VHS tape and costs £5 from Andy at 71 Falcutt Way, Northampton NN2 8PH – postage paid in the UK, add accordingly for overseas despatch. I've viewed the tape and can recommend it as being extremely interesting. Incidentally does anyone have a photograph or illustration of the old BBC Test Card B?

Amateur TV Activities – 1989 Contests

The British Amateur Television Club has supplied the following list of contest periods for 1989. These are periods when ATV operation will be very active, giving the TV-DXer the opportunity to receive signals with greater predictability than the usual random occurrences. If possible, listen to the ATV calling frequency – 144·75MHz.

The Spring Vision contest was from March 11th at 1800 GMT to March 12th at 1200. Sorry we didn't get that in before.

AERIAL TECHNIQUES



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The Summer Fun contest is from June 10th at 1800 GMT to June 11th at 1200.

The IARU (international) ATV contest is from September 9th at 1800 GMT to September 10th at 1200.

The Autumn Vision contest is on November 12th from 0001 to 2359 GMT.

The Winter ATV contest (joint European) is from December 9th at 1800 GMT to December 10th at 1200.

Soviet TV

Bernd Trutenau of the Benelux DX Club has supplied details of the Estonian TV network and the channel allocations. The following list includes only those transmitters likely to be seen in the UK via SpE.

Region	*Channel*	*Region*	*Channel*
Tallinn	R2 E, R3 L	Voru	R3 E
Tartu	R4 K1	Polva	R5 K1
Kohtla-Jarve	R1 K2, R5 L	Ruhnu	R5 E
Parnu	R4 E	Kallaste	R3 E
Haapsalu	R3 K1	Narva	R4 K1, R2 L
Rakvere	R3 E	Poltsamaa	R1 K1
Kunda	R1 K1	Sillamae	R3 K1
Jogeva	R5 K1		

E = Eesti TV, L = Leningrad TV, K1 = CT-1 (Russian first programme), K2 = CT-2 (Russian second programme, networked).

Test transmissions using the UK teletext standard are at present being carried by Eesti TV on weekdays from 1450-1500.

TV Fault Finding

Reports from Roger Burchett, Alfred Damp, Bob McClenning, Ian Bowden, Nick Beer, J. Olijnyk and John L. Howard

Rediffusion Mk 3 Chassis

The very large number of these sets in my area are beginning to suffer from tuning problems. This particularly affects the six-button Rodé-Stucky selector unit. It can be stripped and cleaned, clearing the problem, provided care is taken.

To remove the unit from the set take out two self-tapping screws in the front panel. Next remove the buttons by inserting a small screwdriver in the holes on the underside of the surrounding moulding and prising them off. The cover over the switches and lamp is removed by prising off with a screwdriver in the four slots. You will find that the circuit board is attached to the plastic carriage by four screws, two of which are not immediately obvious as they are covered by plastic plugs. Remove these and the board is free. The selector unit can be unsoldered after which the tracks, on a subpanel riveted at one end of the main panel, are exposed. Cleaning is then a simple job, with no fear of damaging the plastic. Reassembly is also simple. **R.B.**

Jackson Mk 2 Chassis

The models I've seen fitted with this chassis have come in the guise of the Triumph 8209. The soldering is not of the best and it pays to resolder the heavy wound components (chopper and line output transformers) and to check carefully with an eyeglass for dry-joints. The main one to date has been on R29 (27kΩ) which is mounted under the board. It tends to be held to the print at one end, with a "blob" of solder at the other end. Depending on how well this "blob" makes contact with the print the fault shows up as a curious slowness for the line to lock, intermittent line slip with colour drop out, or unlocked lines if you so much as breathe on the set. If the set is left too long like this the BU508D line output transistor TR15 will go short-circuit and soon after R125 (4·7Ω, 2W safety resistor) will go open-circuit. So if you come across a case of a dead BU508D in one of these sets, soak test it very carefully after checking the above points.

Intermittent colour on its own is generally due to a dry-joint on one leg of the crystal.

Spares for these sets are available (trade only) from Jackson Products Ltd. For the address and telephone number see under Harwood in the TV/VCR Spares Guide. **R.B.**

Thorn 9600 Chassis

After a very few occurrences of "flickering" – presumably due to h.t. variations, seeing what happened next – the mains fuse F1 blew violently. W533 was found to be short-circuit. This device is a BY299-1000 which is no longer available. The MR818 is a suitable replacement. Safety resistor R518 (1Ω) also went open-circuit. **R.B.**

Rank T22 Chassis

This one had received amateur attention and was non-operative. Once the 200V supply had been restored a check was made on 4R16 (910Ω) in the 12V regulator circuit. It was found to be still within tolerance, but 4D5 (BZY88C5V6), 4D6 (BZY88C6V2) and 4D7 (1N4148) were short-circuit, with scorch marks on the panel, and 4R58 (56Ω, safety) was open-circuit. When these were replaced the set started up but there was no raster. The TDA2532 RGB matrixing chip IC6 on the signals panel proved to be faulty. **R.B.**

GEC C2110 Series

For intermittent no colour, sometimes coming and going if you tap the board, clean the pins of the TBA560 chroma/luminance processing chip and its holder. A clue is that the luminance varies as well. **R.B.**

Philips CTX-S Chassis

In recent months we've had a number of these sets in with faulty chroma delay lines (type DL701). Symptoms range from intermittent loss of colour to permanent no colour or alternatively severe Hanover blinds. The latter fault can be tracked down to the delay line by tapping its case.

As in the later KT3 chassis it pays to clean the pins of the chrominance chip. These can also be responsible for the no colour symptom when dirty. **R.B.**

Philips 2A Chassis

This is becoming a stock fault with these sets. The reported fault is a dead set and you will normally find that the BU508 line output transistor is short-circuit. If so examine C2609 carefully for bulges and arcing around its legs – this will destroy the BU508. At the same time check whether R3601 (5·6Ω safety resistor) is open-circuit. It supplies the EW modulator. If it is you will usually find that C2616 has gone open-circuit. **A.D.**

Salora 16J20

The problem with this set was no picture, sound o.k. An article on the TDA3562 colour decoder chip, in the October 1987 issue, was the key to discovering the cause of the fault. A scope check on the sandcastle pulse input at pin 7 of this chip showed that the field component of the pulse was incorrect. Moving back through the circuit brought us to transistor TB400 (BC237B) which proved to be defective. Replacing this brought everything back perfectly. When scoping the field component of the sandcastle pulse it helps to remove the other components by isolating pin 7 of the TDA2594 chip – clearing the decks so to speak. **B.McC.**

Ferguson TX85 Chassis

This set was dead. The mains input fuse had blown, the TIPL791A chopper transistor had gone short-circuit collector to emitter and the TEA2018A chopper control/driver chip had an internal short from its 11V supply input (pin 6) to its non-isolated chassis connection (pin 2). The fuse, transistor and chip were replaced and the set was switched on. It appeared to be working normally, apart from a scream from the power supply. So the set was quickly switched off.

A meter was connected to the h.t. output (97·5V) from the chopper power supply to check that the regulation was correct and the set was switched on. The h.t. was correct, but after about fifteen seconds the fuse blew. We found that the transistor and the chip had once more failed. A thorough check was then made on the components in the power supply. This revealed that R101 (1·2kΩ, 5W) in the snubber network across the chopper transistor had gone open-circuit. When all these items had been replaced the set was o.k. **I.B.**

Ferguson TX90 Chassis

The customer had complained of intermittent lack of height which was of course due to dry-joints on the field output transistors, but when setting up the contrast etc. I noticed that there was a dark band down the left-hand side of the picture and severe ringing on low-contrast scenes. I decided to bridge the electrolytics in the video circuits and while looking for C132 saw a capacitor with electrolyte leaking from its top – C132 (10μF, 50V) in fact. It had a small hole in the underside, visible only after it was lifted upright. C132 decouples pin 4 (brightness control) of the μPC1365C colour decoder chip IC103. **N.B.**

Decca/Tatung 130 Chassis

This set had been in several times for intermittently going into the standby mode. Several things had been tried – the tripler, the BU426A chopper transistor, the TDA4600 chopper control chip, etc. As the fault was of such an intermittent nature I decided to change the line output transformer, suspecting an internal arc. This put matters right. **N.B.**

Decca 80 Chassis

We've had a spate of these recently with no sound and field collapse due to the relevant supply being absent. Rectifier diode D400 on the line output panel tends to go short-circuit. **N.B.**

Panasonic TX-C21 (U4 Chassis)

The customer complained that when he turned the sound up the picture went green! Now these sets have a fair audio output, but somehow this seemed unlikely. I was able to instigate the fault however by tapping around – particularly on the text panel. There were several suspect joints in the RGB interface section but the actual cause of the trouble was a peach of a joint at one end of jumper lead JF which connects pin 23 of the TROM chip IC5013 to R5063, running from top to bottom of the panel. **N.B.**

Salora 1G5

No picture with the c.r.t.'s cathode voltages high and the e.h.t. low was traced to a faulty IPSALO transformer (FM214). It had not broken down in the usual way, i.e. wires broken away from the transformer's pins, so a replacement was required. **N.B.**

Salora 24L67

The complaint with this set was of intermittent picture disturbance. A field engineer didn't see the fault and couldn't provoke it, so thinking that the aerial could be at fault he left the customer with a set-top aerial as a check. The next day another field engineer discovered that the fault was very sensitive to tapping in the middle of the single-board chassis. On the bench this proved to be so but no dry-joints or breaks could be found. Very precise tapping narrowed the source of the fault to the area left of the tuner, where even slight application of heat and freezer would instigate it. After a lot more prodding the cause of the trouble was found to be a break within R179 (100kΩ). No visible damage could be seen – maybe a poor connection to one end cap? **N.B.**

Tatung 130 Chassis with System 30 RC

This set was stuck on standby. Overriding the momentary-make contact on the mains switch produced the expected screaming from the line output stage, so the tripler's input lead was disconnected. When switched on again the set remained in standby but overriding the momentary-make contact this time got the set going, without a raster of course. After fitting a new tripler the set worked but only with the momentary-make contact overriden. So attention was turned to the microcomputer control system, which had probably been dealt a deathly blow by the offending tripler. Latch-on of the MAB8021 chip didn't operate but a new MAB8021 didn't improve matters. Replacing the 74LS293N flip-flop chip IR08 did however restore normal operation. The other clue was that the channel LEDs were corrupt. **N.B.**

Triumph CTV8210

This colour portable suffered from field collapse and the customer said he'd seen smoke coming from it. Both R930 (100Ω) and L905 (4·7mH) were open-circuit. The cause of the burn up was not far away. C914 (100μF) had a leak that measured about 2kΩ. **J.O.**

Philips KT3 Chassis

Not a fault but a point to bear in mind if a twiddler has been at work. With this chassis you get a white line that looks like field collapse if the height control has been turned right down. **J.O.**

Rediffusion 365138 (Mk 5 Chassis)

This colour portable was dead. As I'd no manual and didn't recognise the chassis I was on the point of giving up before I started. I noticed some high-value resistors in the power supply however, so I thought I'd check them. Bingo! R718 (120kΩ) was open-circuit. But this was not the end of the story. I switched on and the set was still dead. Cries of "oh dear!" – well I think that's what I said . . . Further investigation led me to R628 (1kΩ) which was open-circuit and the 2SD868 line output transistor which was short-circuit. Don't ask me what blew first. **J.O.**

Salora 22J21

There was no raster though the sound was o.k. A check at the c.r.t. base showed that there was no first anode (G2) voltage. The 2·2kΩ feed resistor had burnt out. As cold checks didn't show any leakage I examined the base panel and found evidence of tracking between the 1kV input and the BCL connection – surprisingly this lead didn't connect to any component on the c.r.t. base panel. After replacing the 2·2kΩ resistor and disconnecting the BCL lead the first anode voltage and hence the brightness were restored. Rather than risk a future call-back the damaged c.r.t. base panel was replaced. **J.L.H.**

Teletopics

SATELLITE TV

BSB's intention to apply for the franchise for the two other official UK satellite TV channels in the 12GHz band could result in some technical changes. There is a trade off between the number of channels and the output power. BSB's first satellite has five transponders but two were intended to act as a back-up: using all five would mean reduced signal strength, at any rate until BSB's second satellite is put into orbit in mid-1990. Reduced transmission power would affect the design of BSB's "squarial", which might have to be larger – 30cm instead of 25cm – and of wider bandwidth. BSB proposes to use adaptive pre-emphasis to improve the signal-to-noise ratio.

Sky Television's descrambler is to be activated by a smart card. A new card with a modified chip will probably be sent to subscribers every three months, when a change is made to the encryption control coding. In this way lapsed subscribers can be cut off. The cards are to be manufactured in the UK by a joint venture being set up by Sky's parent company News International. Production is to start in the autumn and the aim is to manufacture two million cards during the first year. The operation will employ around 400 people.

The separate £10 licence to operate a satellite TVRO installation has been abolished. Some 7,000 licences were issued, the cost barely covering the paper work involved. Abolishing the satellite TV licence does not affect the legal requirement to have a normal TV receiving licence.

The "to be announced" channel in our Astra list on page 357 last month is being used by MTV, the pop music channel.

Philips has joined the group of companies under contract to produce set-top units for the BSB services. The other companies under contract are Ferguson, Nokia and Tatung – BSB has said it will appoint up to five manufacturers who will have access to BSB's encryption/access control technology. Philips intends to establish production capacity to turn out 50,000 units a month and is strongly backing the use of MAC for satellite TV transmissions.

Ferguson has announced a range of equipment for reception of the Astra and BSB transmissions. Model SAP1 at £300 is for Astra, with a 32-channel tuner and 60cm dish. Model SAP2 at £330 has the same electronics with an 80cm dish. These models can be upgraded to provide unscrambling. Due in September is the SBP1 for BSB, with a 10-channel tuner, Eurocypher decoding and a Squarial. Two further models, the SAP3 (60cm dish) at £400 and the SAP4 (80cm dish) at £430, are due in December. These are for Astra reception and will incorporate Palcrypt decoding. So completely separate systems will be required for Astra and BSB.

SATELLITE TV INSTALLATION KIT

Connexions (UK) plc, Unit 3, South Mimms Distribution Centre, Huggins Lane, Welham Green, Herts AL9 7LE (0707 272 091) has introduced a professional satellite TV installation kit. It comes in a durable polypropylene case at an inclusive trade price of £129·95 plus VAT. The kit comprises a CX9102F aerial setting meter, CX9201 inclinometer, CX9202 compass, CX9200 crimp tool, CX9057 multimeter, CX9018 in-line amplifier, CX9056 insertion tool, CX9002 two-way splitter, CX9053 F-type coupler, CX9054 F-to-N adaptor, CX9055 N-to-F adaptor, 100 CX9051 F-type connectors and ten CX9052 protective weather "boots". The CX9056 insertion tool provides quick and easy application of F-type connectors to RG6 coaxial cable and is exclusive to Connexions. All items are available separately and can be obtained from Connexions distributors.

SUPER VIDEO

Sony has released details of the first equipment to use the Hi-Band Video 8 system. Basic details of this system, which brings Video 8 picture quality to a par with S-VHS, were given in the May 1988 Teletopics column. There are two models, the CCD-V900 camcorder at the equivalent of about £1,070 and the EVS-900 VCR at some £1,090. These are being released in Japan this April and no European launch dates have so far been announced. Sony is also releasing the first metal evaporated tape cassettes. There are three, the 60-minute version costing £9. Also being launched are five high-grade MP tapes, with the 60-minute version priced at £6. These new tapes can also be used with standard Video 8 equipment.

Meanwhile two more S-VHS camcorders have been announced in the UK. The JVC GR-S77E is a compact S-VHS-C model with 420,000 pixel CCD image sensor, 10-lux sensitivity, an eight-head system for SP/LP, two-speed ×8 zoom, a variable speed (1/50th, 1/250th, 1/500th and 1/1,000th sec) fast shutter, three-page digital superimpose and date/time recorder. The weight is 1·2kg and the suggested price £1,300. The full-sized Hitachi S-VHS camcorder Model VM-S7200 is being released in May. Features include ×8 zoom, four-speed fast shutter, VISS index system, self timer and edit search. The weight is 2·7kg and the suggested price £1,500.

BATC RALLY/CONVENTION

This year's British Amateur Television Club convention/rally is being held on April 30th at a new location, the Founder's Suite at the Coventry Crest Hotel. This is conveniently located on the A46, 500 yards south of junction two on the M6. There will be demonstrations covering all aspects of amateur and satellite TV equipment and a wide range of trading stalls. The hotel's training centre will be used in the afternoon for technical lectures. There is ample parking and the rally opens at 10 a.m. Admission is free to BATC members on production of a ticket from *CQ-TV*, 50p to non-members. Trade enquiries to G8CJS or G8OZP who are QTHR.

BROADCASTING NEWS

The Home Office has appointed the accountancy/consultancy group Price Waterhouse to study ways of privatising the BBC and IBA radio and television transmitter network. Price Waterhouse has been given just ten weeks to prepare a report. Privatisation of the transmission system was suggested in the recent government white paper on the future of radio and TV broadcasting in the UK.

In Japan NHK has now started daily trial HD-TV transmissions – a full service is to begin next year when two new satellites have been launched. The first transmissions were made during the Seoul Olympics, when NHK installed over two hundred HD-TV sets in public locations. These sets were hand built by several manufacturers and are reputed to have cost around £42,000 each. Sets on sale will not come cheap, in particular due to the large amount of digital storage required. The MUSE technique, which is used to provide bandwidth compression with NHK's HD-TV system, requires field stores and interpolation for motion detection correction.

The BBC has been taking out patents on an improved version of PAL. The idea is to monitor reception at the transmitter, assess impairments and produce a digitally coded correction signal which is transmitted in teletext form. Sets able to take advantage of the system would include circuitry to decode the error signal and provide correction. Other sets would simply ignore the extra signal.

PUBLICATIONS

The 1989 RETRA Year Book and Directory has now been published. Copies can be obtained from the Association's headquarters at £20 each – for the address see "RETRA on the move" elsewhere on this page. Contents of this impressive 256-page book include a points-to-remember section on useful legal and business information, a glossary of satellite TV terms, a section listing brand names and their manufacturers, an international TV systems/mains voltages list and addresses of leading manufacturers.

A new expanded and revised second edition of John Breeds' book "Satellite Television Installation Guide" has now been published. It's available at £11·95 inclusive of post (in the UK) and packing from Swift Television Publications, 17 Pittsfield, Cricklade, Swindon, Wilts SN6 6AN. It's certainly a very useful and practical work.

WILLOW VALE'S COPS

Willow Vale has introduced a computer ordering parts system (COPS) for the radio and television servicing trade. Dealers holding an account with Willow Vale can obtain a password which will give them on-line access via a PC with telephone modem to Willow Vale's mainframe computer for information on availability, prices, etc. for over 50,000 stock items. Advantages include access and ordering without manufacturers' part numbers, access and ordering with part numbers, actual on-line stock availability, part number information, prices and discounts, technical pages and hints, back order display/amendment/deletion, etc. COPS differs from other Viewdata type systems in being user-friendly and not requiring mandatory use of part numbers – all you need is the model number for which a list of parts is displayed in alphabetical order. Dealers not already so equipped can obtain from Willow Vale a terminal complete with modem for £350 plus VAT.

EXPANSION AT SONY BRIDGEND

Sony is to invest £36 million to increase production of colour TV receivers and Trinitron colour tubes at its Bridgend plant in South Wales. Bridgend is Sony's main European centre for colour TV receiver and tube production. Tubes and components made there are also used at plants in West Germany and Spain. It's anticipated that the expansion will create three hundred new jobs, many for people highly qualified in state-of-the-art automated manufacturing and surface coating technology. The initial announcement of Sony's intentions was made last Autumn and the new extension is due to be completed in May 1990. Sony already employs a workforce of 1,500 at Bridgend.

Matsushita (Panasonic) has announced that it itends to increase production in Europe over the next three years. It's likely that new manufacturing facilities will be located in South Wales where the company already has a major plant.

RETRA ON THE MOVE

After ten years at its Newington Causeway headquarters RETRA has moved to Bedford. The purpose of the move is to reduce overheads and improve the services offered to RETRA's 1,500 members. Council meetings will continue to be held in London. The new address is RETRA House, St. John's Terrace, 1 Ampthill Street, Bedford MK42 9EY, telephone number 0234 269 110. RETRA's new headquarters is a 3,000 sq. ft building near the town centre, close to the A1 and M1.

CORRECTIONS

Several errors in recent issues have come to our attention. First the computer program for satellite dish alignment, see page 354 last month. The colons in line 90 should have been the string escape character – this is available below and to the right of the break key. The program will not run properly with colons in line 90. There are also a few spacing errors which affect the displays obtained.

On page 351 last month (VCR Clinic) Panasonic NV-100/NV-10B should have been NV100/NV-V10B. Under the Ferguson FV11 on the same page the symptom intermittent failure to eject should have read tapes ejected when inserted. Nick Beer comments that dry-joints have started to appear on the take-up photosensor with this machine, making it go to stop. There was also an error in the article on S-VHS, page 334. VHS recordings *can* be made on S-VHS tape but not the other way round. When a non-S-VHS cassette is inserted the machine goes into the VHS mode irrespective of the selection made by the user.

In a letter on page 750 of the August 1988 issue the part number of the flywheel holder used in the GEC V4004/Hitachi VT33 was given incorrectly. The GEC part number is V7376323. The recommendation is to use this in the later GEC V4005/Hitachi VT63/64 to cure noisy operation.

A note on errors in the article on j notation (February 1989) is being prepared.

APOLLO LANCASHIRE

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Camcorder Servicing

Part 3

Steve Beeching, T.Eng.

So that it can display a full range of colours the screen of a colour TV tube is backed by phosphor stripes in the primary colours red, green and blue. In a similar though different way the faceplate of a colour camera tube is covered with colour stripes so that it can distinguish between colours. Although the tube's target covers most of the faceplate the area actually used consists of a 7·2 × 5·6mm rectangle – see Fig. 1. Within this area the purity of the target material and its sensitivity are kept within fine limits. The image from the lens is focused on this rectangle and to suppress signals outside this area the rest of the faceplate is covered with a black mask. The back-focus adjustment ensures that the distance between the lens and the tube's faceplate is correct. It's done with the lens set at infinity and the iris fully open.

The Colour Stripe Filter

For colour recognition the image area is covered with a precise fine-stripe filter. The main output from the tube consists of a wideband luminance signal (Y), or rather green. Stripes are used to obtain a red and blue carrier signal. By adding red, green and blue you get white. As the light transmission of red and blue filters is fairly low the filter instead uses the complementary colours yellow and cyan, thus obtaining improved low-light sensitivity. Cyan is −R and yellow −B of course. Feed the signals through inverting amplifiers and you get red and blue. It really is that simple!

The stripes are laid down diagonally as shown in Fig. 2, at an angle of 25° 40′ to the vertical plane. Their width is 13·95μm, there's a gap of 13·95μm between the stripes and the pitch is 30·89μm. The cyan stripes slope from left to right, giving a scanning sequence cyan, gap, cyan, gap etc. The yellow stripes slope from right to left, giving yellow, gap, yellow, gap etc. The colour pixels are the diamond crossovers, identified in Fig. 2 as lines n − 1, n, n + 1, n + 2 etc.

The filter stripes act not only as a colour filter. Their physical dimensions and spacing are arranged so that a signal with specific parameters is generated. As the electron beam scans the area behind the stripes it generates a complex signal determined by the stripe structure. Since the number of stripes along each line is fixed, a carrier signal is generated – think of a child running along some railings with a stick, generating a tone. With the VHS-C system the carrier generated in this way is 4·3MHz. Note that this is not the 4·43MHz PAL subcarrier: it's the camera's R/B carrier signal. Note also that the scanning width is critical: if you alter the tube's scanning width the carrier frequency will alter.

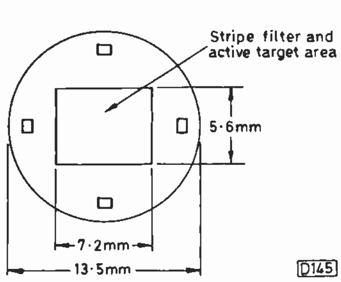


Fig. 1 (left): The camera tube faceplate.

Green is present over the whole filter area since white is R + B + G, cyan is B + G and yellow is R + G. The output from a Saticon tube thus consists of two superimposed signals, wideband luminance which you can call green if you prefer and a 4·3MHz carrier which contains the red and blue colour information. The carrier is amplitude modulated by the red and blue signal components which have a phase difference of 180°.

A little thought given to Fig. 2 will show how this phase difference occurs. Assuming that the line scan is from left to right, progressing down the target in the sequence n −

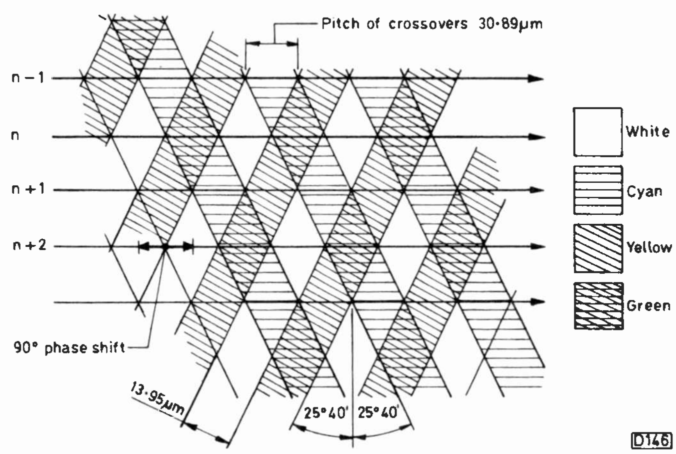


Fig. 2: The colour stripe filter arrangement.

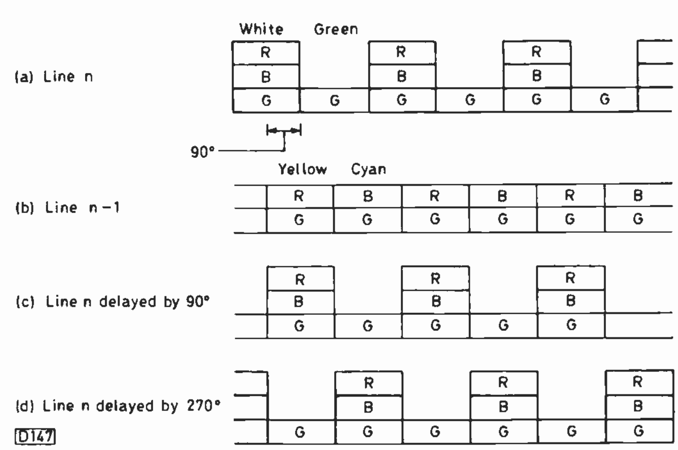


Fig. 3: Separating the R and B components of the R/B carrier signal obtained from the tube.

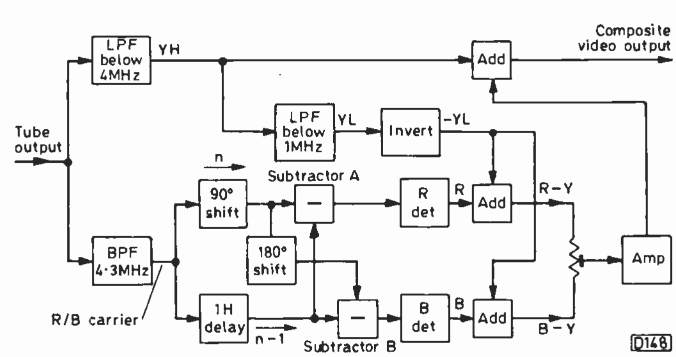


Fig. 4: Block diagram of the R/B signal separation system.

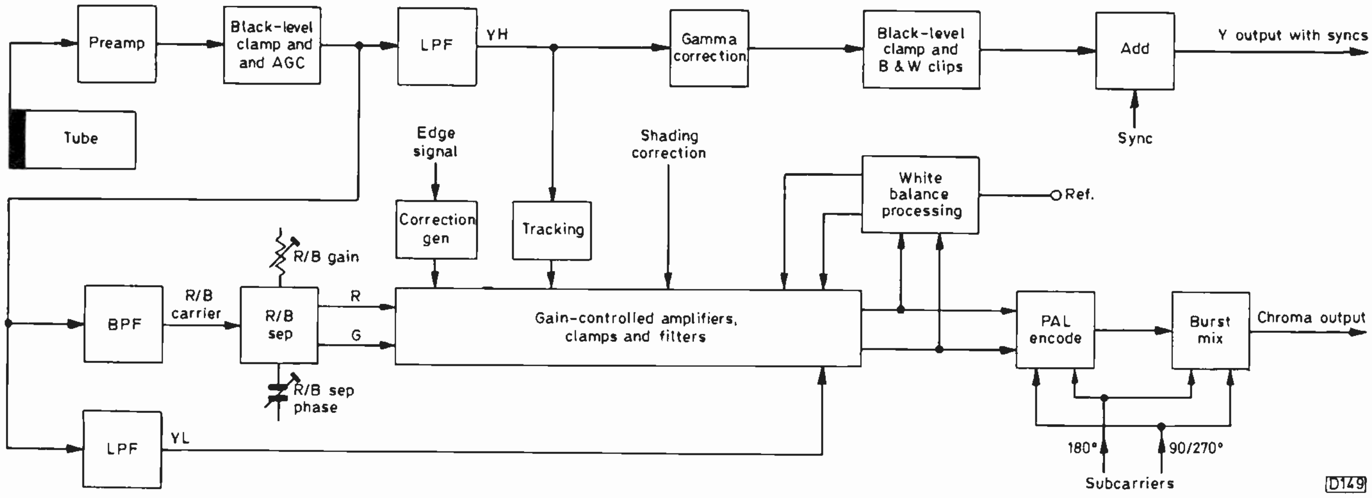


Fig. 5: Block diagram of a typical colour video camera using a pick-up tube.

1, n, n + 1, you can see that with the cyan stripes from left to right the cyan signal gets later and later on successive line scans. With the yellow stripes from right to left however the yellow signal occurs earlier and earlier on successive line scans. Now for the clever bit. The accurate 30·89μm stripe pitch means that the cyan signal is retarded by 90° per line while the yellow signal advances by 90° per line. A 180° phase difference is thus maintained between the two components of the colour signal on a line by line basis, enabling them to be separated in a similar manner to what happens in the decoder of a colour TV receiver.

Separating the R and B Signals

The outputs obtained from the arrangement shown in Fig. 2 are illustrated in Fig. 3. Use of a one-line delay line enables us to mix the signal from line n with that from line n − 1. Line n consists of white, green, white etc. As white is equivalent to R + B + G this is RGB, G, RGB, G etc. as shown in Fig. 3(a). The previous line n − 1 consists of yellow, cyan, yellow, cyan, which is R + G, B + G, R + G, B + G etc. as shown in Fig. 3(b). Note the 90° phase shift between lines n and n − 1.

The way in which the red and blue components of the signal are separated is shown in Fig. 4. The tube's output is fed through a low-pass filter to separate the luminance component and a 4·3MHz bandpass filter to separate the colour carrier. Line n's signal passes through a 90° phase shift network to compensate for the phase shift between lines, then to subtractor A and via a further 180° phase shift network to subtractor B. The signal from line n − 1 is present at the output from the 1H (one line) delay line and is fed to both subtractors. Thus n's signal has been delayed by 90° at subtractor A and 270° at subtractor B. These conditions are shown at (c) and (d) in Fig. 3. Subtracting n − 1, i.e. (b) in Fig. 3, from (c) and (d) gives

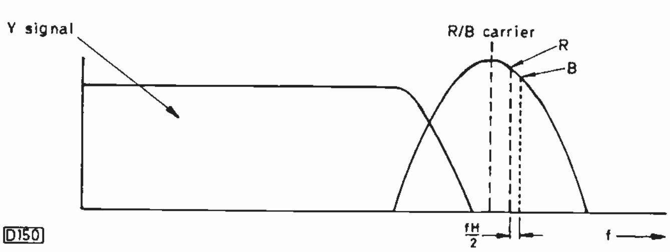


Fig. 6: Frequency spectrum of the tube's output.

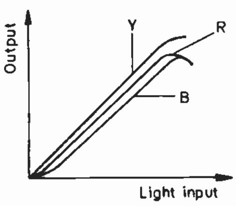
B, B, B, B and R, R, R, R respectively. After detection we get baseband R and B signals which, when added to − Y, provide the conventional R − Y and B − Y colour-difference signals. These are added to Y to give a standard composite luminance-chrominance signal. In practice things are a bit more complicated. The colour signal is clamped, tidied up and vertical edge correction is added.

Camera Block Diagram

Before looking at the rest of the processing we'll consider the overall camera arrangements. Fig. 5 shows a block diagram. The tube's output is first amplified by a high-gain, high-impedance preamplifier whose output is shown in Fig. 6. A.G.C. and black-level clamping are then applied after which the signal paths split, the full bandwidth luminance signal passing to the gamma correction circuit while a bandpass filter separates the R/B carrier and another low-pass filter (cut off above 1MHz) separates a Y signal component that's used to produce the colour-difference signals. The R/B signal is subject to the processing described above, a variable resistor (R/B separation gain) and capacitor (R/B separation phase) being used to ensure accurate separation of the R and B signals. Vertical edge correction is applied at this point to remove any discolouration in black and white horizontal edges in the vertical scan. After separation the R and B signals pass along parallel paths via voltage-controlled amplifiers, where correction waveforms are added for grey-scale tracking and colour shading. Two amplifiers are driven by the white balance circuits. These can give fixed white balance, set white balance or auto white balance. After clamping and filtering − Y is added. The following sections provide PAL encoding and addition of the burst signal.

Gamma Correction

As the tube's output is not a linear voltage change for a linear light input change compensation is required. This is called gamma correction. The problem is made more complicated by the fact that the levels of Y signal and R/B carrier obtained from the tube do not remain constant with respect to each other throughout the range of input light. At low light levels the R/B carrier amplitude is lower in proportion to the Y signal level. This cannot be allowed in a high-sensitivity colour camera as there would



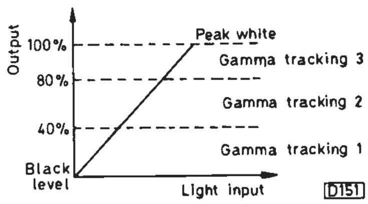


Fig. 7 (left): Camera tube light input/output voltage characteristic.

Fig. 8 (right): Triple-level tracking correction.

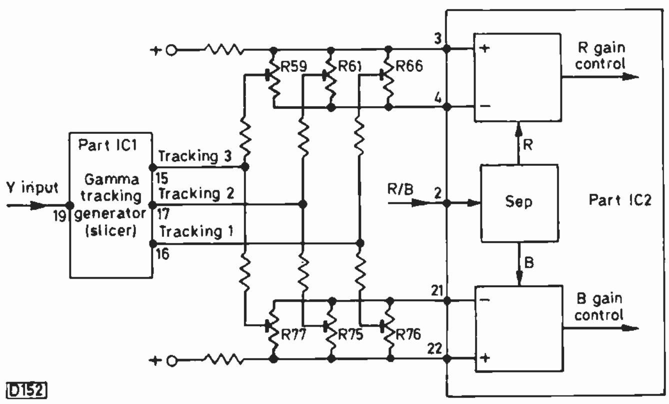


Fig. 9: Basic triple-level tracking circuit.

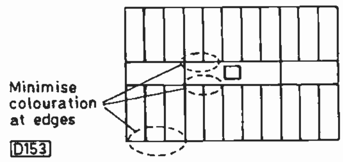


Fig. 10: Vertical edge correction adjustment.

be a tendency towards dark green pictures at low light levels when the R/B output falls off. It can be seen from Fig. 7 that the tube's sensitivity to blue is lowest, the red sensitivity falling between this and the higher Y sensitivity.

At mid-range light levels the sensitivity differences remain constant and can be equalised by gain adjustment so that the signals track together. At the extremes of low and high light however the red and blue signal levels fall off first. To prevent different tints at different light levels a triple-level tracking correction system is used. Fig. 8 shows the effect of this. Tracking (1) works at output levels up to 40 per cent, tacking (2) at between 40 and 80 per cent and tracking (3) at above 80 per cent. Tracking is

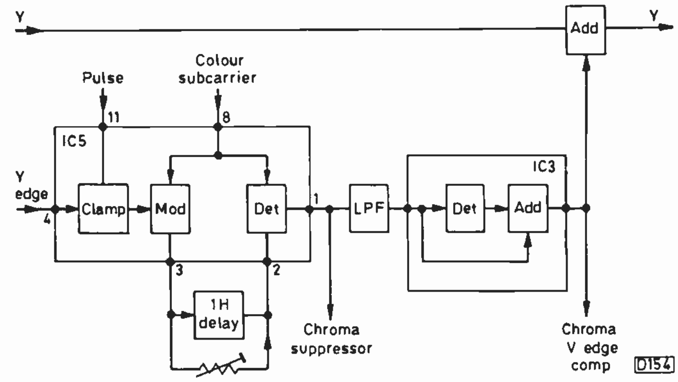


Fig. 11: Block diagram of the edge compensation system.

corrected by adjusting the gains of the red and blue control amplifiers against a Y reference signal.

A similar system is used in most camcorders, based on two chips – see Fig. 9. IC1 is referred to as the gamma tracking generator. It provides three outputs which are derived from the luminance input.

The output at pin 16 is clipped at 40 per cent. Thus luminance signals up to 40 per cent are supplied to tracking controls R66 and R76 to provide white balancing up to this level.

Pin 17 produces an output when the luminance level is between 40 and 80 per cent, white balancing then being via R61 and R75.

Pin 15 produces an output at high light levels, to R59 and R77.

It's not easy to adjust these controls without the correct lighting (3,200°K) and a grey-scale chart. The controls are interactive at the crossover levels of 40 and 80 per cent, and considerable interadjustment is required to get the whole grey-scale tracking correct. Usually a compromise is found. Peak white levels can be adjusted only if control over the automatic iris is possible or a small white area within a black background is illuminated to fool the iris control and open up the iris to provide peak white conditions.

Edge Correction

Better quality broadcast cameras have an aperture correction circuit to crispen the pictures by correcting transition edges in both the horizontal and vertical directions. VHS camcorders have a vertical edge enhancement circuit which works by mixing signals from direct and delayed TV lines – it's often referred to as contour

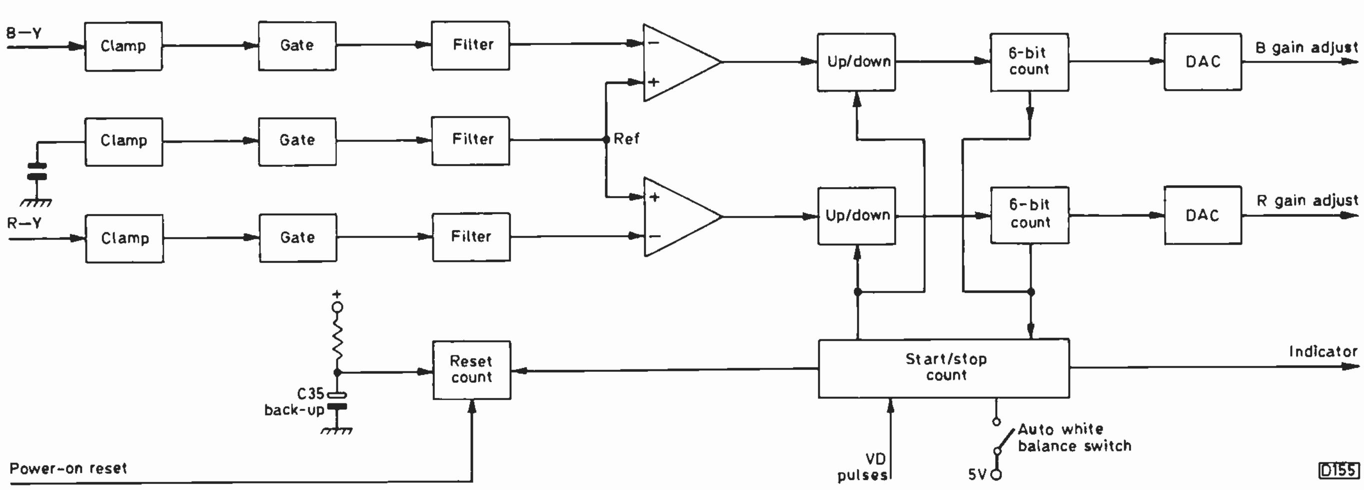


Fig. 12: The white balance system.

correction. This is tied up with the vertical edge correction previously mentioned in the colour separation circuit. If a picture has a dark grey area at the top of the screen and a white area below it the first white horizontal line would, without correction, be discoloured. This is because of the fact that the R/B separator circuit operates over two lines of signal, and since the line above is dark no previous colour exists!

Fig. 10 shows vertical edge correction adjustment. A grey-scale is used. When titled at an angle of about 20° any edge colouration can be seen and removed or minimised.

The edge compensation system is shown in Fig. 11 – its output is used for vertical edge enhancement and is also used for discolouration correction at horizontal edges. A Y edge input signal enters IC5 at pin 4. After clamping, the signal is amplitude modulated, using the colour subcarrier. The reason for modulation is to get the signal through the one-line delay line, after which it's detected (demodulated). A subtraction process occurs in the detector circuit as a result of which the output at pin 1 consists of only signals that occur on one line and not the next, i.e. a difference component. If the two lines concerned are as previously described, i.e. a change from dark to white, a single line output will be produced. This has to be seen at field rate and shows up as a single spike pulse. The output goes to the colour suppressor to kill colouration of very dark or black areas following a transition from white to black during the field scan. It also goes via a low-pass filter to a second detector in IC3 where low-level spikes and noise are removed leaving only clean, healthy spikes. These are added to the luminance signal to beef up the vertical resolution and are also applied to the vertical edge correction system in the R/B channels.

White Balance

The purpose of the white balance circuit is to reduce the colour-difference signals to zero when the camera is pointed at a white surface – despite the colouring effect of the lighting. Once this is achieved, in theory all other colours will be correct.

While the circuit may look complicated – see Fig. 12 – the operation is fairly simple. It's based on the two six-bit binary counters whose outputs are DA converted to obtain variable d.c. levels which are used to adjust the gain in the red and blue channels. The R−Y and B−Y inuts are clamped and gated and fed to two operational amplifiers whose other input is a reference level – you can think of this as a fixed green reference level. The circuit relates the red and blue signal levels to green so that R = B = G, which is white. When the auto white balance switch is closed the counters are enabled. Count up or down is determined by either a high or low output from the comparator amplifier in each channel, the latter output in turn being dependent on the difference signal being lower or higher than the reference level. As six-bit counters are used a total count of 64 is available. At power-on reset the count is 32, giving equal possibilities up or down. Counting is controlled by the VD pulses which occur once per field. When a balance is obtained, by a change of state at either comparator, each counter stops and produces the appropriate d.c. output. C35 can hold the count during power off for a few hours. If the counters reach either 111111 or 000000 without any change a warning is produced – the indicator gives a flashing signal: it produces a permanent signal to indicate

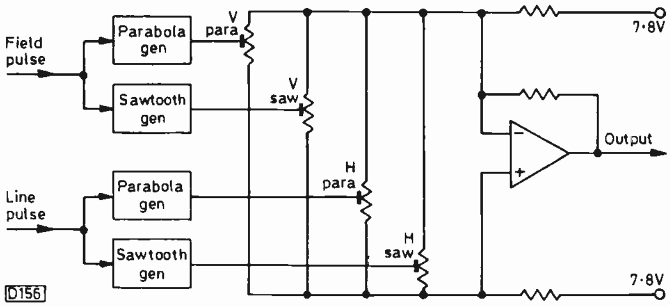


Fig. 13: Method of producing the dynamic focusing and the shading correction waveforms.

the balanced condition.

If the white balance is in the fixed condition the d.c. levels are set to a 1·8V reference. Camera adjustments are made in this condition.

Setting up and Fault Symptoms

So much then for an overall view of the camera section as used in JVC and Ferguson camcorders – Panasonic ones are similar. Adjustments should not be attempted without at least a good oscilloscope, e.g. one of the Grundig ones previously reviewed, and preferably a vectorscope. What about fault symptoms and areas to look at?

Any problem that reduces or eliminates the R/B carrier will turn the picture green – not necessarily all over. The scanning linearity over the target area must be uniform: any defocusing or nonlinearity will turn the picture green, i.e. areas of the picture will shift towards green.

Green in the corners or any part of the perimeter of the picture will be due to incorrect dynamic focus correction and/or poor focusing as the tube ages.

Red or blue shading can be corrected by means of the static shading (four) and red/blue dynamic shading (four each) controls.

The dynamic shading controls are set using a white card with an oscilloscope connected to the R−Y and B−Y test points. Adjust for flat lines at line and field rate.

The same test points can be used for horizontal linearity and dynamic focusing (four controls) adjustment but an R/B carrier test point (after the bandpass filter) is much better. This will give you a typical carrier waveform with a ghostline across the centre. Use a white card. Scanning and dynamic focus adjustments should aim for a flat-topped symmetrical rectangle, nice and straight with no falling off at the start and end and with the ghostline in the middle. This takes practice. The first time anyone sets up a camera it can take days rather than hours – with the option of cocking it up completely and sending the camera along to me with a blank cheque!

Parabolic and sawtooth waveforms at line and field rate are used for dynamic focusing, for R/B dynamic shading correction and for static shading. Fig. 13 shows the basic circuit arrangement.

Static shading adjustment is carried out with the lens cap on, monitoring the YH (full bandwidth luminance) signal, to get flat lines at line and field rate.

Static focus is adjusted on a white card while monitoring the R/B carrier.

When carrying out dynamic focus adjustment be careful that the correct setting isn't masked by incorrect shading adjustment.

The control arrangements differ somewhat with different cameras/camcorders. For precise setting up instructions for a particular model refer to the relevant manual.

Before making any of these adjustments the correction waveforms must be reduced to zero (flat) irrespective of the picture. It all takes a long time to do and may not produce better results if the tube's emission is low. Beware – an aged tube will have inconsistent sensitivity over the target area, producing shading and a poor grey scale. You cannot get rid of this by using the adjustments, particularly if the tube has a poor lag characteristic or a tendency to green at low light levels.

Failure of the R−Y signal will produce a picture that's mostly green and yellow, with no reds at all. Failure of the B−Y signal will product a picture that's all reds and purples with no green. It's also possible to get just chroma, i.e. a dark picture with only red and blue highlights. This indicates a failure in the luminance signal (YH) path.

If the vertical scanning is incorrect the Y signal circuits can clamp on video, reducing the Y signal and turning the picture magenta. This can often be verified by aiming the camera below a window or other bright light source and then tilting it upwards. If the picture turns magenta when the bright light hits the top of the picture, adjust the vertical centring and/or height until the picture is linear without the effect being present.

In the next part we'll deal with the CCD (solid-state) image sensor.

The B & O L/LX2500/2800 Chassis

Nick Beer

The Beovision L2500, L2800, LX2500 and LX2800 chassis are used in models with type numbers in a series 37XX, e.g. 3701, 3702, 3712, 3720, 3741, 3752, 3760 and many others. As the chassis numbers suggest, there are 25 and 28in. models. LX sets come complete with teletext while the L sets can have a teletext panel fitted if required. The cabinets are teak, rosewood or "White Line". Fig. 1 shows the panel layout.

The sets are typically B and O, with high-quality finish, an excellent picture and superb sound, also flexibility of use/presentation. For example, a set can be used as the central item in the B and O Link System, in which compatible hi-fi, TV or video equipment can be controlled and operated via a remote control unit and a Beolink terminal or Master Control Panel. So you could say watch TV or video then select a track on your compact disc player and listen to its output via the stereo speakers of an LX type set. There's an LX-sat satellite TV decoder which, installed in the main receiver, can provide the display on a remote set in another room while the main set continues to provide terrestrial TV reception or VCR playback. We shall have more to say about the Link System in a later article.

As you might expect, with provision for so many features and B and O's reputation for fitting twenty per cent more components than are basically necessary, the circuit is rather daunting. Once you understand the workings of the set however you should have little difficulty in tackling faults. The few troubles we've experienced to date have been fairly simple ones.

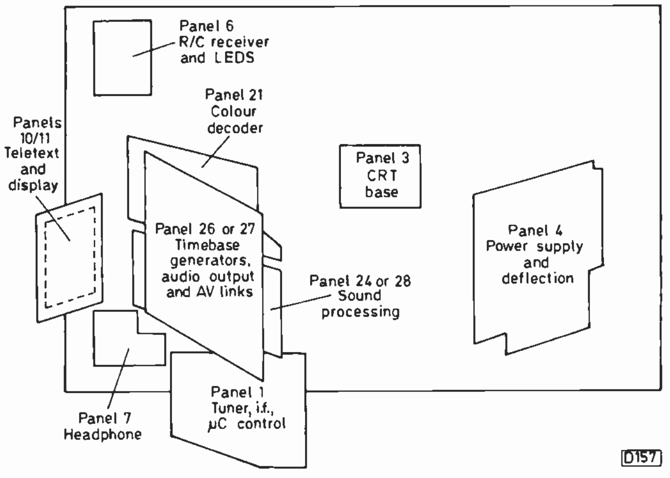


Fig. 1: L/LX2500/2800 chassis panel layout.

The most common fault so far has been failure of the mains switch. It's one of only two controls on the set, the other being a channel-step button. The mains switch brings the set into operation in the standby mode. Full operation is obtained when channel selection (or step) is used. What often happens is that the mains switch fails to latch. Fitting a replacement can be tricky. In view of this when we instal a set we usually advise against frequent use of the mains switch, suggesting instead operation via the remote control unit.

The Microcomputer Control System

To understand these sets it's important to know a bit about the microcomputer control and data bus system, which is outlined in Fig. 2. Operation of the set is controlled by three microcomputer chips which act via three bus lines. These buses are of the I2C type, i.e. each has two lines, one for serial data and the other for the clock signal. Arbitration is used to sequence/organise communication between the various devices in the control circuitry, to ensure that the correct overriding etc. takes place.

Two of the microcomputer control chips, 1IC6 (type MAB8461) and 1IC5 (MAB8441), are on panel 1 along with the tuner and i.f. circuitry. The set's main control line is Bus 1 which is controlled by 1IC6. Its serial data output is at pin 2 and its clock output at pin 3. This bus provides the control link to the tuning interface and memory, to 1IC5 which controls Bus 2 and to 24IC10 (on panel 24) which controls Bus 3. Bus 1 also controls the brightness, contrast and colour, via the SAB3037 DA converter/decoder chip 21IC3 on panel 21. 1IC6 receives data from the remote control receiver at pin 12, which also receives Link System information from the Aux 1 socket. Remote control information from the VCR is fed into and out of the set via pin 8 of the scart socket, entering 1IC6 at pin 27. The AV remote control information from the Aux 3 socket enters at pin 26.

Power failure detection is also carried out by 1IC6, sensing being at pin 1. Fig. 3 shows the arrangement. The two transistors 1TR22 and 1TR15 provide a high input at pin 1 in the event of a fault being sensed on one of the lines they monitor. 1TR15 senses a number of supplies in

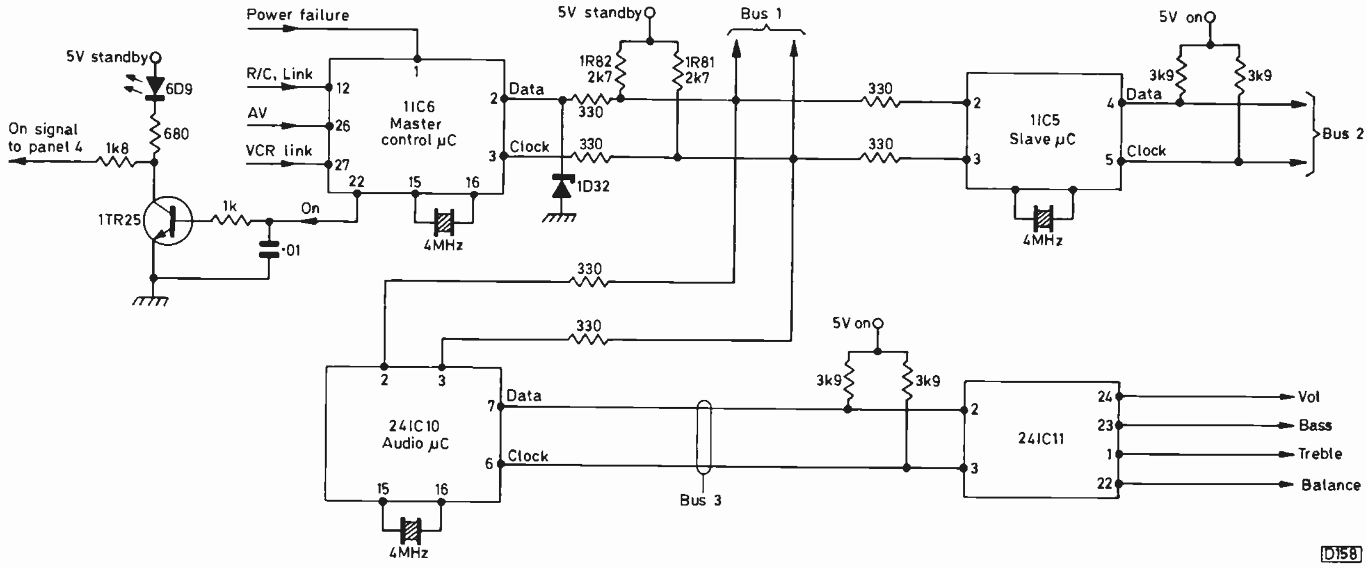


Fig. 2: Outline of the microcomputer control system.

the set, also the beam current, via a diode gate arrangement. 1TR22 monitors the supplies derived from the 17V line. When pin 1 of 1IC6 goes high the set goes into the standby mode.

The slave microcomputer 1IC5 controls the display panel (11) in L models and the teletext panel (10) in LX models, via Bus 2. Its serial data and clock pins for this bus are 4 and 5 respectively.

The third microcomputer chip 24IC10 (MAB8410) on panel 24 controls the SAB3037 chip 24IC11 via Bus 3. 24IC10 receives Bus 1 information on pins 2 (data) and 3 (clock), its outputs to Bus 3 being at pins 6 and 7. The SAB3037 acts in the same way as 21IC3 but this time provides d.c. outputs to control the volume, bass, treble and stereo balance.

For the serial data and clock signals to be transmitted along the relevant lines a d.c. level is required. The Bus 1 lines are pulled up to the 5V standby potential via 1R82 (data) and 1R81 (clock). In addition the data line is protected by the 5·6V zener diode 1D32. These items are suspect if there's no pull-up voltage and thus no data transmission along Bus 1. 1IC5's Bus 2 lines are pulled up to the 5V on rail as this chip does not need to be active in the standby mode. The Bus 3 lines are likewise pulled up to 5V on.

Circuit Features

We will now take a brief look at some of the main circuitry used in these sets, starting with the chopper power supply – see Fig. 4.

When going from standby to on the voltage at pin 22 of 1IC6 (see Fig. 2) goes low. Thus transistor 1TR25 switches off and pin 3 of the operational amplifier chip 4IC1 (Fig. 4) is positively biased from the 5V standby supply. The other input, pin 2, of this section of 4IC1 is held at 2·5V by a zener diode stabilised feed. The output voltage at pin 1 of this chip therefore rises to 15V. As a result, 4C23 charges via 4D26 and 4R32, producing a positive-going ramp which is fed via 4R31 to the emitter of 4TR4. This transistor with 4TR5 form a regenerative switch. When 4TR4's emitter becomes positive with respect to its base it switches on, in turn switching 4TR5 on. 4C23 is then discharged via 4R34 and 4D23. The low voltage at the collector of 4TR5 when it switches on is fed back to the base of 4TR4 via 4C21 and 4R23. Thus 4TR4/5 are held on. As 4C21 discharges via 4R30 4TR4/5 unlatch. The sawtooth voltage thus developed drives 4TR6, the chopper driver transistor, which in turn drives the BU508 chopper transistor 4TR1 via 4T3. Note that 4T1/2/3 provide mains isolation. For timing and regulation, a negative-going pulse derived from winding 17-18 of the chopper transformer 4T1 is fed to the base of 4TR5 to control its switch-off time. The pulse obtained from 4T1 is an exact replica of 4TR1's collector waveform. It's clipped by 4R36, 4D28 and 4TR16 to produce a squarewave which is then differentiated by 4C22 and 4R27 to obtain the negative-going pulse that switches 4TR5 off. With 4TR4/5 off, 4C23 can once more begin to charge. The circuit is thus self-oscillating.

In the TV mode, regulation is based on monitoring the 150V h.t. supply produced by 4D6/4C10. A tap on the potential divider 4R8/37/90/38 feeds pin 6 of 4IC1. The other input pin of this section of 4IC1 is held at 5·1V by the action of zener diode 4D24. The error output at pin 7 of 4IC1 sets the bias at the base of 4TR4 and in consequence the point at which this transistor switches on. This regulation loop is kept stable by the action of 4C19 and 4R28.

In the audio only mode the 150V rail is not loaded and cannot be used as the basis for regulation. In this mode the 17V supply is used as the basis for regulation, via 4D47 and 4D48.

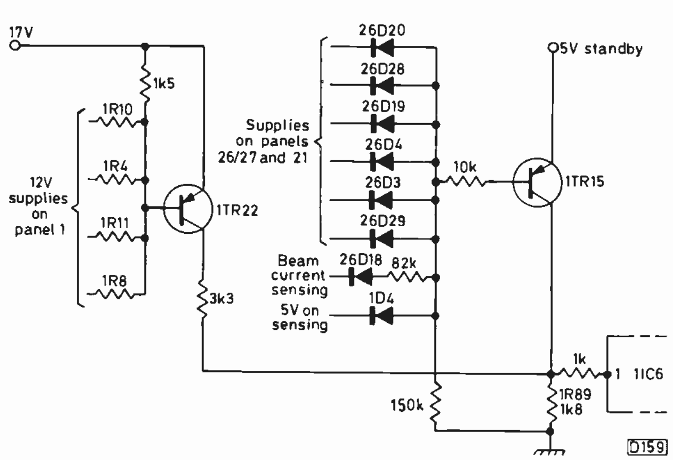


Fig. 3: The power failure detection circuit.

During start-up 4C23 charges via 4D26 from the 17V standby supply. When running 4C23 charges via 4D25 from winding 17-18 of 4T1. Since the voltage here depends on the mains input, the charging of 4C23 will vary as the mains supply varies, thus providing stabilisation against changes in the mains input.

The regulation provided by this circuit is certainly impressive. The set will run on 60V (and that's with a 28in. c.r.t.!) and will start up with a 150V input.

The line output stage is conventional, using a BU508 (4TR11) line output transistor, a diode-split line output transformer, and a diode modulator for EW correction. The line output transformer provides the e.h.t., first anode, focus and c.r.t. heater voltages and also the +12V and −12V supplies used by the TDA2170 field output chip. The line drive signal is generated by a TDA1940 chip on panel 26/27 and is fed via 26/27TR3 to panel 4 where four transistors (4TR8/9/10/15) are used in the driver stage (no driver transformer). The purpose of 26/27TR3 is to act as a switch to remove the line drive in the audio only mode – this prevents e.h.t. generation.

The field sync pulse output from the TDA1940 chip on panel 26/27 is passed to the colour decoder panel 21 and then back to 26/27TR21. This transistor's output is used to control the field oscillator, which consists of an LF353 dual operational amplifier chip (26/27IC6). Half of another dual operational amplifier chip, 26/27IC7 (LF358), acts as the field preamplifier which drives the TDA2170 on panel 4. The other half of 26/27IC7 provides EW drive. The TDA2170 drives the field scan coils directly – this is made possible by the energy efficient c.r.t. deflection system.

The field oscillator runs at 47Hz to allow for graphics injection (e.g. tuning information) with no signal and thus no sync. The sync provides the extra three for 50Hz.

Two TDA2040 chips on panel 26/27 provide 15W of audio output per channel at 8Ω. Each channel has a 4in. woofer and 2in. tweeter, with external speaker options.

Table 1: Tuning Display Frequencies

Channel	*On-screen display-MHz*	*Channel*	*On-screen display-MHz*
21	471	46	671
22	479	47	679
23	487	48	687
24	495	49	695
25	503	50	703
26	511	51	711
27	519	52	719
28	527	53	727
29	535	54	735
30	543	55	743
31	551	56	751
32	559	57	759
33	567	58	767
34	575	59	775
35	583	60	783
36	591	61	791
37	599	62	799
38	607	63	807
39	615	64	815
40	623	65	823
41	631	66	831
42	639	67	839
43	647	68	847
44	655	69	855
45	663		

The output from the audio detector is mono of course. It's split and fed via switching i.c.s 28IC1/2 then through 28IC7 to the dual volume/tone control circuits in 28IC8.

Teletext subtitles can be recorded on these sets and also printed by a suitable printer (LX versions of course). As mentioned earlier, the L models are teletext adaptable. This calls for removal of the display board – but hang on to this for diagnosis (it can prove a Bus 2 fault or teletext decoder fault). Note also that because of the power fail circuit these sets will not operate unless one or other of these boards is fitted. The on-screen display with text sets is provided by the text panel.

Tuning is not by the well-known channel numbers (21-68) but by frequency. Table 1 shows the equivalents.

Despite the fact that the retail price of the LX2800 was over £1,000 these sets sold well in our area. They have since been replaced by the LX2502/2802 series (38XX type numbers) which have only two buses and built-in Link processing.

Stuck in Standby

Our experience has been that faults are usually supply related or in the Bus 1 system. In either case the set will go into standby, as previously described. If you have a set that's stuck in standby and you don't know where to start, proceed as follows.

(1) Try to start the set in the audio only mode. If the set comes on you can rule out faults in the secondary supplies as these will all be up and running. It's likely that there's a Bus 1 fault. The best policy is to switch off, short out the test link connected to pin 11 of 1IC6 and try the set in the TV mode again. This overrides bus error detection. The set will now more than likely start. If so check for data and clock signals on the appropriate lines. If absent check for d.c. pull-up. As previously mentioned absence of pull-up can be caused by open-circuit pull-up resistors or the protection zener diode being short-circuit. Another possibility is excessive loading due to a faulty i.c. The bus lines should give a resistance reading to chassis of 3·5kΩ. A quick check is to remove the 330Ω series resistors (see Fig. 2) to see if this resistance returns. Also look for tuning. If there's none, suspect a fult in the tuning interface or memory.

(2) If the set won't start in the audio only mode look for loading on the power supply, i.e. 4T1's secondaries, for example a short-circuit line output transistor. Such secondary loading is indicated by a noise in the chopper transformer. If there's no noise, suspect a mains input or control circuit fault. 4R3 could be open-circuit or 4TR1 may have failed. For repeated failure of 4TR1 check whether 4C15 (1μF) is open-circuit.

(3) Check for power failure detection at pin 1 of 1IC6. A high here indicates an overload on one of the l.t. supplies.

Once you've understood the basic operation of the chopper power supply and the bus control arrangements you should have no difficulty in repairing faults in these sets. Develop the correct technique for these areas and the rest is much the same as with anyone else's sets!

Fault Report

Here's a list of some of the faults we've had.

(1) A completely dead set (no standby light) is usually due to a burnt up mains switch. If the subpanel is damaged, as it usually is, the complete assembly (part number 8003605) should be replaced – this is done through the

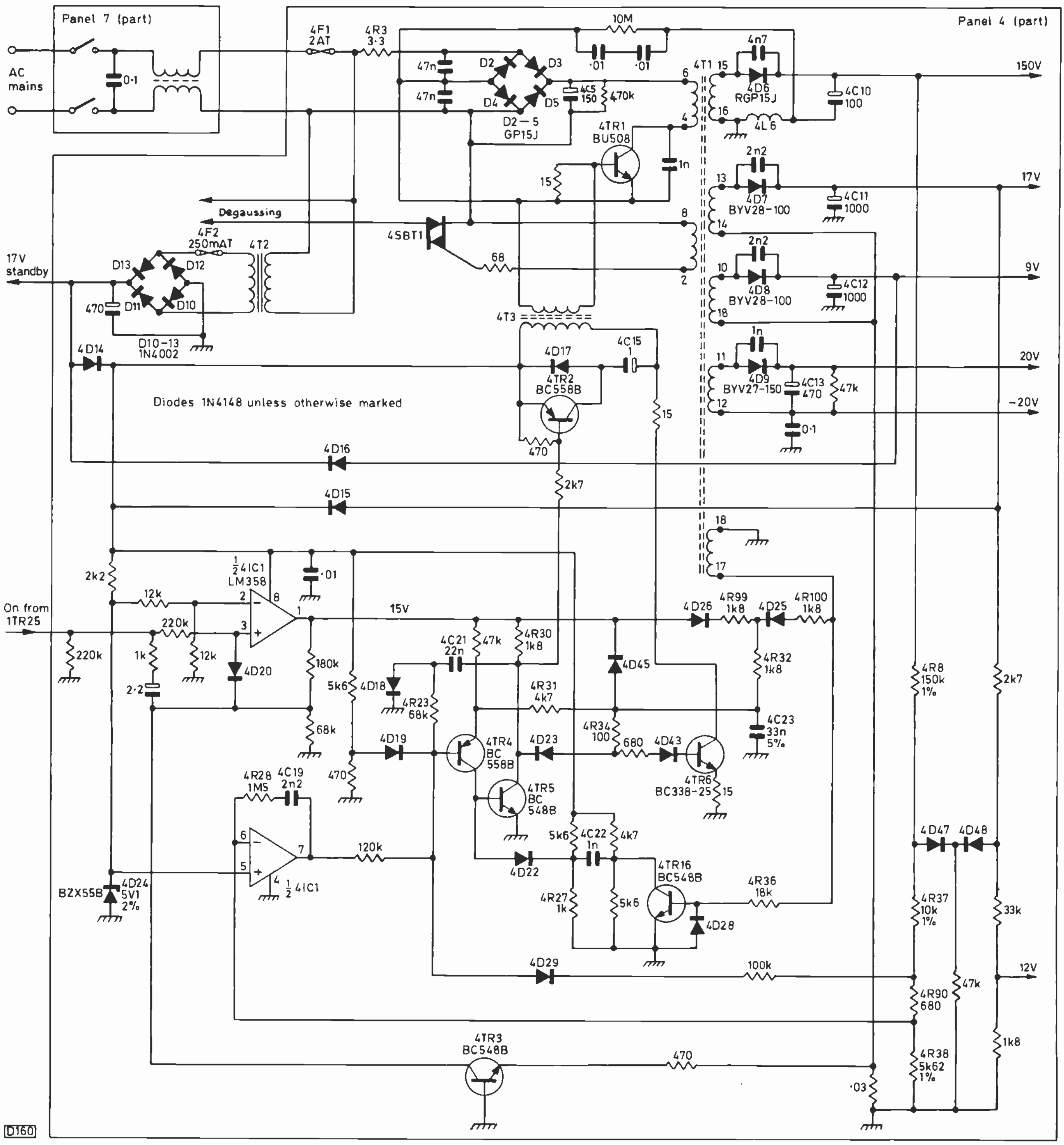


Fig. 4: The chopper power supply circuit. In earlier versions 4R32 was 3·9kΩ with 4R99 and 4R100 omitted. There have been other minor modifications to the circuit.

flap in the bottom of the cabinet.

(2) The most common cause of a set being stuck in standby, again usually preceded by smoke, is an open-circuit surge limiter resistor (4R3, 3·3Ω). A type with improved construction is now supplied.

(3) Reduced width and height has on a number of occasions been traced to the line flyback tuning capacitor 4C32 (1·5nF) being open-circuit.

(4) Stuck on standby, not a Bus 1 fault. The line output transistor 4TR11 short-circuit.

(5) A few lines of field foldover on the picture. Check the 0·1Ω resistors 4R74 and 4R75 in series with the supplies to the TDA2170 field output chip.

(6) No control of a VCR via the Aux 2 socket when used in conjunction with a Beomaster 5500 and Master Control Panel 5500. Data reaching 1IC6 (MAB8461) but no output to the scart socket. Programming of options (datalink) correct but 1IC6 faulty.

(7) No picture when brought on from standby via the MCP 5500 with the above system. 21IC3 (SAB3037) faulty.

(8) No line or field sync after a few seconds. IC5 (TDA1940) on panel 26/27 faulty.

(9) Teletext not running, top line only displayed. Horizontal phase control 26/27R65 slightly off.

As a final note, when removing the back cover it's not necessary to remove the screws completely – this saves losing them.

Letters

REBUILT 30AX TUBES

Having read the article on servicing the Ferguson TX10 chassis (January) I feel I must comment on the final section under the heading "the tube". The author says that retubing a TX10 is a good proposition but goes on to say that sadly very few rebuilt tubes perform to the original standard. I've been in charge of our small rebuilding business for thirty years and can assure you that our 30AX tubes perform to the original standards – many of our customers tell us this. We are an associate of CHS Ltd., Barmby Road, Pocklington, Yorkshire ('phone 0759 303 068) who distribute our tubes to the servicing trade.
J.R. Leigh, Retube Ltd.,
North Somercotes, Louth, Lincs.

EHT ARCING

In reply to G.R. Darby, my article on e.h.t. arcing (January) was written in "strong terms" following a spate of faults that came into our workshop following misguided attempts to deal with problem. A large Japanese manufacturer does indeed smear silicone grease under the anode cap – but the points here for those who pour it over a dirty cap are *smear* and *under*. To keep matters brief I didn't originally mention the problems caused by gas heaters. The point to note is that the whole treatment hinges on the area being thoroughly cleaned.
Nick Beer,
Bideford, Devon.

I feel I really must comment on Les Lawry-Johns' article in the February issue. There have been many letters in the magazine over the past few months on the subject of cowboys and amateurs attacking equipment and getting the trade a bad name. An article on servicing to BEAB standards appeared recently and in the January issue there was an article on dealing with e.h.t. arcing. In view of all this how can someone of Les's standing report fixing two e.h.t. discharge problems by bodging with tape? I'm pleased that the customers were happy when they left the shop. Perhaps they won't be when their sets burst into flames as a result of smouldering PVC tape. We should all be working to stamp out such bad practices.
G.R. Darby, Proprietor Monitech,
Earls Barton, Northampton.

I'd like to support the views expressed by G.R. Darby (Letters, March) on the subject of e.h.t. arcing. So much in servicing is a matter of common sense. Manufacturers and service organisations alike, no matter what their size, are aware that the products they handle go into people's homes. Thus safety is the first consideration and price, though important, is secondary.

As Mr. Darby says, e.h.t. arcing is common with TV sets installed in homes where the occupants smoke heavily, run a bottled-gas heater, dry cloths in front of the fire and so on. No service engineer in his right mind would patch up a final anode connector which has failed under these conditions, but when a new cap has been installed it would be sensible to add some sealant to attempt to delay the date of the next replacement. Not good for business may be, but life's a gamble anyway! Many workshops salvage undamaged e.h.t. caps from defective triplers and diode-split line output transformers, saving expensive repairs whilst keeping the job wholesome. Common sense and good judgement are again necessary here.

TV manufacturers generally don't seal final anode connectors because it involves additional expense and another operation on the production line, for something that's of benefit to only a small minority of the end users.

All of us in this industry have a duty towards the general public in making sure that the repaired equipment we return to their homes is as safe as it was when new, if not safer.
K. Rutherford,
Nottingham.

AMSTRAD AND RANK PARTS

Since I last wrote (Letters March) I've been told by CPC that they can now order R814 (27Ω, 20W) for the Amstrad CTV2200/2210 under the revised part number 1422031.

With reference to D.R. Isham's interesting letter, if any reader would rather buy the selector cams/nuts for the four-button mechanical tuner used in many Rank sets I have a stock and can supply 16 for an s.a.e. plus £1 (coin or P.O.).
Dave Mackrill, 32 Southwater Road,
St. Leonards-on-Sea, East Sussex TN37 6JS.

ORACLE PUZZLE SOLVED

In reply to C. Russell's letter (February), the information on the Oracle lines mentioned is ITV's own data broadcast system used by a chain of chemist shops, the city, betting shops, some libraries, etc., etc. To receive the pages you require a special decoder and to be enabled by ITV — unless enabled for a fee the decoder will not reveal any more than a standard TV set with teletext does. But you would be amazed by what can be done with a second-hand computer, a few chips and a few hundred hours.
A.J. Goloshof,
Tewkesbury, Glos.

In reply to C. Russell, I managed to get this on page 799 (ITV):

```
P799 AIR CALL TELETEXT STOP
VALID AT 19-JAN-89 — 3:25 PM
ATTACHED TO SYSTEM — SYSC-SYS16
HP TX —      9          LP TX —     0
SC Q5 —      0          CA Q5 —     0
FRO — 572612            FR1 —       0
          TURN TO PAGE 700
```

Although I've tried page 700 nothing happens, but if you turn to page 188 more details are available. I suspect that pages 701-3, 713-5 and 719 are part of this system for which a decoder would be required. Incidentally "P799" is very difficult to stop because it scrolls down the screen in a fraction of a second every sixty seconds.
D.R. Hindley,
Bradford, West Yorkshire.

I think I can shed some light on the latest Oracle puzzle (letters, February). With the aid of the wildcard facility on the time-page entry to my computer's teletext card I was soon able to determine that the time code to hold page 799 is 1312. Despite the reveal button exposing more information, the key words on this page are "air call teletext". This name is mentioned (as Televox is) on page

270, regional advertising. I was then led to page 188 and from there to the telephone. In reply to my call I was told that the company is providing an ASCII data transmission service that can be an economical alternative to a modem link.

The data is encrypted and appears as garbage on pages 715 etc. on the TV screen. For subscribers with a black-box adaptor however the data can be decoded and fed to an RS232 port. Companies that use this service include High Street stores, travel agents, etc. The information on page 799 is for the benefit of the providers of the system, some of the details of which may I suspect have changed slightly since the page was composed. I could find no sign of activity on page 700.

Tim Bolt.
Cambridge.

CURE FOR FIELD JUDDER

I was recently given an old Betamax machine that was otherwise going to the tip – I wanted it in order to see a Donohue tape on cryonic suspension recorded by a friend who has a Betamax VCR. In view of the resale value of working Betamax machines professional repair is no longer economic. So it was not unreasonable to try something unconventional.

Unfortunately the machine, a Toshiba V5470B, suffered from drum wear and tape alignment problems. This meant that although a picture could be obtained it was not up to the usual standard. Although the dots and lines on the screen could be cleared the f.m. envelope was still poor, causing an infuriating field judder.

Despite not having a service manual I was able to find the playback video level control and a test point where the head switching squarewave was present. Examination of the video at this control showed that the sync pulses are positive going. I therefore made up a circuit (Fig. 1) that provides a pulse slightly in advance of each field sync pulse. The positive edge of the head switching squarewave is inverted by Tr1 and then passed through a differentiator to Tr2. A second differentiator feeds the input to Tr3. An output pulse is thus obtained from both edges of the squarewave. If the manual had been available a better take-off point from an electrical point of view could probably have been found, but the test point is in a very convenient position. The output, a series of narrow pulses at field frequency, is fed via a 1kΩ resistor to the video level control where it's mixed in with the video signal. As the pulses are derived from the head rotation servo they are effectively a "flywheel field sync" and are therefore immune to all but the most serious interference. Since they come slightly in advance of the real field sync pulses it doesn't matter what mess interferes with these.

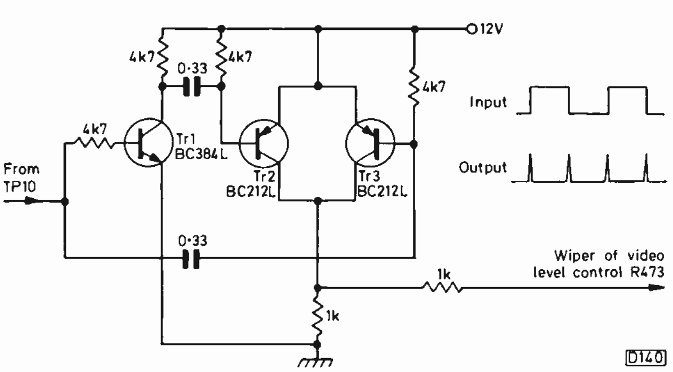


Fig. 1: Pulse generator circuit to cure field judder.

The circuit was built on a small piece of tagstrip and held in place by stiff wires to TP10, which is at the top side of the machine on the panel next to the top left-hand corner of the tuner setting panel. The earth connection was taken to a chassis point near this while the 12V supply required was taken via a wire connected to the large electrolytic at the top right-hand corner of the mechanical section. The machine was then turned over to make the connection to the playback level control. With the machine upside down and the bottom cover removed this control is at the bottom left-hand corner of the big panel. The 1kΩ resistor was soldered to the wiper of this control, the connecting lead being taken through the machine back to the new circuit.

It would seem to me that this is a good way of generating the field sync signal in all VCRs. It will improve reliability and the playback of poor tapes. The cost of the circuitry at the manufacturing stage would be negligible.

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

HELP WANTED

Can anyone supply a service manual/circuit diagram for the Sona 12in. monochrome portable Model S1286? The set was made in Rumania and distributed by Reay Electrical Distributors Ltd. who are unable to help.

K. Pocock, 500 Ripponden Road,
Oldham, Lancs OL4 2LL.

Does anyone know of a source of the CA3023 i.c.? It's a 16MHz wideband amplifier. Grandata had listed it but no longer has stock. Another problem is the scarcity of 8501 chips for Commodore 16s and Plus 4s. A container load from the States wouldn't dent the requirement for these i.c.s!

A. Gall, 2 Commerce Street,
Arbroath, Angus DD11 1NB.

Can anyone suggest a source of the TBA641A12 i.c. which no longer seems to be in stock anywhere?

F. Dawson, 32 Perry Street,
Darwen, Lancs BB3 3DG.

Is there an ex-Rediffusion engineer or anyone out there who can help me make an old lady happy? The problem is teletext interference with a Mk. 13A monochrome receiver. I've tried several things but can't get rid of the lines. I'll gladly accept a reverse charge call on 0773 810 522 (daytime) or 0602 384 176 (evenings).

C. Newman, 58 Portland Road,
Selston, Notts.

Can anyone supply a line output transformer for the Plustron Model CTV14? Several firms have been tried without success.

Len Sutton, Kildare Bungalow, Baghill Lane,
Pontefract, West Yorkshire WF8 2HE.
Telephone 0977 797 063.

TDA1004A AVAILABLE

Your correspondents who asked about the TDA1004A i.c. (February) might like to know that it's available from Greenweld Electronics Ltd., 443 Millbrook Road, Southampton SO1 0HX ('phone 0703 772 501).

David Hills,
Newport, Gwent.

Strange Things

Les Lawry-Johns

Some odd things have been happening to sets around here. Take the two Ferguson TX9s that came in recently.

A Couple of TX9s

The first was brought in by a chap from just over the road. He said the colours were wrong – blue faces etc. I told him to call back later and started on it. The faces were certainly blue, as was the colour of the snooker table. I checked everything thoroughly, first the resistors etc. on the tube base panel then back to the output transistors on the main panel. There was nothing amiss so, feeling a bit of a fool, I removed the RGB drive leads from the tube's base panel. Red at the bottom, blue in the middle and green at the top. I put the red lead at the top and the green one at the bottom. The faces then looked all right but the fields were blue. So I changed over the green and blue leads, which produced green fields and a green snooker table. We now had the blue lead at the bottom, the green lead in the middle and the red one at the top. I didn't like doing this and it worried me. The set was left working all day and when the chap came back I told him what I'd done. He looked at the picture and said it was perfect. I asked him whether anyone had worked on the set and he said no.

So what had gone wrong to make it necessary to swap over the drive leads? The manual says that the green lead should be at the bottom, the red one in the middle and the blue one at the top. Surely the cathodes can't change their colours in this way? The leads looked to be undisturbed, correctly wrapped round – now they are soldered on. The set continues to work well. Strange.

The second TX9 came in with intermittent field collapse. I fitted a new TDA1170S field timebase chip and the set worked for several hours. Then suddenly the field collapsed again and when I pulled the chassis out the field scan was restored. I tapped around and it collapsed again. Next I found that there was no voltage at D94, the rectifier that provides the 24V supply for the field timebase. After a lot of mucking about I discovered that the field collapse came and went when pin 12 of the line output transformer was tapped – it connects the earthy side of the winding that feeds D94 to chassis. I cursed myself for not thinking of this earlier and remade the joint. No amount of tapping had any effect after that. Another easy job made difficult by my bungling.

Fidelity Problems

Fidelity CTV14Rs (ZX2000 chassis) never used to give me any trouble. One came in the other week and seemed to work fine after I'd fitted a new line output transformer. Shortly afterwards it came back. This time I found that the BU208 line output transistor was shorting intermittently. On the last time it had done so it had blown the BUW84 chopper transistor. So I replaced both transistors and the set worked fine. Until next morning, that is. When I switched it on there was a loud bang. This time the BUW84 had shorted, blowing the mains fuse. I checked everything and fitted a new line output transformer, a new BU208 (just in case), two new bridge rectifier diodes, another BUW84 and a mains fuse. The set then worked normally but next morning there was another loud bang at switch on and I was back at square one. Why should a set that works perfectly when repaired go bang next morning? To cut a long story short, apart from two line output transformers, three BU208s, several BUW84s and of course fuses I must have fitted at least a dozen mains rectifier diodes before the set would work reliably.

When the owner came back I told him what had been happening to the set, and to me. He took it away and gave me back an aerial amplifier he'd purchased a week before, refusing to take any money for it. There are some nice people about – I'd begun to think that they were getting to be a bit thin on the ground.

Incidentally I'd like to thank those nice TV boys in Plymouth who repaired my daughter's Fidelity set – the one I'd given her some time ago. I hope it didn't give them as much trouble as the set just mentioned. I also wish they'd come and fix this CTV14 (ZX3000 chassis) that came in with a blank white screen. The lady who brought it in said there wasn't much wrong with it and I'd be able to do it in no time.

I thanked her and started on it. The screen was bright with white lines across it. So I turned down the first anode knob on the line output transformer and changed the TDA3562A colour decoder chip. With the new chip installed a picture appeared. I'd turned the brightness down, and when the controls were readjusted there was a good monochrome picture. But when the colour control was turned up the picture remained in black and white. She said the set required only minor treatment so I gave it up and returned it. I feel ashamed of myself, but there it is – I'm getting old and don't want to do things for nothing.

The Pye G11

A Pye G11 came in recently with no sound or vision. I did my usual checks before switching on – the mains and h.t. fuses all seemed to be intact. So I switched on and heard the e.h.t. rustle up. But there was no l.t. supply at the lower left side i.f. panel. When the line output panel was swung out I found that the lower, 1A l.t. fuse was open-circuit. After switching off I checked from the fuseholder to chassis. There was a dead short which disappeared when the long socket was unplugged. So I turned my attention to the lower left side i.f./tuner panel, having refitted the socket on the line output panel.

As the short was still present I suspected the 12V regulator. When I removed the power input socket however the short disappeared. I started to frown at this and went back to the line output panel. Removing the socket here once more cleared the short. So what was I up against? A short in the wiring? I checked for this but there were no shorts.

It appeared that the short was present only when the socket was connected. I then did what I should have done in the first place. I again removed the socket, then checked from the fuseholder to the panel's true earth (not the frame). This time the short showed. A look at the circuit suggested that the LT1 supply's reservoir capacitor C1350 was the culprit, and when this was removed all was well. A new 150μV, 50V electrolytic restored the sound and vision and after a final check it was time to write out the bill. Another example of making life difficult for myself . . .

Philips VR6470 and Related Models

Barry Loughran

The machines covered by these notes include the Tatung VRH8495TK, the Philips VR6470 and VR6670 and the Pye DV468, DV562 and DV761. They all use Philips mechanisms and electronics and there are probably other clones. We've serviced a hundred or so of them, and as a result have been able to note a few common faults. These are listed below.

13V line missing: Replace transistor 7001 (BD436) and IC7051 (LM393). Always replace them both before switching on.

Loud crackling noise while loading: This is usually caused by a broken tooth on the rack slider. Replacement is the only cure.

Noisy playback, rewind, fast forward or no rewind or fast forward picture search: This has always been found to be due to coupling 214. Repairing this will restore normal operation.

Tape jams in deck: Can be tape stop broken in cassette deck, spring 215 bent or cam 217, 206 broken.

Poor Picture: Usually caused by poor video heads. The type of head used often seems to last for only about one year. On a few occasions the cause of the trouble has been the spring coming off back-tension lever 204.

Switches off when fully loaded: Check whether the capstan motor is trying to go in reverse. If so replace IC7251 (L293B).

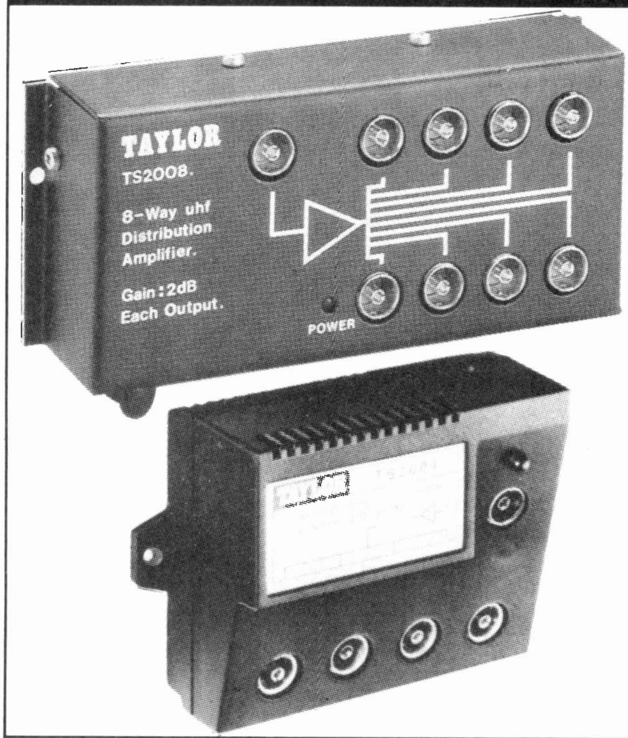
Tape loads then unloads: If this is not caused by a badly positioned cassette deck try replacing the tape-end sensors.

Tape loads only half way when play is pressed: The threading motor can have a tight spot.

This has covered most of the main problems we've had with these machines. On one or two occasions however we've had a very weird problem. The complaint has been that at times the machine won't accept a tape. On each occasion when the machine has been put on the bench the fault has been present and no initial measures would cure it. The tape was then loaded half way using a battery connected to the threading motor. After connecting the mains the machine unloaded and after this the machine accepted a tape on all occasions. We could instigate the fault only by unloading the tape, switching off at the mains then reconnecting the machine. The cause of the problem was eventually traced to the fact that when IC7551 was being reset it held the threading motor on for six seconds longer than it should have done. Replacing IC7551 puts matters right.

As a final point, when replacing the top plate make sure that the pressure roller assembly is located properly. Otherwise the teeth on the rack slider can be broken at the first attempt to load a tape.

TAYLOR U.H.F. TELEVISION DISTRIBUTION AMPLIFIERS



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15/80H	2.72
15/85R	3.28
17052	5.61
17053	5.61
17074	9.30
17089	3.45
17127	2.50
17376	1.58
1N4001	0.04
1N4002	0.06
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1N4006	0.08
1N4007	0.07
1N4148	0.03
1N4448	0.05
1N5401	0.11
1N5402	0.13
1N5403	0.18
1N5404	0.15
1N5408	0.14
1N914	0.04
1S1555	0.31
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1S921	0.10
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2N3442	1.16
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2N3771	2.04
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2N4101	1.33
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2N6109	1.58
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2N6133	1.25
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2N6292	1.65
2SA1006	1.50
2SA1011	1.65
2SA1015	0.49
2SA1012	1.25
2SA1020Y	0.80
2SA1027R	0.45
2SA473	0.75
2SA766S	4.95
2SC1173Y	1.25
2SC1474	1.25
2SC1509	1.35
2SA1095	3.00
2SA1103	6.00
2SA329	0.40
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2SA844	0.65
2SA872	0.59
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2SB681	3.96
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2SB774	0.65
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2SC1096	1.16
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2SC1106	4.54
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2SC1116	4.95
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2SC1129	1.65
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2SC1162	0.55
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2SC1929	2.25
2SC1942	1.98
2SC1959	0.26
2SC1957	0.95
2SC1953	1.93
2SC1962	1.93
2SC1969	1.78
2SC1983	3.28
2SC1985	1.55
2SC2009	0.34
2SC2029	2.33
2SC2028	2.11
2SC2063	0.99
2SC2078	3.39
2SC2073	1.54
2SC2085-Q	1.65
2SC2091	1.30
2SC2141	2.44
2SC2166	0.87
2SC2216	0.69
2SC2233	1.20
2SC2236	1.69
2SC2278	1.14
2SC2314	0.87
2SC2335 + Kit	7.00
2SC2551	1.26
2SC2565	3.84
2SC2570	0.80
2SC2577	1.60
2SC2578	6.75
2SC2671	0.91
2SC288A	1.85
2SC3153	6.50
2SC372	1.40
2SC373	1.16
2SC383	1.33
2SC388	1.27
2SC394V	0.81
2SC403C	0.60
2SC458	0.34
2SC495	0.92
2SC515A	1.85
2SC535	0.79
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2SC537	0.54
2SC605L	1.16
2SC620	1.46
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2SC790Y	1.85
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2SC876	0.96
2SC930	0.54
2SC935	4.13
2SC940	4.68
2SD1128	2.90
2SD1138	0.94
2SD1273	1.30
2SD1453	1.33
2SD152K	2.64
2SD198	3.87
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2SD235	0.60
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2SD257	1.98
2SD292	4.09
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2SD325D	2.26
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AD140	1.06
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AF186	0.53
AF239	0.53
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AN115	3.98
AN155	1.89

AN206	2.58
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AN234	5.09
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AN320	5.47
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AN322	6.78
AN337	5.37
AN340P	1.53
AN355	5.98
AN362	1.50
AN370	3.95
AN5111	3.43
AN5120N	4.50
AN5132	4.42
AN5250	4.40
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AN7156	2.85
AN7158	2.34
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AN7223	4.55
AU107	5.87
AU110	5.69
AU113	6.95
AY105K	2.08
AY106	1.09
BA524	8.94
BA310	0.14
BA1310	1.98
BA1320	1.38
BA1322	3.95
BA1330	2.75
BA145	0.19
BA148	0.25
BA154	0.40
BA155	0.12
BA156	0.05
BA159	0.09
BA182	0.19
BA222	1.66
BA302	1.24
BA311	0.65
BA312	1.45
BA313	0.76
BA317	0.04
BA318	0.09
BA328	1.65
BA333	1.37
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BA5102A	2.50
BA511	1.95
BA514	1.00
BA521	1.20
BA524	8.94
BA526	7.98
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BA532	1.50
BA536	1.70
BA6209	3.10
BA656	1.00
BA7100	11.35
BA841A	28.98
BA843	3.96
BA854	5.76
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BAV19	0.11
BAV20	0.35
BAV21	0.12
BAW62	0.11
BAX12	0.11
BAX13	0.11
BAX16	0.08
BC107B	0.11
BC108B	0.15
BC109B	0.14
BC113	0.14
BC119	0.36
BC126	0.20
BC132	0.14
BC135	0.14
BC137	0.18
BC138	0.34
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BC140	0.45
BC141	0.34
BC142	0.23
BC143	0.34
BC147	0.11
BC148B	0.13
BC148C	0.11
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BC179	0.26
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BC182LB	0.14
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BC184	0.13
BC184LB	0.26
BC186	0.25
BC187	0.28
BC204	0.16

BC207	0.14
BC212B	0.26
BC213L	0.10
BC214	0.10
BC225	0.40
BC237	0.10
BC238	0.10
BC238B	0.08
BC239B	0.25
BC251A	0.31
BC294	0.50
BC300	0.35
BC301	0.23
BC302	0.53
BC303	0.30
BC307A	0.28
BC308A	0.11
BC309	0.17
BC317A	0.13
BC327	0.33
BC328	0.11
BC337	0.09
BC338	0.12
BC368	0.18
BC440	0.69
BC441	0.46
BC454	0.36
BC460	0.42
BC461	0.47
BC462	0.51
BC463	0.30
BC478	0.32
BC479	0.41
BC532	0.28
BC546	0.17
BC547	0.10
BC548	0.10
BC549	0.10
BC550	0.10
BC556	0.16
BC557	0.10
BC558	0.10
BC559	0.10
BC560C	0.14
BC635	0.34
BC636	0.20
BC637	0.24
BC639	0.36
BC640	0.24
BCX34	0.40
BD115	0.36
BD116	0.70
BD124	1.31
BD131	0.42
BD132	0.42
BD133	0.53
BD135	0.36
BD136	0.36
BD137	0.26
BD138	0.28
BD139	0.34
BD140	0.32
BD144	1.43
BD150	0.75
BD157	0.67
BD160	1.60
BD163	0.71
BD166	0.42
BD175	0.28
BD179	0.30
BD181	0.99
BD182	0.99
BD183	0.99
BD184	1.21
BD187	0.53
BD189	0.69
BD190	0.69
BD201	0.49
BD202	0.60
BD203	0.46
BD204	0.41
BD207	1.79
BD208	1.23
BD222	0.50
BD225	0.46
BD226	0.63
BD229	1.05
BD232	0.49
BD234	0.42
BD237	0.47
BD238	0.28
BD239	0.45
BD240	0.57
BD241	0.39
BD242	0.50
BD243A	0.37
BD243C	0.50
BD244	0.31
BD244C	0.72
BD245C	0.70
BD246C	0.80
BD253	1.05
BD278A	0.70
BD317	1.20
BD318	2.72
BD375	0.42
BD380	0.76
BD410	0.49
BD433	0.44
BD434	0.45
BD435	0.49
BD436	0.60
BD437	0.41
BD438	0.52
BD441	0.59
BD442	0.66
BD509	1.42
BD510	0.75
BD519	0.98
BD529	0.60
BD530	0.80
BD533	0.67
BD534	0.52
BD535	0.45
BD536	0.50
BD537	0.50
BD538	0.67
BD544B	0.83
BD677	0.40
BD679	0.57
BD680	0.52
BD681	1.48
BD696	2.47
BD699	1.85
BD700	3.70
BD707	0.60
BD709	0.60
BD710	0.80
BD809	0.80
BD810	0.69
BD879	0.74
BD895	2.18
BD901	0.99
BD902	0.65
BDW83C	0.99
BDW84C	0.99
BDX32	1.88
BDX53A	4.93
BDX53B	3.35

BDX54B	0.31
BDX62A	1.96
BDX63A	1.96
BDY20	1.21
BDY81	1.18
BF115	0.29
BF117	0.66
BF118	0.67
BF121	0.25
BF123	0.13
BF127	0.33
BF137	0.29
BF153	0.25
BF154	0.26
BF157	0.33
BF158	0.18
BF159	0.18
BF160	0.31
BF167	0.18
BF173	0.34
BF177	0.35
BF178	0.40
BF179	0.36
BF180	0.36
BF181	0.36
BF182	0.34
BF183	0.39
BF184	0.43
BF185	0.39
BF194	0.14
BF195	0.14
BF196	0.17
BF197	0.16
BF198	0.17
BF199	0.17
BF200	0.37
BF218	0.36
BF224	0.17
BF237	0.65
BF240	0.19
BF241	0.17
BF245	0.50
BF245B	0.49
BF246A	2.52
BF255	0.20
BF256	0.28
BF257	0.34
BF258	0.33
BF259	0.34
BF262	0.57
BF263	0.57
BF271	0.34
BF273	0.20
BF274	0.20
BF324	0.23
BF336	0.33
BF337	0.45
BF338	0.40
BF355	0.49
BF362	0.60
BF363	0.50
BF371	0.50
BF391	0.25
BF417	0.84
BF418	1.87
BF422	0.30
BF423	0.33
BF450	0.35
BF451	0.29
BF457	0.41
BF458	0.49
BF459	0.52
BF460	0.99
BF469	0.28
BF470	0.26
BF471	0.33
BF472	0.33
BF479	0.61
BF480	1.79
BF491	0.50
BF506	0.43
BF532	0.24
BF596	0.18
BF597	0.27
BF694	0.22
BF757	0.59
BF759	0.47
BF761	1.05
BF762	0.34
BF869	0.49
BF870	0.30
BF959	0.42
BF960	0.49
BF970	0.50
BFR39	0.44
BFR61	0.92
BFR62	0.50
BFR79	0.29
BFR81	0.29
BFR86	1.08
BFR89	1.63
BFR90A	0.85
BFX29	0.34
BFX84	0.37
BFX85	0.41
BFX86	0.36
BFX87	0.55
BFX88	0.34
BFX89	0.44
BFY50	0.30
BFY51	0.33
BFY52	0.27
BFY79	0.49
BFY90	0.42
BLY49	2.20
BR100	0.22
BR101	0.70
BR103	0.66
BR303	1.15
BRC84	2.08
BRX44	0.60
BRX49	0.34
BRY39	0.69
BSS38	0.67
BSTBD140G	4.93
BSTC0246	8.64
BSTC0233	6.12
BSTCC0143	3.07
BSTD1043	2.85
BSV57B	3.91
BSW68	0.60
BSX19	0.34
BSX20	0.19
BSY52	0.50
BSY79	0.51
BT108	1.45
BT119	1.76
BT120	2.17
BT121	2.48
BT123	1.98
BT151-800R	1.03
BTT6018	2.42
BU106	2.48
BU108	1.50
BU109	2.25
BU110	5.69
BU125	2.48
BU126	1.10
BU137	6.53

BU205	1.15
BU206	1.27
BU207	1.65
BU208	1.12
BU208/02	1.88
BU208A	1.12
BU208D	1.43
BU209	1.93
BU226	2.45
BU326	2.00
BU326A	0.99
BU406	1.49
BU406D	1.53
BU407	0.82
BU412	5.29
BU426A	1.67
BU500	1.45
BU508A	1.89
BU536	1.65
BU608	1.65
BU705	2.50
BU806	0.85
BU807	1.40
BU826A	1.95
BUW84	1.39
BUX84	0.50
BUX85	0.69
BY126	0.13
BY127	0.13
BY133	0.06
BY164	0.44
BY176	0.52
BY179	1.42
BY182	1.05
BY187	0.77
BY189	1.76
BY198	1.62
BY207	0.22
BY208	1.11
BY210-400	0.18
BY210-600	0.27
BY210-800	0.19
BY223	1.43
BY224-600	1.88
BY226	0.25
BY227	0.20
BY228	0.60
BY229-1000	1.12
BY229-600	0.92
BY255	0.13
BY295-600	1.03
BY298	0.20
BY299	0.60
BY407	0.90
BY409	1.49
BY448	1.35
BY713	0.65
BYW56	0.14
BYX55-600	0.23
BYX71-600	0.85
BYX71-350	0.62
BYY56	1.20
BZY93C30	1.86
BZY88 RANGE	0.10
BZX61 RANGE	0.18
BZX79 RANGE	0.10
C106D	0.37
C106M	0.76
CA3046	1.55
CA3089	0.83
CA3090AQ	3.25
CA3094	2.20
CA3131EM	2.95
CD4001	0.34
CD4002	0.27
CD4008	1.35
CD4011	0.29
CD4012	0.24
CD4013	0.33
CD4016	0.36
CD4017	0.40
CD4020	1.23
CD4021	0.39
CD4023	0.28
CD4025	0.64
CD4028	0.84
CD4040B	0.60
CD4047	1.06
CD4049	0.24
CD4052	0.64
CD4066	0.21
CD4069	0.29
CD4070	0.25
CD4081	0.14
CD4093	0.40
CD4511	1.10
CD4528	2.04
CD4556	1.47
CR02AM-8	1.70
CV12E	4.09
CX095D	3.14
CX104	8.77
CX108	12.48
CX109	7.86
CX130	8.76
CX134	11.10
CX136	11.49
CX139	11.83
CX157	5.52
CX158	5.50
CX177	8.75
CX187	5.26
CX755	12.95
CX885A	6.85
E1222	0.40
E5024	0.28
E5386	0.25
GD243	4.34
GF758	0.84
HA11215	1.75
HA11211	2.53
HA11225	4.29
HA11229	3.46
HA11235	1.75
HA11124	5.25
HA1125	4.29
HA1137W	1.38
HA1138	5.03
HA11414	5.65
HA1156	1.16
HA1160	4.79
HA1166X	6.60
HA1167	6.45
HA11706	3.61
HA11705	8.00
HA11703	4.22
HA11701	4.56
HA11710	3.45
HA11713	2.90
HA11711	2.00
HA11715	9.90
HA11714	7.76
HA11716	13.10
HA11725	18.26
HA11725MP	16.00
HA117555P	6.23
HA11781	21.15
HA1180	5.15

HA1196	7.43
HA13001	1.73
HA1306	2.26
HA13402	7.87
HA13342	2.65
HA13365	4.02
HA1366WR	1.38
HA1367	2.75
HA1368R	2.45
HA1368	2.07
HA1370	3.71
HA1374	1.80
AA117	9
HA1377	1.75
HA1389R	2.05
HA1389	2.39
HA1392	1.38
HA1394	2.37
HA1397	3.76
HA1398	2.95
HA1406	2.07
HA1452	0.85
HD14538	2.07
HD38702-A2	7.95
HD38750A53	5.77
HD38750A-7	7.25
HD38800A50	14.09
HD44801A05	12.50
HISH1010	8.59
HISH1004	6.00
HISH1002	9.50
HM6231	9.81
HM6232	10.95
HM6251	5.25
HM7103	4.85
HM9032	4.00
HM9012	3.22
HM9015	3.24
HT4207	13.25
HT4208	20.65
KA2101	1.00
KC581C	7.68
KC582C	4.85
L200CV	1.69
LA1201	0.75
LA1210	1.56
LA1230	1.44
LA1320	2.87
LA1357N	9.00
LA1363	1.05
LA1364	3.02
LA1365J	1.15
LA1385	1.53
LA1387	5.95
LA3350	1.43
LA3361	1.60
LA3390	5.52
LA4032P	2.35
LA4100	1.25
LA4101	1.30
LA4102	0.75
LA4112	0.56
LA4125	2.25
LA4138	4.98
LA4140	0.70
LA4192	1.50
LA4220	1.25
LA4420	1.72
LA4422	1.00
LA4430	1.29
LA4440	1.95
LA4445	1.80
LA4460	1.75
LA4461	1.70
LA5112N	1.18
LA7020	13.86
LA7025	11.97
LA7027	10.92
LA7040	9.20
LA7042	3.90
LA7800	1.03
LA7801	0.90
LB1274	3.61
LC7800	9.20
LD3120	1.13
LD3150	2.75
LM1017N	1.81
LM1877	3.50
LM2808	5.94
LM2877	7.45
LM317CKC	1.08
LM324N	0.98
LM339N	0.41
LM340K	11.85
LM348N	2.15
LM380N	2.80
LM384N01	1.55
LM567CN	1.71
LM6402/011	10.23
LM6402A093	10.15
LM748	0.69
LM8360	3.87
LM8361	3.57
LR3419	9.37
LR3471	9.37
LU1141	7.27
LU52012	5.95
LU52011	14.95
LU03112	12.37
M193	6.83
M21C	1.30
M23C	1.98
M293	6.71
M51102L	1.69
M5115P	5.24
M51203L	3.15
M51231P	3.07
M5134-9341	4.13
M51353P	5.25
M51381P	5.98
M51393AP	9.48
M51394P	12.50
M5142P	6.85
M5144P	3.77
M51513L	2.55
M51515BL	2.75
M51517L	2.90
M5192	2.20
M5194AP	5.74
M5231L	4.80
M53274P	1.33
M54532P	1.50
M54544L	1.22
M58478P	6.75
M58485P	12.75
MA06	1.07
MA8001	0.82
MA8003	1.16
MB3705	1.98
MB3712	1.85
MB3713	1.69
MB3730	2.09
MC13002	3.90
MC1310P	2.25
MC1327P	1.33
MC1330P	1.98
MC1350P	0.90

MC1351P	1.32
MC1352P	1.40
MC1357P	2.15
MC1358P	1.48
MC14001	2.40
MC14013	0.41
MC14493P	4.20
MC14494P	2.15
MC14497	3.46
MC14510BAL	3.75
MC14511BCP	1.10
MC14528BCP	2.15
MC1712	3.88
MC5192	19.50
MC7724CP	3.49
MC7818C	2.18
MCR106-5/6	1.23
MCR220/7	2.28
ME0411	0.75
ME6002	0.26
ME6102	0.28
ME8001	0.34
ME0411	0.75
MJ2501	3.30
MJ3001	1.43
MJ481	1.53
MJ802	3.93
MJE2955	1.89
MJE3055	1.25
MJE340	0.49
MJE520	0.49
ML231	0.99
ML232B	3.01
ML237B	2.51
ML238	5.77
ML923	3.10
ML926	3.58
MM5314N	8.99
MM5316N	9.16
MM5318N	3.11
MM5369N	2.01
MM5387AA/N	6.20
MM5841N	6.64
MN1400VL	13.65
MN1405	7.92
MN1435VX	9.50
MP1192	5.07
MP2794	4.00
MP2812	5.07
MP8512	1.57
MPC596	2.13
MPF256C	0.60
MPS6570	0.48
MPSA42	0.35
MPSA56	0.08
MPSA92	0.45
MPSU05	0.86
MPSU10	1.56
MPSU56	0.60
MPSU60	1.33
MR818	0.33
MR854	0.50
MR914	1.20
MSM5816RS	17.35
MSM5840H	13.95
MVS460-02	0.34
NE542	2.65
NE555	0.19
NE556	0.65
NP1106	11.51
OA202	0.11
OA47	0.16
OA91	0.14
OA95	0.09
OC28	2.52
OC29	2.15
OC36	7.53
OC44	0.35
OC45	0.18
OC72	0.44
OC75	0.44
ON236	1.06
ON782	1.98
OT121	1.45
PT6042	2.45
PT8504	4.98
R1038	2.19
R1039	2.19
R2008B	1.33
R2009	1.98
R2010B	2.98
R2029	1.33
R2030	1.33
R2257	2.35
R2265	1.49
R2305	1.18
R2322	0.67
R2323	0.76
R2354A	0.64
R2354B	2.01
R2443	1.36
R2461	1.50
R2540	1.91
R2540X	3.30
R2615	0.67
RCA2060	2.00
RGP01-15	0.70
RGP10	0.30
RGP30M	0.28
RT402	1.58
RT905A	2.38
S1299	5.34
S2800D	1.84
S2802	2.90
S2818	4.05
S3702S	5.21
S40W	13.10
S6080B	9.98
SA8063	5.17
SAA1006	1.85
SAA1020	4.76
SAA1025	4.40
SAA1024	2.81
SAA1075	4.25
SAA1121	7.44
SAA1124	2.45
SAA1130	4.99
SAA1174	7.77
SAA1250	3.95
SAA1251	3.20
SAA1351	8.11
SAA3027P	2.55
SAA5000	3.25
SAA5010	4.40
SAA5012	5.50
SAA5020	5.70
SAA5030	6.33
SAA5050	7.74
SAB1009B	5.98
SAB3011	7.34
SAB3013	2.47
SAB3021	7.90
SAB3024	6.36
SAB3209	5.82
SAB3210	3.10
SAF1032P	3.58
SAF1039	1.95
SAS5010	8.39
SAS560S	1.86

SAS560T	5.42
SAS570T	5.42
SAS570S	2.61
SAS580	2.85
SAS6600	1.33
SAS660	1.33
SAS6700	1.33
SAS670	1.33
SAS6710	2.21
SBA750	1.61
SC84203	19.35
SC9504P	1.95
SDA2006	17.95
SDA2112/2	10.28
SG264A	5.26
SG613	8.75
SG629	8.27
SG6533	10.31
SI1125H	7.50
SI1225HD	19.27
SI1630HD	20.50
SKE2F1/04	1.39
SKE2G3/04	0.85
SKE4F1/06	0.35
SKE4F2/08	1.07
SKE4F2/06	0.80
SKE4F2/10	1.33
SKE4G2/02	0.96
SKE5F3/10	1.60
SKS1/10	2.15
SL1310	3.14
SL1430T	2.31
SL414	3.69
SL432A	3.44
SL439	2.48
SL471	2.88
SL480	3.14
SL490	2.37
SL901B	8.32
SL918A	9.07
SN16861AN0	0.82
SN16862AN	2.98
SN16966N	10.25
SN29717N	7.19
SN29716N	3.66
SN29715N	6.04
SN29722	11.95
SN29723AN	8.77
SN29764AN	2.38
SN29767	3.90
SN29770BN	3.69
SN29772BN	5.60
SN29771BN	4.15
SN29791	1.67
SN29798N	5.56
SN2709	0.44
SN7400N	0.61
SN7401N	0.36
SN7402N	0.65
SN7404N	0.52
SN7408N	0.27
SN7410N	0.27
SN74121	1.60
SN7413N	0.37
SN74141N	2.65
SN74151AN	1.51
SN74154N	1.27
SN74190	1.35
SN7420N	0.34
SN7430	0.49
SN7440N	0.27
SN7472	1.54
SN7474N	0.44
SN7490AN	0.93
SN74LS26N	1.45
SN76001N	1.65
SN76013ND	3.50
SN76023N	2.97
SN76023ND	3.91
SN76033N	5.54
SN76110N	0.90
SN76115AN	1.61
SN76131	0.82
SN76227N	0.85
SN76226DN	2.00
SN76228N	3.27
SN76242	5.23
SN76243	5.23
SN76396	2.90
SN76533N	2.47
SN76532N	0.91
SN76545	4.87
SN76546N	3.47
SN76549	2.45
SN76570	3.08
SN76611	2.59
SN76620	2.59
SN76660N	2.48
SN76666N	1.41
SN76708	4.86
SN76709N	5.94
SN76707N	1.23
SN76705N	6.60
SN76730	5.54
SN76810N	0.60
SN76832N	1.35
SN94041	5.54
SN94042	4.35
SP8385	0.55
SPS5384	1.98
ST1702L	0.99
STA401	2.50
STA441C	3.10
STA471C	7.95
STK0029	5.54
STK0050	7.72
STK016	6.91
STK022	5.25
STK031	12.95
STK040	13.34
STK054	3.95
STK058	27.50
STK077	7.67
STK1039	5.75
STK2110	7.33
STK2145	16.95
STK2240	16.65
STK2250	18.95
STK3042	4.95
STK3044	5.75
STK4019	4.50
STK433	4.78
STK4332	6.25
STK435	4.95
STK4352	1.95
STK436	7.21
STK437	7.50
STK4372	13.13
STK460	7.02
STK466	11.77
STK4833	9.52
STK501	6.32
STK502	7.25
STK5314	12.40
STK5730	3.20
STK7216	13.10
STK772	3.71
STR1096	4.98
STR4090	9.52

STR440	5.37
STR451	4.93
STR453	8.16
STR454	4.95
STR6020	5.85
T6029V	7.98
T6035V	0.73
T6036	0.67
T6037	2.11
T6044V	0.97
T6045	1.20
T6049	1.45
T6052V	0.87
T6058	3.08
T6059	2.77
T9003V	1.25
T9005V	2.38
T9011V	1.40
T9013V	4.95
T9014V	2.42
T9016	1.02
T9019W	1.98
T9034V	1.45
T9035V	1.40
T9051	7.14
T9054V	5.46
T9057V	2.77
T9062V	0.49
T9064	3.90
TA7027	4.80
TA7050	1.74
TA7051	1.74
TA7054	2.55
TA7060AP	0.71
TA7061AP	1.27
TA7069	3.13
TA7070P	1.83
TA7072P	2.57
TA7074P	1.98
TA7076P	7.50
TA7089P	3.10
TA7092P	9.94
TA7093P	3.99
TA7102P	5.88
TA7108P	1.61
TA7109	3.71
TA7122B/P	0.87
TA7124P	2.34
TA7129P	1.50
TA7130P	1.27
TA7136AP	1.89
TA7137P	0.98
TA7141AP	3.87
TA7146	2.50
TA7146P	4.23
TA7148P	1.67
TA7149P	3.26
TA7152P	2.72
TA7161P	4.50
TA7162P	3.61
TA7172P	1.41
TA7176P	1.75
TA7193P	4.80
TA7204P	2.16
TA7206P	12.49
TA7207P	1.48
TA7208P	2.15
TA7210P	1.45
TA7214P	3.63
TA7215P	2.58
TA7217AP	1.45
TA7222	1.95
TA7226	3.57
TA7229P	4.22
TA7230P	1.35
TA7233P	3.46
TA7240AP	2.55
TA7245P	5.92
TA7310P	2.15
TA7313AP	0.65
TA7314	5.94
TA7323P	3.15
TA7325P	1.15
TA7339P	1.85
TA7340P	5.95
TA7607AP	2.10
TA7609	2.65
TA7611AP	2.32
TA7616P	5.25
TA7622AP	8.94
TA7628P	2.50
TA7629P	7.50
TA7630P	0.95
TA7640AP	2.40
TA7672P	2.55
TA7676P	2.81
TA7726P	10.25
TAA320A	1.27
TAA350A	0.80
TAA570	1.85
TAA621AX1	4.85
TAA621A12	2.14
TAA661B	1.00
TAA691	8.58
TAA700	2.37
TAA930	4.87
TAA970	2.83
TAG626-600	1.20
TBA120AS	0.70
TBA120SB	1.05
TBA120T	0.97
TBA120U	2.50
TBA120A	1.05
TBA1440	1.94
TBA1441	1.95
TBA240A	3.99
TBA395	1.10
TBA395Q	0.60
TBA396	1.20
TBA400	2.39
TBA440C	2.34
TBA480Q	1.30
TBA510	1.37
TBA520	1.84
TBA520Q	1.68
TBA530	1.30
TBA530	1.30
TBA540	1.15
TBA540Q	1.15
TBA560C	1.40
TBA560CQ	1.60
TBA570Q	1.60
TBA570A	1.71
TBA651	0.87
TBA673	2.45
TBA700	1.85
TBA720	2.30
TBA730	3.55
TBA750Q	2.90
TBA760	1.71
TBA800	1.08
TBA810S	1.61
TBA810T	1.75
TBA810AS	1.00
TBA820	0.66
TBA820M	0.82
TBA890	3.30
TBA920	1.65
TBA920Q	2.52

TBA940	1.87
TBA950	1.55
TBA970	3.06
TBA990	1.98
TBA990Q	1.68
TCA270Q	1.71
TCA270S	2.15
TCA270SQ	1.05
TCA290A	2.39
TCA420A	2.16
TCA440	2.25
TCA530	2.24
TCA640	2.25
TCA650	3.05
TCA660B	2.60
TCA730	3.81
TCA750	2.25
TCA800Q	5.95
TCA830S	2.30
TCA890	5.44
TCA900	2.04
TCA910	1.65
TCA940	0.82
TCA940E	2.93
TD3F800R	3.67
TD3F900H	5.36
TD62706P	4.50
TDA1001B	2.31
TDA1003A	1.79
TDA1005A	2.22
TDA1006A	7.00
TDA1010AF	4.25
TDA1011	2.40
TDA1010	1.02
TDA1011A	1.51
TDA1028	2.45
TDA1034B	2.42
TDA1035S	2.95
TDA1035T	2.55
TDA1037	1.95
TDA1037D	2.05
TDA1044	1.95
TDA1047	3.25
TDA1059B	0.80
TDA1054M	1.21
TDA1060	2.60
TDA1082	3.25
TDA1151	1.22
TDA1190	2.11
TDA1190Z	2.48
TDA1200	1.51
TDA1235	3.88
TDA1236	3.30
TDA1270	3.74
TDA1327A	1.50
TDA1412	1.08
TDA1420	1.52
TDA1440	3.45
TDA1470	2.90
TDA1470P	4.25
TDA1506	6.58
TDA1510	4.60
TDA1512	2.89
TDA1515	2.89
TDA1559	3.15
TDA1670	4.48
TDA1770	2.75
TDA1905	1.27
TDA1908	2.98
TDA1940	1.95
TDA1950	2.50
TDA2005	1.45
TDA2006	1.55
TDA2004	1.48
TDA2002	0.90
TDA2003	1.00
TDA2030	1.35
TDA2140	2.14
TDA2150	6.20
TDA2151	1.30
TDA2160	4.01
TDA2161	2.40
TDA2170	4.50
TDA2270	3.96
TDA2520	2.25
TDA2522	2.50
TDA2524	4.50
TDA2521	3.71
TDA2525	3.90
TDA2532	2.50
TDA2530	2.20
TDA2541	1.88
TDA2540	2.15
TDA2545Q	5.94
TDA2560	2.17
TDA2575A	0.50
TDA2578A	2.73
TDA2576A + Kit	12.35
TDA2581	1.60
TDA2582	1.80
TDA2591	2.70
TDA2594	3.40
TDA2593	3.40
TDA2595	5.52
TDA2600	7.60
TDA2611AQ	1.25
TDA2612Q	4.68
TDA2611A	1.25
TDA2610	2.79
TDA2620	1.96
TDA2630	2.50
TDA2631	2.73
TDA2640	3.61
TDA2652	8.25
TDA2653	6.18
TDA2654	4.73
TDA2670	2.48
TDA2680	3.20
TDA2740	6.00
TDA2780AQ	8.84
TDA2795	2.78
TDA2791	1.81
TDA2910	13.25
TDA3300B	6.98
TDA3330	2.88
TDA3506	4.40
TDA3501	12.09
TDA3500	4.25
TDA3510	5.95
TDA3520	9.71
TDA3540	6.99
TDA3541	2.22
TDA3560	4.25
TDA3571Q	2.83
TDA3576	7.48
TDA3590	6.79
TDA3591	6.45
TDA3650	5.90
TDA3652	2.60
TDA3651AQ	3.95
TDA3651	1.95
TDA3651A	2.50
TDA3950	4.50
TDA4050B	3.40
TDA4280	7.20
TDA4290	1.95
TDA4400	4.90
TDA4420	2.30
TDA4422	8.32
TDA4427S	9.00

TDA4431	2.27
TDA4440	3.26
TDA4442	4.15
TDA4500	4.75
TDA4600-2	2.10
TDA4610	6.88
TDA4620	6.73
TDA5500	7.45
TDA5700	2.75
TDA7270S	2.25
TDA8190	3.96
TDA9403	1.50
TDA9503	2.92
TDA9513	3.15
TDB1033	2.68
TDE1081	7.05
TEA1002	2.30
TEA1009	0.80
TEA1014	1.50
TEA1020SP	4.93
TIC106C	0.61
TIC106M	0.77
TIC44	0.72
TIC45	0.56
TIC47	0.77
TIP120	1.55
TIP110	0.53
TIP112	0.34
TIP117	0.95
TIP121	0.40
TIP126	0.38
TIP132	0.99
TIP137	0.96
TIP29	0.84
TIP2955	0.86
TIP29A	0.46
TIP29B	0.63
TIP29C	0.40
TIP29D	0.75
TIP3055	0.66
TIP30A	0.41
TIP30C	0.40
TIP31A	0.34
TIP31B	0.38
TIP31C	0.30
TIP32A	0.35
TIP32B	0.46
TIP32C	0.28
TIP33	0.85
TIP33A	1.02
TIP33C	0.80
TIP34	0.75
TIP41A	0.49
TIP41B	0.31
TIP41C	0.68
TIP42A	0.60
TIP42B	0.79
TIP42C	0.82
TIP47	0.65
TIS43	1.43
TIS90	0.21
TL011CP	1.56
TL494CN	8.95
TL072CP	1.45
TMP4320	15.00
TMS1024NLL	10.50
TMS1025N	6.25
TMS3720ANS	5.25
TMS3748NS	14.95
TMS3755	13.65
TMS3894NL	19.25
TMS5102NLL	6.25
TUA2000	8.98
TY6010B	2.97
ULN2204	8.50
UPA53C	4.94
UPC1003	5.95
UPC1009C	6.32
UPC1025H	2.90
UPC1028H	2.00
UPC1032H	0.82
UPC1042C	8.95
UPC1156H	1.45
UPC1161C	4.98
UPC1182H	1.50
UPC1186H	1.05
UPC1181H	1.35
UPC1185H	2.10
UPC1188	8.77
UPC1212C	0.80
UPC1225H	4.83
UPC1230	1.48
UPC1238	2.10
UPC1278H	5.95
UPC1351C	1.81
UPC1350C	1.40
UPC1353	1.58
UPC1355C	2.13
UPC1363	4.20
UPC1362	4.10
UPC1365C	2.50
UPC1366	1.65
UPC1360C	4.51
UPC1378H	2.44
UPC141C	4.95
UPC1458	2.00
UPC151C	2.95
UPC2002	1.48
UPC30C	2.51
UPC324C	4.70
UPC32C	4.95
UPC339C	4.35
UPC41C	4.10
UPC4558C	2.15
UPC474	5.11
UPC554C	1.85
UPC575C2	2.40
UPC580C	6.60
UPC587C2	1.34
UPC592H	2.15
UPC595	2.95
UPC596	1.98
UPD1514C	4.76
UPD2819C	4.98
UPD4013B	4.00
UPD4066B	4.95
UPD553-164	19.52
UPD8049C-1	11.50
X0022CE	5.75
X0029CE	7.09
X0031CE	6.32
X0035TA	6.18
X0040TA	4.50
X0042CE	4.35
X0043CE	2.75
X0056CE	6.25
X0057GE	6.00
X0062CE	8.35
X0065CE	5.77
X0074GE	10.00
X0077GE	15.96
X0079CE	4.95
X0092CE	4.95
X0096CE	5.95
X0109CE	11.25
X0113CE	2.07
X0195CE	7.50
X0204CE	8.74
X0261CE	8.98
ZPY120	3.25

IF YOU DON'T SEE IT LISTED ASK FOR QUOTE. GIVE MAKE MODEL LOCATION. REMEMBER TO ADD 60p POST & HANDLING. U.K. MAINLAND ONLY. HANDLING CHARGE TO ALL EXPORT ORDERS AT COST. ADD 15% VAT TO TOTAL

TELEVISION VIDEO INFO CARD – 2

NEC
PVC470E E
PVC2400 E
NV370 E
NV688 E
NV730 E
NV777B E
NV788 E
NV830 E
NV850 E or F
NV2000 E
NV2010 E
NV3000 E
NV7000 E
NV7200 E
NV7800 E or F
NV8170 E
NV8400 G
NV8600 G
NV8610 E

NordMende
Spectravideo VIS D
Spectra W D
V100E C
V1001 C
V100H F
V100K F
V101 C (5)
V102 C (5)
V150 F (4)
V200 D
V250 C
V300E C
V300H F
V300K F
V302 F (5)
V303 C
V350 F
V380 F
V400 D
V460H D
V500E C
V500H F
V500K F

Orion
H1 E
H2 E

Panasonic
NV100 E
NV200 E
NV333 E
NV366 E

Philips
N1500 (3)
N1700 (3)
VR2020 (1)
VR2021 (1)
VR2022 (1)
VR2023 F
VR2024 F
VR2025 F
VR2220 F
VR2323 F
VR2324 K
VR2334 K
VR6520 C

Pye
20VR20 (1)
20VR22 (1)
20VR23 F
22VR20 F
23VR24 K
23VR33 K
6520 K

RCA
TC3451X E

Rank
6910 G

Saba
VR2000 F
VR6000 F
VR6004 K
VR6005 K
VR6010 F
VR6012 F
VR6020 F
VR6022 F
VR6024 F
VR6028 F
VR6068 F
VR6069 F
VR7720 F

Saisho
VR705 E

Salora
SV8300 B

Sansui
SV7020 C

Sanyo
VC8700 D
VC9700 D
VPR5800 E
VTC3000 E
VTC3000P A
VTC5000 E
VTC5150 E
VTC5300 E
VTC5400 E
VTC5500 H
VTC5600 H
VTC6500 E
VTC9300P D
VTC9300PN D
VTC M10 E

Schneider
SVC20 G

Siemens
CVC500 G
FN204.6 F
FM204.7 F
FM304 F

Sharp
VC220 G
VC381 C
VC386 C
VC387 C
VC388 C
VC390 C
VC482 C
BC483 C
VC486 C
VC496 C
VC2300 B
VC3300 C
VC6300 D
VC7300 D
VC7700 D
VC7750 D
VC8300 D
VC9300 C
VC9500 C
VC9700 C

Sony
SL3000 E
SL8000 E
SL8080 E
SLC5 E
SLC6 E
SLC7 E
SLC9 E
SLF1 E

Tatung
VRH8300 C
VRH8500 J

Telefunken
All F except:
VR520 C

Teleton
VG200B G
VG220B G
VG240B G

Toshiba
V31B G
V33B G
V55B J
V57B J
V5470 G
V8600 G
V8650 G
V8700 G
V9600 G

INTERCONNECTING LEADS

To link two VCRs for signal exchange, find the intersection of their group columns and rows in the matrix then refer to the list for source and part number of the link required.

1 Pi 211-678
2 Pi 211-681
3 Pi 211-679
4 Pi 211-674
5 Pi 211-662
6 Pi 211-692
Pa VRA150
7 Pi 211-677
Pa VRA135
8 Pi 211-680
9 Pi 211-679
10 Pi 211-900*
11 Pi 211-687
Pa VRA145
12 Pi 211-684
Pa VRA144
13 Pi 211-677
Pa VRA142
14 Pi 211-665
Pa VRA133
15 Pi 211-691
Pa VRA149
16 Pi 211-670
Pa VRA137
17 Pi 211-686
18 Pi 211-684
Pa VRA144

19 Pi 211-900*
20 Pi 211-682
Pa VRA133
21 Pi 211-676
Pa VRA141
22 Pi 211-664
Pa VRA132
23 Pi 211-693
Pa VRA151
24 Pi 211-668
Pa VRA136
25 Pi 211-683
26 Pi 211-682
Pa VRA143
27 Pi 211-900*
Ph 321-20484
28 Pi 211-671
Pa VRA138
29 Pi 211-673
Pa VRA140
30 Pi 211-695
Pa VRA152
31 Pi 211-672
Pa VRA139
32 Pi 211-675
33 Pi 211-682
Pa VRA141

34 Pi 211-900*
35 Pi 211-660
Pa VRA130
36 Pi 211-689
Pa VRA147
37 Pi 211-661
Pa VRA131
38 Pi 211-663
39 Pi 211-664
Pa VRA132
40 Pi 211-900*
41 Pi 211-688
Pa VRA146
42 Pi 211-690
Pa VRA148
43 Pi 211-694
44 Pi 211-693
Pa VRA151
45 Pi 211-900*
Ph 321-20485
46 Pi 211-066
Pa VRA134
47 Pi 211-669
48 Pi 211-668
Pa VRA136
49 Pi 211-900*
50 Pi 211-685

A	B	C	D	E	F	G	H	J	K	
1	2	3	4	5	6	7	8	9	10	A
	11	12	13	14	15	16	17	18	19	B
		20	21	22	23	24	25	26	27	C
			28	29	30	31	32	33	34	D
				35	36	37	38	39	40	E
					41	42	43	44	45	F
						46	47	48	49	G
							50	51	52	H
								53	54	J
									55	K

Note: Most manufacturers and wholesalers can supply a universal copy-lead set to cater for any combination of BNC/Phono/PL259 (video lead) and 5-DIN/Phono/3·5mm jack (audio lead) by means of terminal adaptors.

51 Pi 211-683
52 Pi 211-900*
53 Pi 211-682
54 Pi 211-900*
Ph 321-20484
55 Pi 211-770
HRS CL92
Ph 321-20486
(1·5m)
Ph 321-20487
(3m)

Pi = Pinnacle
Pa = Panda
Ph = Philips

VCR-TV LINKS

Socket combinations

		SCART	6-DIN	8-DIN
VCR	A	1	2	3
	B	4	5	6
	C	7	8	9
	D	10	11	12
	E	13	14	15
	F	16	17	18
	G	19	20	21
	H	22	23	24
	J	25	26	27
	K	28	29	30
TV		SCART	6-DIN	8-DIN

1 Pi 211-900*
2 Pi 211-504
3 Pi 211-514
4 Pi 211-900*
5 Pi 211-507
6 Pi 211-517
7 Pi 211-900*
Ph 321-20484
8 Pi 211-505
Pa VRA183
9 Pi 211-515
Pa VRA173

10 Pi 211-900*
11 Pi 211-503
Pa VRA182
12 Pi 211-513
Pa VRA172
13 Pi 211-900*
14 Pi 211-501
Pa VRA180
15 Pi 211-511
Pa VRA170
16 Pi 211-900*
Ph 321-20485

17 Pi 211-508
Pa VRA184
18 Pi 211-518
Pa VRA174
19 211-900†
20 Pi 211-502
Pa VRA181
21 Pi 211-512
Pa VRA171
22 Pi 211-900†
23 Pi 211-506
24 Pi 211-516

25 Pi 211-900*
26 Pi 211-505
Pa VRA183
27 Pi 211-515
28 Pi 211-900*
Ph 321-20486
(1·5m)
Ph 321-20487
(3m)
29 Pi 211-900*
30 †

Notes: TV/VCR manufacturers can supply link-leads to couple any two of their own products. Special leads can be made up by Lektropacs, 17 Turnham Green Terrace, London W4 (01-994 2784): quote length required and equipment model numbers or socket types.

* The Pinnacle SCART-Universal lead consists of a SCART plug and lead with terminal adaptors for groups A–K inclusive.

† Available from Tape Recorder Spares Ltd., 206 Ilderton Road, London SE15 (01-639 7844).

Etron. Brand name used by Nikkai Imports Ltd.
Expert. Spares from Tatung, GEC or Luxor depending on chassis.
Ferguson Ltd., Service Division, PO Box 121, Lea Valley Trading Estate, Angel Road, Edmonton, London N18 3BP. 01-807 3060. Move due to Box 1594 Crown Road, Enfield, Middx EN1 1DY. 01-804 7979. Trade only. See also CPC, HRS, Chas Hyde, Wizard.
Fidelity. Spares available from SEME, CPC, McLelland, Wizard and Willow Vale.
Finlux. Lohja UK Ltd., Valley Farm Way, Stourton, Leeds LS10 1SE. 0532 714 521. Trade only.
Fisher Sales (UK) Ltd., PO Box 294, Watford, Herts WD2 8JF. 0923 222 244.
Fujitsu General. See Teleton Electro (UK) Co. Ltd.
Galaxy monochrome portables. See Iskra Ltd.
GEC. Spares available from Hotpoint Ltd., Celta Road, Peterborough PE2 9JB. 073 368 989. See also CPC, Chas Hyde, McLelland, SEME, Wizard.
General. See Teleton Electro (UK) Co. Ltd.
GoldStar UK Sales Ltd., Goldstar House, 264 Bath Road, Slough SL1 4DT. 0753 691 888. Spares for Model GHV1232I available from Cathay Electronics.
Goodmans Loudspeakers, Tees Building, Unit 2-3, Mitchel Way, Portsmouth PO3 5PR. 0705 673 734.
Grundig International Ltd., Mill Road, Rugby, Warwickshire CV21 1PR. 0788 565 128. Account holders only supplied. See also Willow Vale. Spares for VCR4000 and SVR4004 ranges available only from Willow Vale.
HMV. Sets use Ferguson or Fidelity chassis.
Harwood. Spares available (trade only) from Jackson Products Ltd., 18th Floor, Station House, Harrow Road, Stonebridge Park, Wembley, Middx HA9 6DE. 01-900 0433.
Hinari Consumer Products Ltd., Unit 6-10, Badenheath Place, Westfield, Cumbernauld, Glasgow G68 9HX. 0236 722 505. Account holders only supplied. See also CPC, Chas Hyde, SEME.
Hitachi Sales (UK) Ltd., Hitachi House, Station Road, Hayes, Middx UB3 4DR. 01-848 8787. Account holders can use 01-569 1843 (known part no.) or 01-569 1975 (part no. not known). See also Chas Hyde, McLelland, Wizard.
HRS Electronics plc., 11 Garretts Green Lane, Garretts Green, Birmingham B33 0UE. 021 789 7575. Wide range of spares including Ferguson, Philips, Rank etc. Trade only.
Huanyu. Spares available from Audio Visual Technical Support Ltd., 67A Shelson Avenue, Feltham, Middx TW13 4QS. 01-890 3004 or 3010.
Chas Hyde & Son Ltd., Prospect House, Barmby Road, Pocklington, York YO4 2DP. 0759 303 068. Official spares distributors for Ferguson, Philips, Pye and Sharp. Spares stocked for Amstrad, GEC, Hinari, Hitachi, Matsui, Saisho, Samsung, Sanyo, Sony, Toshiba etc. Trade only.
Indesit. Spares no longer available from manufacturers/agents.
Ingersoll. Spares available from Plusmaster.
Iskra Ltd., Redlands, Coulsdon, Surrey CR3 2HT. 01-668 7141.
ITC(bv), P.J.E. Marketing Ltd., Sporhams Farm House, Sporhams Lane, Danbury, Chelmsford, Essex CM3 4AJ. 0245 414 292.
ITT and ITT Nokia. Spares available from Hoopwell Ltd., Unit B9, Larkfield Trading Estate, Larkfield, Maidstone, Kent ME20 6SW, 0622 882 285. See also Wizard.
JVC (UK) Ltd., JVC House, Eldonwall Trading Estate, Priestley Way, Staples Corner, London NW2 7BA. 01-450 3282. Trade only.
Konica, Plane Tree Crescent, Feltham, Middx TW13 7HD. 01-751 6121.
Körting. Spares available from Telefaults, St. Michael's Road, Pitts Hill, Turnstall, Stoke-on-Trent ST6 6LS. 0782 813 757.
Lincoln. Spares for Model 35C available from Nikkai Imports Ltd.
Lloytron Electronics Ltd., Service Dept., Kingsonic House, Derby Street, Cheetham, Manchester MM8 8HB. 0618 328 320.
Loewe Opta UK Ltd., Sherwood House, 33-35 Wellfield Road, Hatfield, Herts AL10 0BS. 0707 262 020/5.
Logik. Brand name used by Dixons. See Mastercare Components, CPC.
Luxor. Spares available from NCS.
Marconiphone. See Ferguson Ltd.
Marantz Audio UK Ltd., Unit 15-16, Saxon Way Industrial Estate, Moor Lane, Harmondsworth, Middx UB7 0LW. 01-897 6633.
Mastercare Components Division, Maylands Court, Maylands Avenue, Hemel Hempstead, Herts HP2 7DE. 0442 232 000.
Matsui. Brand name used by Currys. Spares available from Mastercare Components, CPC, Chas Hyde.
McLelland-Datatext Ltd., Unit 3A, Bankfield Industrial Estate, Kitson Road, Leeds LS10 1NT. 0532 455 169. Wide range of spares including Fidelity, GEC, Hitachi, Philips, Sanyo, Sharp and Sony. Trade only.
Metz. Spares available from Visionair Rentals, 5 Crown Point Parade, Crown Dale, London SE19 3NG. 01-670 2555. Trade only.
Mitsubishi Electric (UK) Ltd., Traveller's Lane, Hatfield, Herts AL10 8XB. 0707 276 100.
Morphy Richards Technical Services Ltd., 6 Albany Parade, Brentford, Middx. 01-560 5331.
Murphy. More recent sets fitted with Fidelity chassis. Many sets fitted with Rediffusion chassis. Model CTV3500 refer to Cathay Electronics. Older sets fitted with Rank chassis (see HRS Electronics plc.).
National, National Panasonic. See Panasonic.
NCS, Bridgemead Close, Westmead Industrial Estate, Westmead, Swindon, Wilts SN5 7YG. 0793 511 636. Trade only.
NEC Home Electronics Division, NEC House, 1 Victoria Road, Acton, London W3 6UL. 01-993 8111. Trade only. See also SEME.
NEI, Network. Spares available from HRS Electronics plc.
Neptune. Spares available from Ampmace Ltd., Falkland Close, Coventry CV4 8HQ. 0203 471 241. Trade only.
Nikkai Imports Ltd., Regents Park House, 45 Byron Street, Leeds LS2 7QJ. 0532 441 640.
NordMende. Spares available from Ferguson Ltd. Agents in Ireland: Reynolds Electronics Ltd.
Olympus Optical Co. (UK) Ltd., 2-8 Honduras Street, London EC1Y 0TX. 01-253 2772. Trade only.
Orion. Spares for some models available from Hinari Consumer Products Ltd. or Hinari stockists.
Osaki. Brand name used by Rumbelows. Spares for Models P50G, P60G, T22P, VCR31, VCR32, VCR33 available from Cathay Electronics.
Panasonic (UK) Ltd., 300-318 Bath Road, Slough, Berks SL1 6JB. 075 382 1111. Move to Southern Industrial Estate, Bracknell due in early May. Orders can be sent via depots as follows: Bristol 0454 201 263, Hinckley 0455 632 777, Livingston 0506 419 719, Normanton 0924 895 681.
Philips Service, 604 Purley Way, Croydon CR9 4DR. 01-686 5414. Account holders only supplied. See also CPC, HRS, Chas Hyde, McLelland, SEME, Willow Vale, Wizard.
Pioneer High Fidelity (GB) Ltd., 1-6 Field Way, Greenford, Middx UB6 8UN. 01-575 7199.
Plusmaster (Electronics) Ltd., No. 26 The Craft Centre, West Wilts Trading Estate, Westbury, Wilts. 0373 826 739.
Plustron. Spares available from Ross Microwave Ovens, 17-23 Waterloo Road, Burslem, Stoke-on-Trent ST6 2EH. 0782 838 462.
Prinz. Brand name used by Dixons. See Mastercare Components.
Proline. Brand name used by Comet Radiovision.
Pye. See Philips Service.
Radionette. See Tandberg.
Rediffusion Business Electronics Ltd., TV Spares Dept., Unit 9, Mole Business Park, Randalls Road, Leatherhead, Surrey KT22 7BA. 0372 386 732.
Reynolds Electronics Ltd., Unit 20, Chestnut Road, Western Industrial Estate, Naaf Road, Dublin 12. 01-500 144.
Rigonda. Technical and Optical Equipment (London) Ltd., Zenith House, 69 Lawrence Road, Tottenham, London N15 4TG. 01-800 8088.
Roberts Dynatron Co. Ltd., Molesey Avenue, West Molesey, Surrey KT8 0RL. 01-979 7474.
Rumbelows. See telephone directory for local service centre.
Saba. Spares only available from Saba Gmbh, 7210 Rottweil, Konigsberger Str. 12, W. Germany.
Saisho. Brand name used by Dixons. See Mastercare Components, CPC, Chas Hyde.
Salora. Spares available from NCS.
Samsung Electronics (UK) Ltd., Industrial Unit A, Stafford Park 12, Telford, Shropshire TF3 3BJ. 0952 292 262. See also Chas Hyde. Agents in Ireland: Reynolds Electronics Ltd.
Sanyo Marubeni (UK) Ltd., PO Box 294, Watford, Herts WD2 8JF. 0923 222 244. See also Chas Hyde, McLelland.

TELEVISION

TV/VCR SPARES GUIDE 1989

The following list gives spares department addresses and telephone numbers or, where these are the same, service department or head office addresses and telephone numbers. Also included are details of major spares distributors.

Aiwa UK Ltd., Unit 5, Heathrow Summit Centre, Skyport Drive, West Drayton, Middx UB7 0LY. 01-897 7000.

Akai (UK) Ltd., Haslemere Heathrow Estate, 12 Silver Jubilee Way, Parkway, Hounslow, Middx TW4 6NF. 01-897 6388.

Alba Radio Ltd., Unit 1A, Rippleside Commercial Estate, Ripple Road, Barking, Essex. 01-594 5533. Early large-screen CTVs use Philips or Thorn Chassis. Trade only.

Ambassador. Brand name used by Sentra Consumer Products.

Amstrad. Spares available from CPC Ltd. and Chas Hyde & Son Ltd. Reynolds Electronics Ltd. handle computers in Ireland.

Aro. Spares available from HRS Electronics plc.

ASA. Spares can be ordered from Finlux. Agents in Ireland: Bagenalstown TV Centre, Market Square, Bagenalstown, Co. Carlow. 01-503 21581. Trade only.

Autovox. See Comet Radiovision Services Ltd.

Benkson. B. Benkert Ltd., Benkson House, 26 Thames Road, Barking, Essex IG11 0JA. 01-594 7532. Trade only.

Beovision/Beocord. Bang and Olufsen UK Ltd., Eastbrook Road, Gloucester GL4 7DE. 0452 307 377. Trade only.

Binatone International Ltd., Binatone House, 1 Beresford Avenue, Wembley, Middx HA0 1YX. 01-903 5211. Trade only.

Blaupunkt. Robert Bosch Ltd., PO Box 98, Broadwater Park, North Orbital Road, Denham, Uxbridge, Middx UB9 5HJ. 0895 838 383. Trade only.

Bush Radio plc., Wharf Road, Enfield, Middx EN3 4TE. 01-805 2065. Trade only. Spares for Rank produced CTVs (up to T24/T26 chassis) available from HRS Electronics plc.

Canon (UK) Ltd., Unit 4, Brent Trading Centre, North Circular Road, London NW10. 01-459 1266.

Cathay Electronics, 7 Blacklands Way, Abingdon Business Park, Abingdon, Oxfordshire OX14 1SU. 0235 325 555.

Cihan. Spares available from HRS Electronics plc.

Classic monochrome portables. See Iskra Ltd.

Commodore. Spares for Commodore computers available from HRS Electronics plc.

Comet Radiovision Services Ltd., Service Dept., Marshgate Industrial Estate, Marshgate, Doncaster DN5 8AF. 0302 340 486.

Contec. CTVs sold by Dixons. Spares available from Mastercare Components.

CPC Ltd., 186-200 North Road, Preston, Lancs PR1 1YP. 0772 555 034. Official spares stockists for Amstrad, Ferguson, Fidelity, GEC, Hinari, Logik, Matsui, Philips, Pye, Saisho, Sinclair, Sony and Triumph.

Crown. Spares available from HRS Electronics plc.

Decca. See Tatung (UK) Ltd. and Wizard Distributors. Spares for chassis up to and including the 110/115 series available from D & S Electonic Services, Building 15, Unit 4, Stanmore Industrial Estate, Bridgnorth, Salop WV15 5HR. 0746 766 641.

Doric. Rediffusion brand name. See Rediffusion Business Electronics Ltd.

Dwektron colour sets. See Iskra Ltd.

Dynatron. Pre-1981 sets see Philips Service. Post-1981 sets see Roberts Radio Ltd.

Ekco. See Philips Service.

Elftone Electronics Ltd., 4 Beresford Avenue, Wembley, Middx HA0 1YZ. 01-902 6222.

Schneider (UK) Ltd., Schneider House, 5 Harrowden Road, Brackmills, Northampton NN4 0BE. 0604 769 255.

Seleco (UK) Ltd., Orchard House, Amersham Road, Chesham, Bucks HP5 1NE. 0494 774 366.

SEME Ltd., Units 2E and 2F, Saxby Road Industrial Estate, Melton Mowbray, Leics LE13 1BS. 066 465 392. Wide range of spares including Ferguson, GEC, Hinari, Philips, Pye, Sharp. Full range stocked for Fidelity and NEC. Trade only except for Fidelity and NEC cabinet parts.

Sentra Consumer Products, Locksley Road, Brighouse, W. Yorks HD6 1QF. 0484 714 355.

Sharp. Spares available from Willow Vale Electronics Ltd., 11 Arkwright Road, Reading, Berks. 0734 876 444. See also Chas Hyde, McLelland, SEME.

Siemens. Spares for Model numbers beginning FF available from Mastercare Components (see above). Spares for Model numbers beginning FC available from John Langman Ltd., 5 Bryants Close, Frenchay, Bristol BS16 1PA – 0272 567 184. Spares available in the Republic of Ireland from Siemens Ltd., Domestic Appliances Division, Dublin Industrial Estate, Finglas, Dublin 11 – telephone no. 302 855.

Sinclair. Spares available from CPC Ltd.

Skantic. See Salora.

Solavox. Brand name used by Comet Radiovision Services Ltd.

Sonatel. Brand name used by Morphy Richards Consumer Electronics Ltd.

Sony (UK) Ltd., Spares Division, PO Box 58, Newbury, Berks RG13 4LX. 0635 60000. Account holders only supplied. Spares obtainable from SES at Oldbury 021 544 8818, Dulwich 01-693 9622, Glasgow 041 554 2751, Leeds 0532 527 387, Staines 078 466 111. See also CPC, Chas Hyde, McLelland.

Steepletone Products Ltd., Park End Works, Croughton, Nr. Brackley, Northants NN13 5RD. 0869 810 081.

Sunkyong Europe Ltd., Sunkyong House, Springfield Road, Hayes, Middx UB4 0TY. 01-561 1200. Trade only.

Tandberg. R.D.E. Tandberg, Holly Tree House, The Green, Full Sutton, York YO4 1HW. 075 972 795.

Tashiko. Brand name used by Granada. Spares available from UK Rental & Retail Ltd., Unit 37, Roman Way Industrial Estate, Preston, Lancs PR2 5BD. 0772 651 551. Trade only.

Tatung (UK) Ltd., Service Division, Stafford Park 10, Telford, Shropshire TF3 3AB. 0952 613 111. Trade only.

Telefunken. Paul Spring Electronics, 6 Oasthouse Way, St. Mary Cray, Orpington, Kent BR5 3PT. 068 931 341. Trade only. Spares for 712/712A and earlier chassis no longer available.

Teleton Electro (UK) Co. Ltd., 154 Great North Road, Birchwood Industrial Estate, Hatfield, Herts AL9 5JN. 070 727 2841.

Tensai. UK agents John Walker Ltd., 55 North Street, Thame, Oxfordshire OX9 3BN. 0844 213 277.

Texet. The Hiro Co., Ltd., Elizabeth House, Elizabeth Street, Manchester M8 8JJ. 0618 347 432.

Thomson. TV and VCR spares available from K.M. Services Ltd., 19 Market Place, Brackley, Northants NN13 5AB. 0280 701 650. Trade only. For camera and microwave spares see Plusmaster (Electronics) Ltd.

Toshiba Technical Centre, Units 6/7, Admiralty Way, Southern Trading Centre, Camberley, Blackwater, Surrey GU15 3DT. 0276 694 000. Trade only. See also Chas Hyde.

Trical. Brand name used by Hinari Consumer Products Ltd.

Triumph. Brand name used by Currys. See Mastercare Components, CPC.

Ultra. See Ferguson Ltd.

Vega. Technical and Optical Equipment (London) Ltd., Zenith House, 69 Lawrence Road, Tottenham, London N15 4TG. 01-800 8088.

Willow Vale Electronics Ltd., 11 Arkwright Road, Reading, Berks RG2 0LU. 0734 876 444. Official spares stockists for Ferguson, Fidelity, GEC, Grundig, Philips, Pye, Sharp. Other spares available.

Winthronics. Spares available from Lloytron Electronics Ltd.

Wizard Distributors, Empress Street Works, Empress Street, Manchester M16 9EN. 0618 725 438 or 0618 480 060. Spares stocked include Decca, Ferguson, Fidelity, GEC, Hinari, Hitachi, ITT, Philips, Pye, Rank, Sharp, Sony. Trade only.

York. Spares available from Plusmaster (Electronics) Ltd.

Zanussi. Spares available from Seleco (UK) Ltd. See above.

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Head Part Nos.: VEH0171
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Machine No.: NV430 — VHS W
Head Part Nos.: VEH0174
Machine No.: NV366 — VHS X

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Test Report: The Crotech 3133 Scope

Eugene Trundle

An oscilloscope is an essential tool for servicing TV, video and similar consumer electronic equipment. Modern general-purpose scopes offer many advantages over the vintage types still in use in many workshops — higher sensitivity, greater bandwidth, improved triggering facilities and better display tubes, all at very reasonable prices. The Crotech model reviewed here is representative of modern design.

Basic Features

Crotech has a range of oscilloscopes. I picked the 3133 as being best suited, in terms of price and specification, for use by the "brown goods GP" on the bench and in the field. It's manufactured in India and is a dual trace type with a bandwidth of 25MHz and a maximum sensitivity of 2mV/division. It offers Y add, invert and subtract modes as well as X-Y operation and a facility for Z (brightness) modulation.

The rectangular display tube runs at 2kV and has 8 × 10 screen divisions of 1cm. The timebase range is from 200msec/div to 500nsec/div, extendable with ×5 expansion and vernier control to about 40nsec/div. Comprehensive triggering facilities are provided, including a TV sync separator, a low-pass filter and hold-off control.

Extra features include a *dual* component tester and auxiliary d.c. outputs of 5V at 1A and ±12V at 200mA. These can be used to power the equipment under test or other bench test equipment such as a DMM or a function or signal generator,

Further details are given in the accompanying specification — see Table 1.

On Test

The scope was put to work on the bench and used for fault diagnosis, testing and setting up TV sets, VCRs and audio equipment over a long period. It proved to be easy to drive and is straightforward in operation. The control panel layout is logical, with all the controls for each section grouped together. The only slight disadvantage is the positioning of the Y1 input socket half way up the left-hand side of the fascia where its plug and lead tend to obscure the controls — I'd rather have had it at the bottom of the control panel or even on the side of the instrument. All the controls have a positive and solid feel.

Starting with the Y amplifiers, I found that these were free of drift and that the bandwidth was in excess of the specification. The lowest gain setting offers 10V/div, so that a maximum 800V peak-to-peak signal can be displayed via a 10:1 probe. This is not enough to be able to examine the waveform at the collector of a line output transistor, but then most 10:1 probes are rated at only 600V or 800V peak input anyway.

My first action was to set up the probes using the convenient front panel calibrated output. I found that no single probe-trimmer setting would give "square corners" at all settings of the Y1 gain switch. Slight variations in the factory setting of the attenuator trimmers probably accounts for this — the Y2 channel was much better in this respect. The absence of a vernier gain control is no real disadvantage with a 1-2-5 switch sequence, and certainly avoids mistakes due to misadjustment.

The Y invert and add facilities permit rejection of common-mode signals in the Y1 and Y2 channels or, if required, a full-bandwidth "piggy-back" display at 1mV/div sensitivity by connecting both probes to the test point and adding the waveforms. A more serious use for the Y-add mode is when investigating glitches and gate operation in logic circuits.

The range of timebase sweep speeds is well matched to the instrument's Y amplifier and display sections. A continuously variable control bridges the eighteen preset steps and a ×5 horizontal magnification switch is provided. Where the required "segment" display can be achieved by careful triggering this is preferable to horizontal expansion since it involves no brightness penalty.

The triggering facilities are comprehensive: inputs from the mains, Y1 or Y2 channels or a BNC socket on the front panel can be used, with a.c. or d.c. coupling, processing via a low-pass filter or a TV sync separator from which either the field or line rate can be selected, a negative or positive flank at variable level can be used, and there's an auto-trigger facility which ensures that you don't lose the trace with no signal input. These arrangements work well provided you take the trouble to study the instruction manual and get to know just what you are doing with the trigger controls — so many operators poke and twiddle at random until some sort of jittery stationary display comes up on the screen! Personally I prefer external triggering. It's easily done with this scope via a third probe or clip-lead connected to the BNC front-panel mounted external trigger socket — for most TV work merely hanging the probe near the line output transformer suffices.

The X-Y facility has a 1MHz horizontal amplifier bandwidth with access via the Y2 channel. It would be useful for servicing CD players, though the opportunity to try this out didn't arise during our test period. A form of X-Y display is used in the component tester feature.

The component tester works at 50Hz, applying a voltage of 8·6V r.m.s. to the device being tested and measuring the resulting current (maximum 28mA). Voltage is indicated on the screen as horizontal deflection and current as vertical deflection, so that each type of component gives a unique signature — diagonals for resistors, circles and ellipses for capacitors, knees and crank-handles for semiconductor devices and so on. Fine for quick checks, but its usefulness depends on the operator getting into the habit.

An incentive to use this mode of testing is the provision of two identical component testers, one for each trace. This permits comparison — overlay if required — of the characteristics of two devices for test, selection or matching purposes. Using this feature in two identical items of equipment or channels could provide a quick and easy way of tracking down faults, perhaps in situations where inductors are involved or where applying the operating power leads to damage. . .

The heart of an oscilloscope is its c.r.t., which virtually dictates the design of all the other sections and also determines the price and usefulness of the instrument. In

Table 1: Abridged specification.

Operating modes: Channel 1; dual trace alternate or chopped (at 100kHz); Ch. 1 + Ch. 2; Ch. 1 − Ch. 2; X-Y operation.

Y amplifiers: A.C. or d.c. coupled. Bandwidth d.c. to 25MHz (−3dB point). 2mV to 10mV/division in 12 steps, 1-2-5 sequence. Rise time <14nsec. Accuracy ±3%. Input impedance 1MΩ/25pF.

Timebase:0·5μsec/division to 0·2sec/division in 18 steps. Vernier control and ×5 magnifier. Accuracy ±5%.

Trigger: Auto/normal; internal/mains/external; TV line or field; a.c./d.c./low-pass filter; positive- or negative-going slope; 5:1 hold-off. Sensitivity 1 div in most modes.

X amplifier: Input via Y2; bandwidth d.c. to 1MHz (−3dB point); other details as for Y amplifier (see above).

Probe test: 200mV peak-peak squarewave at 1kHz.

Auxiliary outputs: +5V (negative ground) at 1A maximum; 12-0-12V (floating) at 200mA.

Component tester: Dual capability. 50Hz, 8·6V r.m.s. maximum. Maximum current 28mA.

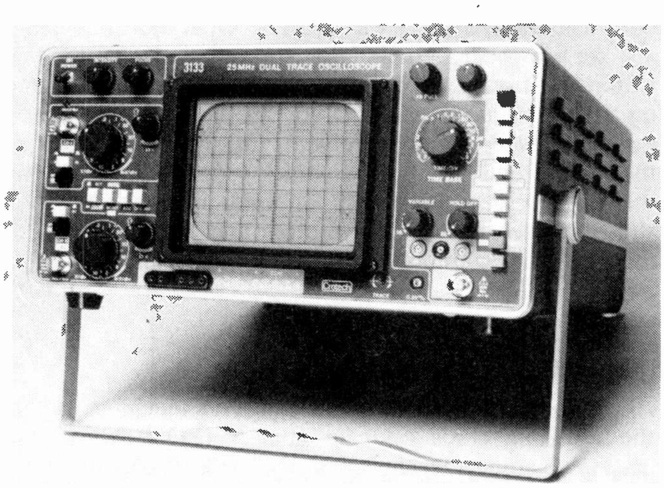
Display: 130mm flat-face mono-accelerator c.r.t., 2kV e.h.t., P31 phosphor, ruled 8 × 10cm divisions.

Power: 115/220/230/240V a.c. at 48-62Hz. Consumption 40VA without auxiliary outputs loaded.

General: Weight 8·5kg, size 165 high × 330 wide × 395 deep mm. Instruction manual, component tester/power supply leads and two input leads with BNC plugs supplied with scope. Optional extras: switched probes ×1/×10; light hood; front panel transit cover with probe pouch; top cover, probe pocket.

this price range you get a mono-accelerator tube working at 2kV e.h.t. Its display is adequate for most TV, audio and VCR work, but the limited brightness available can make it difficult to see short duty-cycle events like a magnified portion of a video head sweep, a field sync pulse train or a horizontal segment of a picture such as the multiburst or colour-bar features of a test pattern. Loss of brightness in these and similar situations can be minimised by (a) using a light hood, (b) operating in the single-beam mode, and (c) avoiding X-expansion by careful use of the trigger and hold-off controls. For better performance in this respect you have to buy a more expensive scope with a higher e.h.t.

The tube fitted in the review model didn't defocus at any setting of the brightness control, which is a better



The Crotech 3133 25MHz dual-trace oscilloscope.

performance than with many scopes we've tried out. The brightness reserve is not very high though, and I found that the brightness control was fully advanced throughout my tests of the instrument.

The graticule is not integral with the tube's faceplate. You thus get a degree of parallax error when taking readings. Maintaining a large waveform display keeps this to a minimum. The 0/10/90/100 per cent markers on the graticule are useful in experimental, testing and design work for measuring time-constants and rise times.

The 5V/1A and 12-0-12V/200mA supplies are available at miniature sockets at the bottom of the front panel. Handy connecting leads, terminated with colour-coded mini-croc-clips, are supplied. I found that both voltage sources were accurate and well stabilised, and capable of withstanding a sustained dead short cruelly put on to test the machine's defences. These auxiliary supplies are a useful and convenient source of power. Well worth having.

The 3133 is a big oscilloscope, well made and attractive in appearance. There's very little plastic in its construction, which is unusual these days. Inside the aluminium case I found the circuit beautifully laid out on four main glassfibre PCBs, with two smaller sub-boards. The e.h.t. generator sector is in a separate screened compartment. The switches and potentiometers appear to be sturdy and of good quality — this fact along with the beefy, cool-running mains transformer and the generally sturdy construction of the instrument suggest that if bought now it will carry on well into the twenty first century. The component reference numbers (and in some cases the values) are clearly marked on the PCBs — more than can be said for many TV sets and audio equipment.

User's Manual

The user's manual provides full circuit diagrams and descriptions, board layouts, parts lists and alignment instructions. Most of the parts used are readily available so that service and repair, should it ever be required, should present little difficulty. Also supplied with the instrument is a little book entitled "Getting the best from your scope". This supplements the operating instructions in the user's manual. Very good.

Conclusion

In conclusion this is a good oscilloscope, well made and with a performance which I would describe as being competitive rather than spectacular. It's main competition comes from the almost identically priced Hameg HM203-6. Buying the Crotech model gives you an extra 5MHz of bandwidth in each channel, the dual component test facility and the auxiliary d.c. outputs. You lose the vernier Y controls and the internal c.r.t. graticule. Certainly I feel that the Crotech 3133 is good value for money, and I would confidently recommend it to anyone looking for a good general-purpose oscilloscope. For use in the field I feel that the front panel transit cover (an optional accessory) is essential to protect the knobs and tube bezel. For viewing short duty-cycle traces the light hood, also an optional accessory, is really a necessity.

Availability and Price

The scope is available from Crotech Instruments Ltd., 2 Stephenson Road, St. Ives, Huntingdon, Cambs PE17 4WJ (0480 301 818) at £319 plus VAT.

VCR Clinic

Reports from Philip Blundell, Eng. Tech., Alan Shaw, Paul Hardy, Eugene Trundle, Ian Bowden, Nick Beer and B. Ross

Philips VR6468

At switch on the cassette carriage moved in and out as usual but the clock display was out and none of the keyboard controls worked. The +13a supply was missing at the keyboard panel as R3509 (15Ω) on panel P607 was open-circuit. **P.B.**

Grundig VS400

The customer complained that when a cassette was ejected a loop of tape was sometimes left hanging out of it. The only way in which I could make the fault occur was to press stop with the machine in rewind search. The tape then wasn't drawn back into the cassette. Slight readjustment of the mecha state switch was required. **P.B.**

Ferguson 3V31

The trouble with this machine was field bounce in the still frame mode, the vertical pulse control on the front panel having no effect. A dry-joint was eventually found at C75 on the servo board. **P.B.**

Philips VR6462

If play is selected without a cassette inserted these machines usually provide the test pattern. This one produced the test pattern even with a cassette in! The test signal is enabled by the TPI signal on Bus C: it was high all the time because transistor 7508 was open-circuit. **P.B.**

Grundig VS220

For intermittent faults such as the display goes haywire or the mechanism does odd things check the ripple on the +12Vd supply. If it's excessive either C437 or C436 has probably dried up. **P.B.**

Ferguson 3V65

Playback of a test tape was good but there was a smeary E-E picture. Replacing the luminance module IC101 put this right. **A.S.**

Orion VHL3

There was no sound muting in the search mode. The DTC124F digital transistor Q1025 was faulty. **A.S.**

Hinari VXL5

This machine would operate for about twenty seconds in play or record then shut down. The take-up reel sensor was faulty. Here's a tip: switch to counter, press play and observe the erratic and irregular number changes. **A.S.**

Amstrad TVR3

Here's an interesting one we've had with several of these new combi-units (TV plus VCR). The remote control handset operates the VCR functions but not the TV ones. The fault lies within the VCR section, associated with the remote control receiver. Ribbon cable CL8 to the front of the tuned circuit can should have six leads but a five-wire cable is fitted, leaving a vacant hole at either end of the ribbon. Fitting a short length of wire cures the problem. So much for quality control . . . **A.S.**

Hitachi VT17

The heads had worn out and were replaced. After doing this I was left with a problem: the top half of the picture was fine but the lower half was noisy and there was a definite division between the two. The cause of the fault was traced to the relay on the video drum PCB. It shorts out the trick mode heads during normal playback but was not doing its job properly. A replacement provided an effective cure. **P.H.**

Philips VR6542

The problem with this machine was that recordings had intermittent colour. It was to some extent signal-dependent – a weaker signal was more prone to cause the symptom. Changing IC501 on the Y/C panel made no difference and we eventually found that the 627kHz signal was off frequency by about 70kHz. Resetting this produced reliable operation.

We've had several of these machines that don't seem to like E240 cassettes – the tape commits suicide on the mechanism though there doesn't seem to be any mechanical fault. Does anyone have any ideas about this? **P.H.**

JVC HRD320

The problem with this brand new machine, straight out of the box, was that three of its buttons were inoperative – set–, set+ and Ch. set. On investigation we found that D11 on the timer/display board had been fitted back-to-front. It's part of the key-scan matrix. The diode was undamaged and fitting it the correct way round restored normal operation of all the buttons. The same symptoms would arise with other makes and models fitted with this type of timer/display board. **E.T.**

Sony CCD-V30

The viewfinder tube in this camcorder displayed a picture locked to a multiple of the line rate. This occurred with both camera and playback pictures. Operation through a TV set via the r.f. modulator showed that all was well within the basic camcorder circuitry, so we concentrated on the electronic viewfinder. The line hold control RV952 was responsible for the problem, due to poor contact at the riveted end of its carbon track – flexing and twisting this little preset could restore a normal picture display. It's strange to recall that the symptom and the root cause of the fault were common with the TV sets of the sixties! **E.T.**

JVC HRD110/120/Ferguson 3V35 etc

A common problem with this range of machines is that the retaining studs on cam gear 1 (PQ30028) of the cassette loading mechanism break. This allows the associated slide gears to escape, producing symptoms such as no front loading, no eject, loading system jammed etc.

The only long-term cure is to replace gear 1, but a temporary cure (while awaiting spares?) can be achieved by refitting the stud using a small self-tapping screw through the back of gear 1. The sort that RS Components used to call an "8BA binder" will work. This assumes of course that you can find the broken stump of the plastic stud! **E.T.**

Panasonic NV370

The user's description of the fault with this machine was "no functions". At switch-on an eerie "heartbeat" noise came from within and continued until the machine switched itself off a few moments later: it was caused by the capstan motor shunting back and forth. Meanwhile eject wouldn't work.

This effect is usually due to a missing 5V rail, Q501 on the head drum assembly being open-circuit. The 5V line was intact this time, but the 12V line was missing. We quickly traced the cause of this to an open-circuit safety resistor (R1101) in the unregulated 12V supply. It appeared to have failed for its own internal reasons. **E.T.**

Panasonic NV-G45

This machine was faulty when taken from the box. The playback picture would come and go, due to drum speed variations that could also be heard. When we turned the machine on its side to remove the bottom cover the fault cleared. While looking for a loose plug/socket connection we removed the drum cylinder and found a crack almost half way across the double-sided stator panel, between the socket and where the panel enters the drum unit. **I.B.**

Panasonic NV-M5

This camcorder was stuck in the camera mode. Normally when the clear cover over the VTR controls is slid up to uncover them a small microswitch (SW6313) operates. It closes for camera, opens for the VTR mode, but something was wrong with the switching. When closed (camera mode) SW6313 connects the base of QR6009, a UN2113 pnp transistor with internal bias resistors, to chassis. As a result positive key-scan pulses pass to the control chip IC6001. SW6313 should be open and QR6009 off in the VTR mode. Even with QR6009's base disconnected however the pulses were getting through as the transistor had an emitter-to-collector leak. **I.B.**

Panasonic NV788

The complaint was of a poor picture. On test however the picture was all right except in the still mode, when almost half the picture was lost in noise. Having seen this problem with other machines I checked the playback tension, suspecting that this was low (10g-cm instead of 30g-cm). The cassette carriage assembly was removed, a cassette was put in it and another one was held in the machine. A check on the back tension then proved that it was correct. I tried again with the cassette carriage refitted and spotted the cause of the problem – the back-tension post arm, which runs against the tape, moved too far to the left and rested against part of the carriage assembly. With the assembly removed the arm moved far enough to give the correct tension. The cure was to move the fixed end of the brake band to pull the arm further to the right when running then adjust the tension spring for correct back tension. This problem could very easily arise if the brake band is replaced and the position of the back tension arm, when playing a tape, isn't checked before refitting the carriage. **I.B.**

Panasonic NV-G40

We've had several of these machines with faulty video heads when new, but the complaint with this one was very grainy r.f. loop-through. A check on the unswitched 12V supply to the r.f. amplifier showed that this was low at about 5·2V. Further checks indicated that the rail was not being loaded excessively so attention was directed to the power supply, which is usually very reliable. Regulator transistor Q1004 (2SD1330) was soon found to be open-circuit. **N.B.**

Sony SL-F1

The complaint with this portable machine was that it wouldn't play. We found that the pinch press lever had become disengaged from the pinch solenoid lever. When a new press lever had been fitted – the original one had a worn plastic arm – the machine played for about two-three seconds then cut out. We then found that the take-up torque was low. Since fast forward operation was perfect it seemed that the cause of the fault was servo rather than motor trouble. While checking the waveforms in the reel servo I found the rather unlikely cause of the fault – a speck of solder was bridging two contacts on adjacent print lands. At first sight it looked like a single length of track, but the short effectively joined pin 1 of IC201 (supply FG) to pin 29 of IC601 (syscon-2). Fortunately no lasting damage had been done. The short must have been present from new and it's remarkable that it had only now showed up. Our customer accepted the estimate but refused a second one for the drum surfaces causing the usual rewind trouble – apparently he rewinds his tapes in another machine! **N.B.**

Grundig 2 × 4 Super

The customer brought this machine along in a great hurry as he wanted to record a programme. He said it wouldn't load a cassette. The cause was quickly found – the cassette-in switch CL wasn't making. As a temporary measure to enable the customer to make his recording we shorted the switch out by linking pins L1-6 and 7 on the switch board. This restored normal operations including unloading. To load it was necessary to insert a cassette then press "tape", after which the machine would load. Note that if the CL-closed signal is not present no functions are available (play, wind, etc.) even with a loaded tape. **B.R.**

Philips VR2021

This machine would thread up and then unthread about two seconds later. The head and reels turned during this period, as they should, but the head speed was slow. A check on the voltages around the servo and motor drive amplifier circuits showed that they were incorrect, the cause being lack of signals from the head pulse optocoupler circuit on board P61. This was in turn due to the LED on the winding spool optocoupler unit P60 being open-circuit. The LEDs for P64 (tape tension optocoupler), P60 and P61 are connected in series via a limiting resistor from the 12V line. So there were no pulses to the head servo circuit. **B.R.**

A Look at Operational Amplifiers

Part 1

Keith Cummins

The operational amplifier has been with us for many years but until recently had generally not figured significantly in the TV/video field. The audio and servo sections of VCRs and CD players lend themselves to the use of operational amplifiers however so perhaps it's time we gave them a closer look.

The first use of operational amplifiers was in analogue computers – a long time ago! They were used to perform arithmetical *operations,* for example the addition and subtraction of voltages representing numerical values. While this original need for the operational amplifier has largely disappeared, the basic concept nevertheless provides an extremely useful building block for circuit design in a multitude of applications.

Basic Op Amp Features

Fig. 1 shows the circuit symbol for an operational amplifier. In its simplest form it consists of an amplifier with two inputs and one output. The inputs are referred to as inverting and non-inverting: the inverting one is identified by the minus symbol and the non-inverting one by the plus symbol – these are not power supply connections! A positive voltage applied to the non-inverting input causes the output to move positively while a positive voltage applied to the inverting input moves the output in the negative-going direction. In addition to its inputs and outputs the operational amplifier needs a power supply. Very often this consists of both positive and negative voltages, balanced about earth (0V).

The d.c. gain of a typical operational amplifier chip is generally enormous. A voltage gain of half a million is common today, and it's this fact that enables us to use the amplifier to carry out neat and clever functions, with just a few peripheral components. Because the gain is so large it's generally expressed in dBs. This is known as the "open-loop gain". Normally the loop is closed, using passive components, and we shall soon see that the performance of such a circuit is defined almost entirely by the passive components. Consequently the design can be made totally predictable and repeatable. Ideal, for example, for use in mass-produced servo systems.

Let's get down to business then and take a further look at the operational amplifier shown in Fig. 1. Say it's open-loop gain is 500,000, i.e. 114dB. Thus a change of $+2\mu V$ at the non-inverting input, relative to the inverting input, will produce a +1V change at the output. Conversely a change of $+2\mu V$ at the inverting input, relative to the non-inverting input, will produce a −1V change at the output. Having made this basic point, we must consider two further points.

First, if both inputs move by the same amount in the same direction the changes subtract from one another. Thus the output doesn't change. Putting this another way we can state that the output changes only when there's a difference change between the two input voltages. This ability of the operational amplifier to ignore changes in the same direction is called common-mode rejection. It's important and we'll return to it later.

Secondly if the inputs move in opposite directions the output moves by an amount that's proportional to the sum of the changes of the input voltages, i.e. the total potential difference between the two input terminals. We'll elaborate on this later.

Basic Circuits

We'll next consider some basic operational amplifier uses.

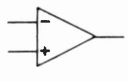
The inverting amplifier is shown in Fig. 2. In addition to the operational amplifier there are two resistors, R1 and R2. Remember that the typical operational amplifier requires a difference of only $2\mu V$ between the two inputs to produce a 1V change at the output. This is the key to what happens. Let's take a simple, practical example. Say R1 is 1kΩ and R2 is 5kΩ. Positive and negative 10V supplies are connected to the chip.

Say we connect +1V to the input. The immediate effect of this is that the inverting input tries to move away from 0V (the non-inverting input) via the potential divider R1-R2. The output moves negatively, applying sufficient negative-going voltage to R2 to move the inverting input back towards 0V (within a few microvolts!).

The situation is thus as follows. The inverting and non-inverting inputs are very close together in terms of voltage, so close in fact that since the non-inverting input is at 0V the inverting input is at virtually 0V – we call it a virtual earth. This means that R1 has 1V at one end and 0V at the other. As its value is 1kΩ, the current flowing through it is 1mA. No current is flowing into the operational amplifier's inverting input, so the current flowing through R1 also flows through R2. Since R2 is 5kΩ, with 1mA flowing through it the voltage developed across R2 is 5V. The sense of current flow means that the operational amplifier's output stands at −5V. It can't do anything else!

What do we know from this? Simply that the gain of the circuit with the closed-loop feedback as specified is −R2/R1. We put +1V in and −5V comes out. The gain is −5 (−5,000/1,000 = −5). This gain is defined entirely by the values of R1 and R2: the more precise their values, the more precisely the gain of the circuit is defined.

Since the input resistor R1 "sees" a virtual earth, the circuit's input impedance is simply R1. The output imped-



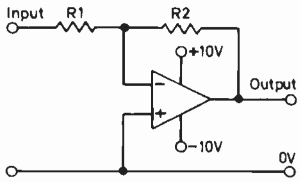
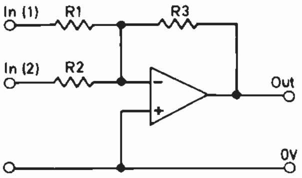


Fig. 1 (left): The operational amplifier circuit symbol.
Fig. 2 (right): The basic inverting amplifier circuit.



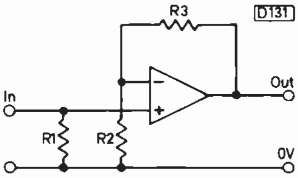


Fig. 3 (left): The summing and inverting amplifier.
Fig. 4 (right): The non-inverting amplifier circuit.

ance is low: a few ohms is typical, but the amplifier won't have the capability of high-current drive (more on this later).

The second circuit, Fig. 3, is a summing and inverting amplifier. There are two input resistors R1 and R2 and this time the feedback resistor is R3. The junction of the three resistors is the virtual earth point, and the arithmetical sum of the currents here is zero. Seen from input one the gain is $-R3/R1$ while from input two it's $-R3/R2$. Note that since each input resistor is connected to virtual earth, the input resistors are "unaware" of each other and there's no cross-coupling between the inputs.

If we call the current through R1 I1, that through R2 I2 and that through R3 I3, then $I1 + I2 = I3$. That is,

$$(V1in/R1) + (V2in/R2) = (-Vout/R3).$$

If we make R1, R2 and R3 equal, then $V1in + V2in = -Vout$, i.e. the output is the sum of the input voltages with the sign reversed.

By manipulating the values of the resistors we get different input to gain ratios and overall amplification as required. Use of a ladder of input resistors provides the basis of a digital-to-analogue converter.

Having dealt with the basic inverting operational amplifier configuration I hope you'll feel more at home with the principles involved. We can summarise the action of a feedback-controlled operational amplifier by stating two important rules:

Rule 1: The output of a feedback-controlled operational amplifier always moves to try to reduce the voltage between its two inputs to zero.

Rule 2: For most practical purposes we can say that the inputs draw no current.

Fig. 4 shows the basic non-inverting operational amplifier circuit. The input is applied to the non-inverting input, which has a high impedance – determined by the value of R1. The gain is determined by the amount of feedback, and is inversely proportional to the feedback attenuator network R3, R2. The amount of potting down is $R2/(R2 + R3)$. Thus the gain is $(R2 + R3)/R2$.

In the special case where R3 is zero and R2 is not fitted we have a voltage-follower with a gain of one. It's like an up-market emitter-follower: it can drive well in both directions and has no offset of 0·6V between the input and output – a very useful configuration which we'll come across again later.

Quoted Characteristics

From what we've said so far you'll see that the basic design of operational-amplifier circuits can be carried out by means of very simple calculations. There are pitfalls to watch out for however. Having covered the fundamentals we can move on to consider the operational-amplifier characteristics that have to be taken into account when the device is used in more demanding applications. We shall also see why, although operational amplifiers are great for use in servo, audio and power supply applications, you won't find them used much in video circuits. We must next define some of the basic characteristics.

(1) Open-loop gain. This has already been mentioned: it's the d.c. gain with no feedback applied.

(2) Input offset voltage. However hard the manufacturer pursues this ideal, the input circuits within an operational-amplifier chip are never identical. The input offset voltage is the difference in input voltages (at the inverting and non-inverting inputs) required to bring the output to zero. Some operational amplifiers have the facility to trim the input offset voltage to zero externally, using a potentiometer connected to pins set aside for this purpose. With a good operational amplifier the input offset voltage can be of the order of microvolts: for the old 741 type it can be up to 6mV.

(3) Gain-bandwidth product. Operational amplifier data sheets quote a gain-bandwidth product figure. Up to now I've quoted the open-loop d.c. gain. The gain falls as the frequency rises however. The gain-bandwidth product refers to the closed- as well as the open-loop gain. In other words it applies whatever gain we intend. It works like this. If we use an operational amplifier whose gain-bandwidth product is 1MHz and design the circuit for a gain of 100, the gain will fall off significantly as the frequency approaches 10kHz. That is, gain (100) × bandwidth (10kHz) = the gain-bandwidth product (100 × 10,000 = 1MHz).

If you are restricted to the use of this particular operational amplifier with its 1MHz gain-bandwidth product and need to maintain the gain right up to 10kHz you can use two amplifiers in cascade, each providing a gain of ten. This will give you a useful bandwidth up to 100kHz while still maintaining the overall gain of 100.

(4) Slew rate. This is the rate at which an operational amplifier's output can change. It's usually quoted in volts/microsecond. What it means is that as the frequency rises so the maximum attainable peak-to-peak output voltage drops off. From the point where the slew rate limiting starts to "bite", the maximum amplitude falls as the reciprocal of frequency.

(5) Phase margin. This is a more difficult characteristic, but it's as well to be aware of it. A typical operational amplifier circuit's open-loop gain rolls off in the same manner as the response provided by a simple *RC* filter, i.e. it follows a 6dB/octave curve. This means that every time the frequency is doubled the gain is halved. It results in a 90° lagging phase shift to begin with, increasing up to 160° as the frequency approaches the gain-bandwidth figure (that is, the gain is approaching one). The phase margin is the difference between this phase shift and 180°, where the feedback becomes positive. Generally speaking this does not cause problems at low frequencies, but it can be a real pain at higher (e.g. video) frequencies, when the operational amplifier can "hoot", i.e. produce parasitic oscillations.

I recall designing a 2MHz active low-pass filter using operational amplifiers. It produced the desired 18dB/octave roll-off, but also produced a low-amplitude hoot at 20MHz. All attempts to manipulate the operational amplifier circuit to get rid of the hoot mucked up the frequency response. In desparation I finally used a pi-section passive filter to give an 18dB/octave roll-off above 5MHz. This wiped out the hoot as far as the outside world was concerned, but of course I knew what was still going on inside the unit! Not one of my proudest moments – I don't talk about it much any more, despite the fact that the unit has continued to provide sterling service for many years.

So much then for the basic characteristics of operational amplifiers. Next month we'll look at some more classic operational-amplifier circuits.

Service Bureau

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

SHARP C2002

This set is reluctant to start up from standby. It's more willing to start in the evening when the room temperature is higher. Once running the set will continue to operate unless switched off by remote control then on again.

We suggest you check the following components for being high-resistance or open-circuit and replace as necessary: R616 1·5MΩ, R717 390kΩ, R709 and R710 both 68kΩ and C715 10μF, 100V. Before you do this check thoroughly for dry-joints around IC701, T701 and T602.

FIDELITY CTV1404R

There are two problems with this set. First, when one channel has been tuned to a particular station all the other channels are tuned to the same station, and the channel isn't stored. The M491B and TDA4500 chips have been replaced but the fault remains. When the channel is changed via the handset the same picture is displayed though the channel indicator will run through numbers 1-8. Secondly there's cramping at the bottom of the picture. All capacitors in the vicinity of the TDA3651 field output chip have been replaced.

For the first problem we suggest that you check, preferably by substitution, the 500kHz resonator connected to pins 7 and 8 of the control chip IC201. Also make sure that the 5V supply (pin 9) is present, correct and free from ripple and hash. The TDA3651 chip could well be responsible for the second problem, but before condemning it check the 25V supply at pin 9. It's important that this line is well decoupled.

HITACHI CPT2228

The remote control system suffers from reduced range and intermittent reception. A check with another receiver has proved that the handset is in order and the μPC1373H IR preamplifier chip has been changed.

First check that the infra-red receiving window/filter is clean and hasn't become obscured with age – try operation "naked" to prove this. If necessary check C1802 and C1804, then the SFH205 photodiode – the latter by substitution. If the remote-control a.g.c. is operating correctly there should be little change in the pulse amplitude at SC1803 with the handset at a distance of up to 15 feet or so.

PANASONIC NV2000

Forward and reverse rewind are all right but when the play switch is pressed the cassette begins to load then after a few seconds the machine stops loading. The belts have been changed but the problem persists.

It's almost certain that the mechacon section is not receiving an afterload signal from the deck. This may be because loading is not being completed for some mechanical reason (though the belts you have changed are the most common cause of this) or because the mode selector switch S6551 is faulty or incorrectly positioned. Close examination should reveal which of these is causing the trouble. Instructions for mode selector switch adjustment are given in the full manual.

FERGUSON TX10 CHASSIS

There's a very faint vertical white line with a kink in the lower half – the kink tends to move up and down – seven inches from the left-hand side of the screen. It can hardly be seen except on darker scenes, but annoys the customer. I've tried moving the cables etc.

Ensure that the triple RGB lead to the c.r.t. base panel is correctly folded and dressed and not dangling near the timebase or chopper sections. If this is o.k., suspect that one of the semiconductor devices, a diode or transistor, in the chopper circuit is faulty and radiating. Check this by substitution, starting with the chopper transistor TR701 then D703.

SHARP VC378

Failure of the Digitron display led us to check the power supply which appears to be in order apart from the fact that the a.c. output, which is specified as 7·5V, reads only 2·2V when measured with an Avo meter. A scope check shows a good trace with about 6·2V p-p at a frequency of around 200kHz. Are these readings normal and how would 7·5V a.c. have been measured? The negative component fed to the Digitron circuit is 16·5V d.c., which appears to be about right with the main negative line at 22V.

The 7·5V figure is probably the r.m.s. a.c. voltage across terminals ER9 and ER10: it feeds the display tube's heater. Since the −22V supply is about correct, the oscillator is clearly running all right. Check that the display segments are being pulsed by the display driver chip. If so the fluorescent panel itself is suspect – it may have lost its vacuum.

SONY KV2022UB

This set is working well apart from the fact that there are four teletext lines across the top of the screen and also four faint white lines across the centre of the screen. None of these lines are present at switch on. They appear after about five minutes then remain.

The problem is probably due to ageing electrolytic capacitors. Check, preferably by substitution, those associated with the field output stage – C563, C566, C587 etc. Also if necessary check D575.

SANYO VTC9300

This machine will not run. When switched on, only the eject and stop switch levers will go the full length of travel. When moved to the right with a small screwdriver the bar inside the machine to the front of the video heads will allow the rewind, fast forward and play buttons to be depressed to maximum. The electronics appear to be in order.

First ensure that the stabilised 12V line is exactly correct. If not, replace the regulator transistor Q702 with a TIP41 type and adjust VR701 for 12V at C709. If the machine appears to work normally when the latching bar is overridden it's likely that the afterload switch (the large microswitch on the upper deck surface) has failed or that the end-sensor oscillator has stopped – check with a scope, then for power to the CX141 chip on the syscon panel. A further possibility is that the machine thinks it has dew (low at collector of Q807). Check if necessary that the solenoid switching transistors Q801/2 are not leaky.

TEST CASE

316

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.

TV and video servicing can be a complex business these days. Various levels of skill and expertise are required, depending on the nature of the fault and the age and design of the equipment. At busy times – which is most of the time recently! – the simpler jobs are passed on to those who are less experienced and whose normal job is not full-time bench servicing, but who can achieve much under the guidance of a senior engineer.

An early Ferguson TX9 colour receiver (PC1001 main panel) looked a likely candidate for this treatment. The fault was described as "set dead", and we assumed that the internal mains fuse had blown. So John took off the back cover and checked FS1. It was intact, and so was the fuse in the mains plug. The set was next plugged into a safety-isolated socket and switched on. There was a slight buzz from the degaussing system followed by silence and no picture. John settled down with his meter and the set's circuit diagram.

He found that the output from the mains bridge rectifier W62-W65 measured above 200V – there's no reservoir capacitor here as the bridge supplies a regulating thyristor. This voltage was also present at the thyristor's anode. Switching to the meter's d.c. range John found, rather to his surprise, that some 130V was present at the cathode of the thyristor and that over 120V was present at R197, on the other side of the reservoir inductor. In short, the power supply was working correctly.

Further meter checks quickly established that the 115V h.t. potential was present at the collectors of the line driver transistor VT67 and the line output transistor VT68. There was no voltage at their bases however, so John concluded that the basic problem was lack of line drive. Sure enough a borrowed oscilloscope showed a complete absence of line drive pulses at the base of VT68, at the line driver transformer T2 and at the base of VT67. This led him back through the coupling capacitor C173 to pin 3 of the TDA9503 sync/line generator chip IC54. He found zero voltage at this pin and very soon found that there was a total absence of voltage at all the other pins as well.

The circuit diagram for the PC1001 version of the TX9 chassis is very helpful in using brightly coloured lines and symbols to indicate the source and routing of the various supply lines. From this John saw that the operating power for the TDA9503 chip is provided by the 12V regulator IC56. This receives an input of 15V from rectifier diode W95, which is fed from a winding on the line output transformer. Of the various possibilities here, W95 and IC56 were picked out for the initial checks. An ohmmeter test proved that the diode was in order and the regulator was checked by substituting a known good one from the stores.

A commendable effort, but fruitless since the set still didn't work. The h.t. was present, but there were no 15V and 12V supplies. As a further step John checked the continuity of the winding that feeds W95, and also checked its reservoir capacitor C193. He then consulted the others in the workshop. Having poured out his troubles, explaining matters with the aid of the circuit diagram, he was given a short description of the operation of the circuit in the line timebase area. As a result he soon found the cause of the trouble. What had he overlooked? See next month for the solution.

ANSWER TO TEST CASE 315
– page 360 last month –

Before the problem was finally solved, three engineers had given their attention to the faulty Toshiba V66 VCR described last month! The sort of picture jitter it produced is symptomatic of very short-term changes in the head scanning velocity, but the fact that it was more severe towards the bottom of picture suggested that the tape's movement became progressively rougher towards the exit side of the drum at the right.

This was the clue that led Sage to examine the exit guide. It consists of a nylon sleeve which spins freely on a highly machined shaft. When Sage went in with his little screwdriver he "stuck" this rotating sleeve, completely altering the jitter effect on the picture. When he removed the guide he found that the nylon sleeve didn't run smoothly on its shaft. As an experiment, one tiny drop of oil was introduced into the guide. After cleaning the outer surface of the sleeve the guide was then replaced in the machine. When a scrap tape was run the picture was seen to have rigid, straight verticals.

While this proved the point, there was the possibility of tape polution if the treated guide was left in the machine. A new guide assembly was ordered and fitted before the machine went home to Crowfield.

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TELEVISION APRIL 1989

Published on approximately the 22nd of each month by IPC Magazines Limited, King's Reach Tower, Stamford Street, London SE1 9LS. Filmsetting by Trutape Setting Systems, 220-228 Northdown Road, Margate, Kent. Printed in England by the The Riverside Press Ltd., Thanet Way Whitstable, Kent. Sole Agents for Australia and New Zealand – Gordon and Gotch (A/sia) Ltd.; South Africa – Central News Agency Ltd. Subscriptions: Inland £18, overseas (surface mail) £21 per annum, payable to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex RH16 3DH. "Television" is sold subject to the following conditions, namely that it shall not, without the written consent of the Publishers first having been given, be lent, resold, hired out or otherwise disposed by way of Trade at more than the recommended selling price shown on the cover, excluding Eire where the selling price is subject to currency exchange fluctuations and VAT, and that it shall not be lent, resold, hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever. ISSN 0032-647X.

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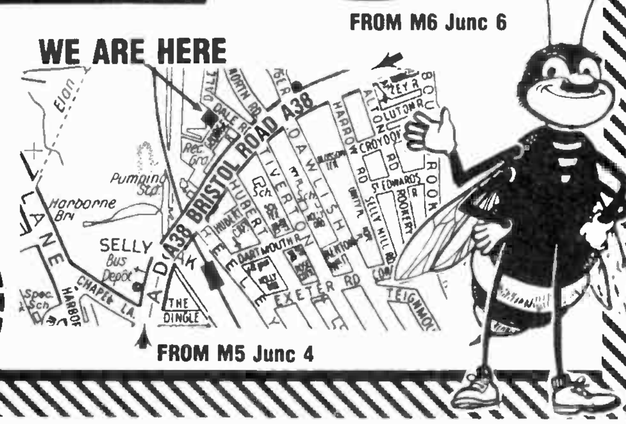

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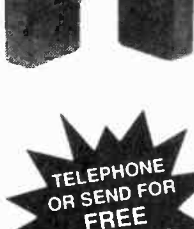

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BFR34	110p
BFR36	110p
BFR40	25p
BFR51	21p
BFR62	21p
BFR79	25p
BFR90	52p
BFR91	99p
BFR94	500p
BFS22	110p
BFT37	130p
BFT42	30p
BFT43	30p
BFW84	30p
BFW92	35p
BFX29	20p
BFX84	20p
BFX85	20p
BFX87	15p
BFX88	15p
BFX89	60p
BFY17	30p
BFY18	40p
BFY41	28p
BFY50	14p
BFY51	14p
BFY52	14p
BFY56	25p
BFY57	25p
BFY64	25p
BFY90	45p
BLY48	85p
BLY49	85p
BR100	14p
BR101	43p
BR103	37p
BR303	85p
BRY39	55p
BRY49	38p
BRY56	33p
BSS74	33p
BSX20	15p
BSX26	18p
BSX29	19p
BT100A	70p
BT106	120p
BT109	90p
BT116	80p
BT119	100p
BT120	100p
BT138	60p
BT146	99p
BT151	58p
BTY79	140p
BU100A	110p
BU104	100p
BU105	80p
BU108	100p
BU109	100p
BU110	110p
BU111	140p
BU124	60p
BU126	70p
BU180	150p
BU184	100p
BU204	75p
BU205	70p
BU206	100p
BU208	75p
BU208A	80p
BU208D	100p
BU209	140p
BU225	190p
BU226	190p
BU312	120p
BU325	55p
BU326	85p
BU406	85p
BU406D	95p
BU407	75p
BU407D	95p
BU408	85p
BU408D	95p
BU409	95p
BU426	120p
BU500	110p
BU508A	120p
BU508D	100p
BU536	150p
BU526	150p
BU546	140p
BU608	150p
BU626	150p
BU636	150p
BU801	95p
BU806	120p
BU807	95p
BU902	130p
BU903	130p
BU920	130p
BU921	130p
BU922	130p
BU930	180p
BUX80	180p
BUX82	180p
BUX84	65p
BUX85	65p
BUY69A	200p
BUY70C	160p
C106D	28p
J174	38p
J300	50p
MCR220	120p
MEO411	18p
MEO414	125p
ME3001	12p
ME4103	12p
ME6001	12p
ME6002	15p
ME8001	15p
ME9021	12p
MJ802	350p
MJ900	200p
MJ901	200p
MJ1000	200p
MJ1001	200p
MJ10012	300p
MJ15001	325p
MJ15002	300p
MJ15003	325p
MJ15004	370p
MJ15022	400p
MJ2500	100p

MJ2501	110p
MJ2955	55p
MJ3000	115p
MJ3001	115p
MJE29A	30p
MJE30A	30p
MJE340	25p
MJE350	80p
MJE520	30p
MJE2955K	90p
MP8111	40p
MP8112	45p
MP8113	55p
MP8512	50p
MPN3404	30p
MPS6571	20p
MPS9012	20p
MPS9013	20p
MPS9014	20p
MPS9015	20p
MPSA05	15p
MPSA06	15p
MPSA13	15p
MPSA20	15p
MPSA42	15p
MPSA43	15p
MPSA65	25p
MPSA66	25p
MPSA70	15p
MPSA92	20p
MPSA93	20p
MR510	35p
MR856	36p
MRF479	350p
MV1622	80p
MV209	48p
MV2209	48p
OC28	250p
OC29	250p
OC35	250p
OC36	250p
OC45	50p
OC71	30p
OC72	50p
OC200	180p
OT121	120p
R2008B	100p
R2010B	100p
R2030	100p
R2306	55p
S2800D	52p
S2800M	72p
T2800D	52p
T2800M	72p
TAG4442	76p
TAG4443	76p
TAG4444	76p
TIP29	15p
TIP29A	22p
TIP29C	25p
TIP30	25p
TIP30C	30p
TIP31A	24p
TIP31C	30p
TIP32	24p
TIP32A	24p
TIP32C	28p
TIP33	50p
TIP33C	60p
TIP34	50p
TIP34C	60p
TIP35C	65p
TIP36C	65p
TIP41A	22p
TIP41C	25p
TIP42A	22p
TIP42C	25p
TIP47	40p
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
TIP130	30p
TIP131	30p
TIP130	30p
TIP141	90p
TIP142	90p
TIP145	65p
TIP146	90p
TIP147	100p
TIP150	90p
TIP151	90p
TIP2955	42p
TIP3054	45p
TIP3055	42p
TIS43	45p
TIS44	40p
TIS61	15p
TIS88A	45p
TIS90	15p
TIS91	18p
TIS93	20p
VK1010	88p
VN.10KM	60p
VN.46AF	88p
VN.66AF	100p
VN.88AF	115p
VN.89AF	110p
Y723	75p
Y827	75p
Y860	22p
Y969	65p
ZTX107	11p
ZTX108	11p
ZTX109	12p
ZTX212	27p
ZTX300	13p
ZTX301	16p
ZTX302	16p
ZTX303	24p
ZTX304	17p
ZTX320	29p
ZTX326	29p
ZTX500	13p
ZTX501	13p
ZTX502	18p
ZTX503	18p
ZTX504	25p
ZTX550	24p
2N.696	26p
2N.697	22p
2N.698	40p
2N.699	45p
2N.706	22p
2N.708	22p
2N.914	28p
2N.918	38p
2N.930	18p
2N.1131	28p

2N.1132	28p
2N.1613	24p
2N.1711	24p
2N.1893	30p
2N.2102	50p
2N.2160	300p
2N.2218A	24p
2N.2219	24p
2N.2221	23p
2N.2222	23p
2N.2369	15p
2N.2484	20p
2N.2646	40p
2N.2904	20p
2N.2905	20p
2N.2906	18p
2N.2907	18p
2N.2926	8p
2N.3019	28p
2N.3053	18p
2N.3054	40p
2N.3055	38p
2N.3055H	50p
2N.3440	58p
2N.3442	85p
2N.3525	150p
2N.3583	90p
2N.3585	120p
2N.3702	9p
2N.3703	9p
2N.3704	9p
2N.3705	9p
2N.3706	9p
2N.3707	9p
2N.3708	9p
2N.3710	12p
2N.3711	12p
2N.3771	85p
2N.3772	90p
2N.3773	110p
2N.3799	18p
2N.3819	29p
2N.3866	68p
2N.3903	11p
2N.3904	11p
2N.3905	11p
2N.3906	11p
2N.4031	25p
2N.4036	25p
2N.4037	25p
2N.4058	13p
2N.4062	12p
2N.4064	100p
2N.4240	150p
2N.4248	130p
2N.4401	12p
2N.4403	12p
2N.4443	76p
2N.4444	76p
2N.4904	75p
2N.5061	20p
2N.5062	28p
2N.5088	20p
2N.5163	45p
2N.5192	50p
2N.5241	500p
2N.5245	45p
2N.5294	30p
2N.5296	30p
2N.5303	200p
2N.5320	90p
2N.5321	60p
2N.5366	25p
2N.5401	12p
2N.5448	12p
2N.5496	30p
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	150p
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	28p
BY299	28p
BY476	90p
BYX10	15p
BYX55/350	30p
BYX55/600	30p
BYX55/800	32p
BYX70/300	29p
BYX70/500	32p
BYX70/800	36p
BYX71/600	80p
OA47	6p
OA90	6p
OA91	8p
OA200	7p
OA202	7p
IN.914	2p
IN.4001	4p
IN.4002	4p
IN.4003	4p
IN.4004	4p
IN.4005	4p
IN.4006	4p
IN.4007	5p
IN.4148	2p
IN.5400	9p
IN.5401	10p
IN.5402	10p
IN.5403	11p
IN.5404	11p
IN.5405	12p
IN.5406	13p
IN.5407	13p
IN.5408	13p
SKE4F2/06	50p
SKE4F2/08	70p
SKE4F2/10	90p
I.C. SOCKETS	
8pin	6p
14pin	8p
16pin	9p
18pin	12p
20pin	14p
22pin	16p
24pin	18p
28pin	20p
40pin	25p

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

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

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

LA-7027	400p
LA-7031	250p
LA-7032	700p
LA-7033	400p
LA-7040	280p
LA-7042	280p
LA-7043	300p
LA-7045	300p
LA-7046	300p
LA-7048	300p
LA-7050	250p
LA-7051	300p
LA-7060	250p
LA-7061	250p
LA-7070	500p
LA-7071	500p
LA-7072	350p
LA-7090	300p
LA-7110	400p
LA-7112	300p
LA-7205	250p
LA-7210	300p
LA-7212	300p
LA-7215	300p
LA-7220	300p
LA-7224	150p
LA-7225	180p
LA-7230	500p
LA-7505	250p
LA-7506	250p
LA-7507	250p
LA-7508	250p
LA-7520	500p
LA-7590	250p
LA-7620	500p
LA-7621	500p
LA-7751	450p
LA-7755	300p
LA-7770	300p
LA-7800	180p
LA-7801	280p
LA-7802	300p
LA-7803	400p
LA-7805	400p
LA-7806	260p
LA-7808	250p
LA-7810	300p
LA-7811	300p
LA-7820	250p
LA-7822	280p
LA-7823	280p
LA-7910	150p
LA-7920	150p
LAP-512	310p
LAG-552	200p
LAG-600	200p
LAG-634D	300p
LAM-508	200p
LC-7120	280p
LC-7130	280p
LC-7131	260p
LC-7132	400p
LC-7137	450p
LF-347	110p
LF-351	45p
LF-353	48p
LF-355	60p
LF-356	60p
LF-357	70p
LF-398	300p
LM-301	26p
LM-307	42p
LM-308CN	70p
LM-310	220p
LM-311	35p
LM-318	120p
LM-319	165p
LM-324	35p
LM-325	45p
LM-334Z	115p
LM-335Z	120p
LM-336	140p
LM-337	250p
LM-339	37p
LM-348	55p
LM-358	45p
LM-377	220p
LM-380	100p
LM-381	150p
LM-382	130p
LM-383	300p
LM-384	130p
LM-386	85p
LM-387	100p
LM-389	150p
LM-391	160p
LM-392	100p
LM-393	55p
LM-394CH	370p
LM-558	160p
LM-709DIL	30p
LM-710	45p
LM-711	85p
LM-723	40p
LM-725CN	380p
LM-733	60p
LM-741DIL	18p
LM-741MET	45p
LM-747	58p
LM-748	35p
LM-1458	33p
LM-1889	400p
LM-3900	40p
LM-3909	80p
LM-3911	160p
LM-3914	250p
LM-3915	255p
LM-3916	290p
LM-8560	300p
LM-016H	3200p
M-5155	150p
M-50120	600p
M-51102	290p
M-51316B	540p
M-51513L	160p
M-51514	160p
M-51515BL	220p
M-51516	260p
M-51517L	260p
M-51518	200p
M-54836	600p
MB-3705	150p
MB-3712	140p
MB-3722	310p
MB-3730	240p
MB-3731	300p
MB-3756	230p
MB-3759	200p
MB-8719	360p
MC-1310P	130p
MC-1327	70p
MC-1413	65p
MC-1455	45p
MC-1458	33p
MC-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
SAA-1006	300p
SAA-1008	450p
SAA-1009B	350p
SAA-1024	250p
SAA-1016T	400p
SAA-1220	400p
SAA-1251	380p
SAA-1272C	280p
SAA-1274	280p
SAA-3004	400p
SAA-5040A	280p
SAA-5040B	400p
SI-3242P	360p
SI-7300A	1400p
SNR-20A130K	200p
STA-301A	380p
STA-312	280p
STA-401A	380p
STK-0025	420p
STK-0029	430p
STK-0030	400p
STK-0039	410p
STK-0040	560p
STK-0049	570p
STK-0050	570p
STK-0059	620p
STK-0060	900p
STK-0070	1100p
STK-0080	690p
STK-011	370p
STK-013	700p
STK-014	700p
STK-015	490p
STK-016	800p
STK-020	540p
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STK-024	700p
STK-025	700p
STK-031	820p
STK-041	700p
STK-043	980p
STK-050	1450p
STK-056	820p
STK-077	600p
STK-078	620p
STK-080	710p
STK-082	720p
STK-084	740p
STK-086	910p
STK-430	500p
STK-433	490p
STK-435	510p
STK-436	490p
STK-437	600p
STK-439	550p
STK-441	740p
STK-443	740p
STK-457	580p
STK-459	610p
STK-460	720p
STK-461	720p
STK-463	780p
STK-465	800p
STK-501	580p
STK-563	480p
STK-583	600p
STK-732	850p
STK-734B	510p
STK-772B	480p
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STK-1050	750p
STK-1060	760p
STK-1070	1200p
STK-1080	1000p
STK-2025	800p
STK-2028	650p
STK-2029	500p
STK-2110	680p
STK-2120	820p
STK-2125	650p
STK-2110	680p
STK-2155	1000p
STK-2139	800p
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STK-4026	800p
STK-4036	500p
STK-4038	680p
STK-4048	1280p
STK-4060	580p
STK-4111	650p
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STK-4121	800p
STK-4131	650p
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STK-4151	720p
STK-4161	820p
STK-4162	820p
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STK-4311	800p
STK-4332	500p
STK-4352	700p
STK-4362	625p
STK-4372	600p
STK-4392	720p
STK-4773	1000p
STK-4793	1180p
STK-4803	820p
STK-4813	950p
STK-4833	920p
STK-4843	865p
STK-4853	950p
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STK-5421	625p
STK-5422	600p
STK-5441	500p
STK-5471	500p
STK-5476	600p
STK-5481	520p
STK-6922	600p

STK-6962	320p
STK-6972	630p
STK-7216	610p
STK-7308	800p
STK-7309	650p
STK-7402	660p
STK-7404	680p
STK-7406	800p
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STK-7410	1200p
STK-7563	1000p
STK-8250	700p
STK-8050	880p
STK-4833	1200p
STR-370	650p
STR-380	580p
STR-440	520p
STR-441	480p
STR-451	500p
STR-453	700p
STR-2012	650p
STR-3115	580p
STR-3125	580p
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STR-6020	600p
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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
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TA-7237	400p
TA-7238	400p
TA-7240	260p
TA-7241	260p
TA-7242	290p
TA-7243	350p
TA-7245	450p
TA-7247	800p
TA-7267	290p
TA-7269	850p
TA-7270	250p
TA-7271	400p
TA-7272	260p
TA-7273	350p
TA-7274	260p
TA-7280	330p
TA-7281	270p
TA-7282	260p
TA-7283	260p
TA-7288	260p
TA-7299	400p
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TA-7641	170p
TA-7658	130p
TA-7668	160p
TA-7680	480p
TA-7688	250p
TA-7698	720p
TA-7699	1200p
TA-7769	300p
TAA-550	20p
TAA-611B12	100p
TAA661	100p
TBA-120S	50p
TBA-395	60p
TBA-396	70p
TBA-520	120p
TBA-530	120p
TBA-540	120p
TBA-560	120p
TBA-641B11	400p
TBA-750	120p
TBA-800	40p
TBA-810AS	60p
TBA-820	65p
TBA-820M	50p
TBA-920	120p
TBA-950	120p
TBA-990	120p
TBA-1440G	120p
TC-5020	285p
TC-9109	500p
TC-9106	470p

TCA-240	200p
TCA-610	100p
TCA-740	130p
TCA-830	90p
TCA-940	100p
TCEP-100	200p
TDA-1001	200p
TDA-1003	150p
TDA-1029	300p
TDA-1035	120p
TDA-1044	300p
TDA-1054	200p
TDA-1083	200p
TDA-1170	100p
TDA-1180	190p
TDA-1190	100p
TDA-1200B	80p
TDA-1270	200p
TDA-1410	210p
TDA-1412	100p
TDA-1420	200p
TDA-1470	140p
TDA-1670A	300p
TDA-1770A	300p
TDA-1870A	300p
TDA-1908A	100p
TDA-1940	280p
TDA-1950	280p
TDA-2002	80p
TDA-2003	150p
TDA-2004	170p
TDA-2005	170p
TDA-2006	150p
TDA-2008	175p
TDA-2009	200p
TDA-2010	100p
TDA-2020	140p
TDA-2030	140p
TDA-2532	120p
TDA-2540	100p
TDA-2560	120p
TDA-2575A	100p
TDA-2581	180p
TDA-2590	200p
TDA-2593	150p
TDA-2600	580p
TDA-2611A	120p
TDA-2653	380p
TDA-2670	150p
TDA-2690	100p
TDA-2760	400p
TDA-3190	100p
TDA-3300B	480p
TDA-3301B	380p
TDA-3560	350p
TDA-3561	280p
TDA-3651A	290p
TDA-3652	300p
TDA-3710	320p
TDA-3800	350p
TDA-4420	180p
TDA-4600	260p
TDA-4601	250p
TDA-4950	200p
TDA-5700	200p
TDA-7040	250p
TDA-7050	200p
TDA-7211	150p
TDA-7220	150p
TDA-7270	150p
TEA-1002	650p
TLO-61	40p
TLO-64	80p
TLO-71	38p
TLO-72	55p
TLO-74	92p
TLO-81	40p
TLO-82	46p
TLO-83	67p
TLO-84	80p
UCN-5801A	560p
ULN-2002	70p
ULN-2003	69p
ULN-2004	69p
ULN-2068	270p
ULN-2802	170p
ULN-2803	130p
ULN-2804	170p
UPC-16C	160p
UPC-20C	220p
UPC-30C	190p
UPC-358	150p
UPC-554	130p
UPC-555	60p
UPC-556H	80p
UPC-558	200p
UPC-566	60p
UPC-571	220p
UPC-572	200p
UPC-574	60p
UPC-575C2	90p
UPC-576	200p
UPC-577	64p
UPC-578	400p
UPC-580	300p
UPC-592	95p
UPC-595	190p
UPC-596	190p
UPC-1001	220p
UPC-1018	170p
UPC-1020	200p
UPC-1021	200p
UPC-1023	60p
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UPC-1026	95p
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UPC-1032	60p
UPC-1155	200p
UPC-1156	250p
UPC-1158H2	70p
UPC-1167C2	170p
UPC-1168	105p
UPC-1181	110p
UPC-1182	110p
UPC-1183	200p
UPC-1185H2	230p
UPC-1186	80p
UPC-1187	150p
UPC-1191	100p
UPC-1197	140p
UPC-1216	120p
UPC-1222	130p
UPC-1230	210p
UPC-1238	120p
UPC-1263	230p
UPC-1277	240p
UPC-1278	240p
UPC-1350	115p
UPC-1353	160p
UPC-1363	190p
UPC-1365	320p
UPC-1373	85p
UPC-1378	210p
UPC-1380	450p
UPC-1382	110p
UPC-1383	250p
UPC-1384	260p
UPC-1394	170p
UPC-1397	450p
UPC-1470	200p
ZN-423	100p
ZN-424	100p
ZN-425	320p
ZN-426	260p
ZN-427	560p

LINEAR IC'S — Cont.
ZN-428425
ZN-429215
ZN-435340
ZN-448510
ZN-459190
ZN-1034170
ZN-1040640
ZNA-134H2150
ZNA-234E920
2SJ-48480
2SJ-49425
2SJ-50425
2SJ-77350
2SJ-122580
2SK-15350
2SK-1945
2SK-4950
2SK-55100
2SK-68100
2SK-133480
2SK-134415
2SK-135415
2SK-147160
2SK-176800
2SK-191160
2SK-19245
2SK-195150
2SK-197140
2SK-210130
2SK-211130
2SK-217130
2SK-291300
2SK-294400
2SK-312750
2SK-322300
2SK-323130
2SK-555480
2SK-557650
3SK-8870

JAPANESE TRANSISTORS

2SA-473	35p
2SA-483	400p
2SA-490	60p
2SA-562	57p
2SA-563	45p
2SA-571	500p
2SA-634	50p
2SA-636	50p
2SA-673	20p
2SA-684	60p
2SA-699	100p
2SA-715	90p
2SA-720	20p
2SA-733	30p
2SA-798	55p
2SA-844	30p
2SA-872	40p
2SA-872A	50p
2SA-886	90p
2SA-899	60p
2SA-907	650p
2SA-909	700p
2SA-933	40p
2SA-934	40p
2SA-935	40p
2SA-937	40p
2SA-940	70p
2SA-950	30p
2SA-952	50p
2SA-953	60p
2SA-965	60p
2SA-966	70p
2SA-970	50p
2SA-979	85p
2SA-984	50p
2SA-992	30p
2SA-1012	130p
2SA-1015	30p
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2SA-1103	200p
2SA-1104	200p
2SA-1105	250p
2SA-1106	250p
2SB-022	80p
2SB-324	55p
2SB-370	45p
2SB-546	70p
2SB-557	225p
2SB-561	50p
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2SB-595	60p
2SB-598	60p
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2SB-616	190p
2SB-621	85p
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2SB-649	40p
2SB-688	120p
2SB-703	125p
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2SB-707	200p
2SB-716	30p
2SB-727	200p
2SB-754	80p
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2SB-772	45p
2SB-775	160p
2SB-791	260p
2SB-792	70p
2SB-795	60p
2SB-825	135p
2SB-861	160p
2SB-882	160p
2SB-884	120p
2SB-886	225p
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2SB-950	180p
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2SC-97A	380p
2SC-454	45p
2SC-458	15p
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2SC-495	60p
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2SC-1106	180p
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2SC-1115	400p
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2SC-2073	70p
2SC-2075	80p
2SC-2078	95p
2SC-2086	60p
2SC-2098	600p
2SC-2166	90p
2SC-2228A	60p
2SC-2229	25p
2SC-2233	125p
2SC-2235	60p
2SC-2236	60p
2SC-2238	70p
2SC-2240	45p
2SC-2259	80p
2SC-2271	60p
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2SC-2290	1800p
2SC-2314	70p
2SC-2324	120p
2SC-2329	480p
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2SC-2695	2100p
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2SC-2749	350p
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2SC-2810	360p
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2SC-2922	610p
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2SC-3025	500p
2SC-3039	140p
2SC-3040	260p
2SC-3042	300p
2SC-3060	900p
2SC-3148	410p
2SC-3150	200p
2SC-3151	230p
2SC-3152	250p
2SC-3153	350p
2SC-3156	400p
2SC-3158	260p
2SC-3173	180p
2SC-3178	340p
2SC-3181	240p
2SC-3210	400p
2SC-3212	510p
2SC-3264	510p
2SC-3277	260p
2SC-3293	85p
2SC-3299	120p
2SC-3318	500p
2SC-3355	90p
2SC-3358	80p
2SC-3402	50p
2SC-3416	80p
2SC-3417	90p
2SC-3422	110p
2SC-3467	70p
2SC-3468	70p
2SC-3503	90p
2SC-3568	200p
2SC-3675	160p
2SC-3685	400p
2SC-3789	75p
2SD-024	60p
2SD-313	70p
2SD-325	80p
2SD-348	460p
2SD-371	240p
2SD-401	130p
2SD-438	100p
2SD-600	120p
2SD-613	70p
2SD-718	100p
2SD-1277	190p
2SD-1398	250p
2SD-1453	180p
2SD-1609	110p

BRIDGE RECTIFIERS

1A/50V	16p
1A/100V	18p
1A/200V	19p
1A/400V	21p
1A/600V	23p
1A/800V	28p
2A/100V	33p
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
1.5A/800V	40p

PLASTIC CASED TRIACS

4A/400V	60p
6A/400V	69p
8A/400V	68p
12A/400V	85p
16A/400V	105p
20A/400V	190p
25A/400V	205p
8A/400V	52p

THYRISTORS

0.8A/60V	20p
0.8A/100V	28p
0.8A/200V	29p
4A/400V	28p
8A/300V	59p
8A/400V	70p
8A/600V	79p
12A/400V	75p
12A/600V	90p
2N4444	76p
BR103	37p
BR303	85p
BT106	120p
BT116	80p
BT119	100p
BT120	100p
OT121	120p
TIC44	22p
TIC45	27p
TIC47	32p
17088	200p
17089	200p
17127	200p
15/80H	230p
15/85R	230p
SG613	850p
SG264A	300p

4000B SERIES CMOS IC's

4000	13p
4001	13p
4002	13p
4006	34p
4007	13p
4008	38p
4009	20p
4010	21p
4011	13p
4012	13p
4013	19p
4014	32p
4015	32p
4016	18p
4017	29p
4018	30p
4019	28p
4020	33p
4021	36p
4022	36p
4023	13p
4024	25p
4025	13p
4026	60p
4027	18p
4028	29p
4029	34p
4030	17p
4031	90p
4032	52p
4033	60p
4034	76p
4035	42p
4036	180p
4037	75p
4038	46p
4039	180p
4040	30p
4041	36p
4042	30p
4043	36p
4044	36p
4045	72p
4046	42p
4047	45p
4048	27p
4049	18p
4050	20p
4051	38p
4052	35p
4053	35p
4054	83p
4055	52p
4056	52p
4060	40p
4063	52p
4066	20p
4067	120p
4068	13p
4069	13p
4070	13p
4071	13p
4072	13p
4073	13p
4075	13p
4076	42p
4077	13p
4078	13p
4081	13p
4082	13p
4085	36p
4086	30p
4089	75p
4093	18p
4094	44p
4095	58p
4098	50p
4099	42p
4501	27p
4502	36p
4503	30p
4504	55p
4505	180p
4506	58p
4507	30p
4508	67p
4510	32p
4511	30p
4512	38p
4513	80p
4514	65p
4515	65p
4516	36p
4517	100p
4518	36p
4519	28p
4520	36p
4521	86p
4522	43p
4526	38p
4527	41p
4528	38p
4529	65p
4532	48p
4551	75p
4553	140p
4555	29p
4556	36p
4557	140p
4583	60p
4584	30p
4585	40p
40100	120p
40101	78p
40102	150p
40103	120p
40104	90p
40105	140p
40106	35p
40107	50p
40108	260p
40109	74p
40110	170p
40114	160p
40117	180p
40147	240p
40160	55p
40161	55p
40162	55p
40163	55p
40174	48p
40175	60p
40181	170p
40182	70p
40192	48p
40193	48p
40194	58p
40208	240p
40257	120p

74 SERIES

7400	20p
7401	16p
7402	18p
7403	20p
7404	35p
7405	10p
7406	40p
7407	40p
7408	25p
7409	20p
7413	35p
7414	45p
7416	40p
7417	32p
7420	22p
7421	25p
7425	15p
7430	25p
7437	28p
7438	35p
7442	45p
7447	60p
7450	22p
7451	10p
7454	25p
7470	30p
7473	30p
7474	40p
7475	25p
7481	90p
7482	70p
7485	30p
7486	28p
7489	80p
7490	35p
7492	45p
7493	35p
7495	48p
7497	80p
74107	30p
74111	52p
74116	85p
74119	85p
74122	40p
74123	20p
74125	40p
74126	45p
74132	42p
74141	55p
74145	70p
74153	45p
74155	45p
74157	45p
74160	50p
74164	50p
74167	35p
74173	50p
74174	70p
74175	65p
74176	45p
74180	50p
74182	45p
74192	40p
74196	40p
74197	45p
74393	70p

74HC SERIES HIGH SPEED CMOS

74HC00	14p
74HC02	14p
74HC03	14p
74HC04	15p
74HC08	18p
74HC10	20p
74HC11	14p
74HC14	28p
74HC20	20p
74HC21	20p
74HC27	20p
74HC30	20p
74HC32	20p
74HC42	32p
74HC51	20p
74HC73	26p
74HC74	26p
74HC75	30p
74HC76	30p
74HC77	40p
74HC85	33p
74HC86	29p
74HC93	50p
74HC107	31p
74HC109	31p
74HC112	31p
74HC113	31p
74HC123	43p
74HC125	35p
74HC126	36p
74HC131	38p
74HC132	37p
74HC133	36p
74HC137	55p
74HC138	36p
74HC139	24p
74HC147	45p
74HC148	40p
74HC151	36p
74HC153	35p
74HC154	110p
74HC155	50p
74HC157	36p
74HC158	36p
74HC160	44p
74HC161	44p
74HC162	44p
74HC163	44p
74HC164	44p
74HC165	58p
74HC166	70p
74HC173	55p
74HC174	38p
74HC175	38p
74HC181	130p
74HC182	60p
74HC190	46p
74HC191	60p
74HC192	60p
74HC193	43p
74HC194	47p
74HC195	47p
74HC221	100p
74HC237	50p
74HC238	65p
74HC240	48p
74HC241	47p
74HC242	55p
74HC243	60p
74HC244	44p
74HC245	49p
74HC251	25p
74HC253	37p
74HC257	41p
74HC258	50p
74HC259	55p
74HC273	42p
74HC279	37p
74HC280	65p
74HC283	65p
74HC297	960p
74HC298	52p
74HC299	105p
74HC354	38p
74HC356	45p
74HC365	34p
74HC366	36p
74HC367	36p
74HC368	36p
74HC373	47p
74HC374	50p
74HC375	60p
74HC377	65p
74HC386	20p
74HC390	55p
74HC393	50p
74HC423	70p
74HC533	68p
74HC534	65p
74HC540	73p
74HC541	73p
74HC563	73p
74HC564	73p
74HC573	73p
74HC574	70p
74HC583	90p
74HC595	85p
74HC597	85p
74HC620	110p
74HC623	110p
74HC640	90p
74HC643	90p
74HC646	150p
74HC648	150p
74HC651	110p
74HC652	110p
74HC670	90p
74HC688	150p
74HC690	120p
74HC691	120p
74HC4002	25p
74HC4015	85p
74HC4016	75p
74HC4017	48p
74HC4020	50p
74HC4022	40p
74HC4024	34p
74HC4028	40p
74HC4040	34p
74HC4049	50p
74HC4050	50p
74HC4051	95p
74HC4052	95p
74HC4053	95p
74HC4059	85p
74HC4050	33p
74HC4066	33p
74HC4072	33p
74HC4075	28p
74HC4078	32p
74HC4094	50p
74HC4316	100p
74HC4351	110p
74HC4352	160p
74HC4310	120p
74HC4511	86p
74HC4514	140p
74HC4515	130p
74HC4516	130p
74HC4518	70p
74HC4520	60p
74HC4538	90p
74HC4543	120p
74HC7266	75p
74HC22106	580p
74HC40104	190p
74HC40105	250p

74LS SERIES LOW POWER SCHOTTKY T.T.L.

74LS00	14p
74LS01	14p
74LS02	14p
74LS03	14p
74LS04	14p
74LS05	14p
74LS08	14p
74LS09	15p
74LS10	14p
74LS11	14p
74LS12	14p
74LS13	22p
74LS15	15p
74LS20	15p
74LS21	15p
74LS22	15p
74LS24	38p
74LS26	15p
74LS27	15p
74LS28	15p
74LS30	15p
74LS32	17p
74LS33	17p
74LS31	16p
74LS38	17p
74LS40	16p
74LS42	28p
74LS47	56p
74LS48	52p
74LS51	15p
74LS54	15p
74LS55	17p
74LS73	26p
74LS74	20p
74LS75	26p
74LS76	26p
74LS78	26p
74LS83	40p
74LS85	40p
74LS86	28p
74LS90	29p
74LS91	60p
74LS92	35p
74LS93	28p
74LS95	45p
74LS96	56p
74LS107	30p
74LS109	30p
74LS112	30p
74LS113	30p
74LS114	30p
74LS122	38p
74LS123	38p
74LS124	85p
74LS125	32p
74LS126	32p
74LS132	32p
74LS133	32p
74LS136	32p
74LS138	31p
74LS139	31p
74LS145	70p
74LS147	100p
74LS148	80p
74LS151	30p
74LS153	36p
74LS154	85p
74LS155	36p
74LS156	41p
74LS157	28p
74LS158	31p
74LS160	44p
74LS161	44p
74LS162	44p
74LS163	40p
74LS164	40p
74LS165	56p
74LS166	60p
74LS168	68p
74LS169	60p
74LS170	75p
74LS174	36p
74LS175	38p
74LS190	51p
74LS191	48p
74LS192	46p
74LS193	47p
74LS194	47p
74LS195	50p
74LS196	55p
74LS197	48p
74LS221	50p
74LS240	50p
74LS241	46p
74LS242	50p
74LS243	55p
74LS244	45p
74LS245	46p
74LS247	46p
74LS248	48p
74LS249	78p
74LS251	28p
74LS253	40p
74LS256	58p
74LS257	38p
74LS258	40p
74LS259	55p
74LS260	38p
74LS266	26p
74LS273	50p
74LS279	37p
74LS280	100p
74LS283	55p
74LS290	30p
74LS293	30p
74LS365	30p
74LS366	35p
74LS367	33p
74LS368	35p
74LS373	50p
74LS374	50p
74LS375	52p
74LS390	46p
74LS393	41p
74LS399	75p
74LS629	105p
74LS641	100p
74LS642	140p
74LS644	140p
74LS645	140p
74LS670	68p
74LS674	320p
74LS687	260p

COMPUTER IC'S

2114	200p
2532	330p
2716	200p
2732	280p
2732A	300p
2764	240p
27C64	550p
27128	350p
26256-25	400p
41256-15	450p
256DRAM	450p
4116	75p
4164	150p
6116	200p
6264-15	300p
6502	300p
6502A	400p
65C02	930p
6503	570p
6520	170p
6522	330p
6530	1050p
6532	480p
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
8156	360p
81LS95	120p
81LS96	130p
81LS98	130p
8224	270p
8226	270p
8228	270p
8243	250p
8250	850p
8087	11000p
8251	320p
8253	320p
8255	310p
8256	1200p
8257	350p
8259	360p
8271	3400p
8272	1200p
8279	450p
8282	300p
8283	400p
8284	440p
8287	360p
8288	650p
8748	1100p
8755	1400p
AY3-1015	290p
AY5-3600	570p
SP0256AL2	500p
Z80ACPU	180p
Z80BCPU	500p
Z80ADMA	650p
Z80AP10	230p
Z80BP10	480p
Z80ACTC	250p
Z80AS10	660p
Z80AS10-1	700p
Z80BP10-2	700p
Z80ADRT	680p
74S188	175p
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
75189	60p
75195	185p
75322	130p
75324	340p
75325	155p
75365	145p
75450	45p
75451	42p
75452	42p
75453	65p
75454	65p
75480	135p
75491	60p
75492	60p
8T26	95p
8T28	110p
8T31	330p
8T95	90p
8T96	110p
8T97	90p
8T98	110p

UHF TUNERS

U322LO	600p
U341	500p
U342	500p

VIDEO RUBBER BELTS

AKAI	
VS-2EG/5EG 5 belts/kit	180p
VS-9300 7 belts/kit	220p
VS-9700EG 6 belts/kit	200p
VS-9500/9800 7 belts/kit	220p
JVC	
HR-3300/3600 9 belts/kit	220p
HR-3330 7 belts/kit	200p
HR-3360/3660 7 belts/kit	190p
HR-4130 7 belts/kit	195p
HR-7200 3 belts/kit	75p
HR-7600 3 belts/kit	145p
HR-7730 3 belts/kit	77p
NATIONAL	
NV-300 5 belts/kit	160p
NV-333 5 belts/kit	135p
NV-777 4 belts/kit	130p
NV-2000 5 belts/kit	155p
NV-3000 6 belts/kit	180p
NV-7000 5 belts/kit	100p
NV-7200 5 belts/kit	90p
NV-8600 7 belts/kit	200p
SONY	
SL-C72SL-J7 6 belts/kit	140p
SL-T7ME/T7MER 6 belts/kit	170p
SL-T9/P7/J9 7 belts/kit	210p
SL-8000-8080 6 belts/kit	240p
SANYO	
VTC-5300 5 belts/kit	190p
VTC-5500 3 belts/kit	95p
VTC-9300 4 belts/kit	240p
HITACHI	
VT-5000 7 belts/kit	155p
VT-8000 3 belts/kit	110p
VT-11 5 belts/kit	190p
FISHER	
VBS-7000 6 belts/kit	245p
VBS-9000 3 belts/kit	120p
TOSHIBA	
V-5250/5280 5 belts/kit	230p
V-5480 7 belts/kit	210p
V-5475 6 belts/kit	190p
V-7540 5 belts/kit	190p
V-8600 6 belts/kit	150p
SHARP	
VC-6300 5 belts/kit	195p
VC-7300 5 belts/kit	160p
VC-8300 5 belts/kit	175p
VC-9300 5 belts/kit	155p

CASSETTE MOTOR

6V	290p
9VCW	290p
12VCCW	290p
12VCW	290p
13.2VCW	290p
13.2VCCW	290p

CASSETTE TAPE HEADS

Mono Head	90p
Stereo Head	150p
Mono Mini Head	230p
Auto Reverse Head	260p

VIDEO MOTORS

Sanyo	
Reel Motor (RM11) P/N 4-529V-10800	790p
Capstan Motor 4-527V-51000	2400p
Sony	
Capstan Motor BHF-1100D	2500p
Sharp	
Reel Motor RMOTB 1007 Gezz	1750p
Reel Motor RMOTM 1008 Gezz	1750p
Loading Motor RMOTM 1017	1000p
JVC	
Capstan Motor PU-55371V	2200p
Capstan Motor PU-45979	2250p
Drum Motor PU-46414	2250p

VIDEO PINCH ROLLERS

National	
NV-300	475p
NV-7000	475p
Sanyo	
VTC-9300	475p
VTC-5500	475p
Sony	
SL-T7	475p
SL-C7	475p
JVC	
HR-3300	500p
HR-3330	500p
HR-3360/3660	500p
HR-7200	500p
HR-3300	500p
Akai	
VS-9700EG	360p
Hitachi	
VT-5000	475p
Sharp	
VC 6300/6500	

IDLERS & PULLEYS REPLACEMENTS

Sanyo	
Reel Pulley 143-0-662T-01201	520p
Gear Idler 143-04904-00900	450p
Take Up Idler 143-0-4204-00100	650p
Idler 143-256T-03200	450p
Sony	
Rew Pulley A-6706-348-B	400p
Rew Pulley A-6706-391-A/B	300p
Sharp	
Idler Assembley NIDL0005 Gezz	325p
Idler Assembley NIDL0006 Gezz	325p
Idler Sharp NIDL0005 Gezz	225p
Hitachi	
Idler Assembley 6886971	300p
Idler Assembley V-68661482	385p
JVC	
Idler Assembley PU-47752	480p
Take Up Idler PU-51402A	145p
Take Clutch PU-55373	225p
Idler Arm PU-55374-3-8	285p
Fast Forward Idl PU-45896C	210p
National	
Idler	300p

SERVICE AIDS

SERVISOL PRODUCTS

V. Head Cleaner	85p
Switch Cleaner	100p
Silicone Grease	115p
Freeze It	105p
Foam Cleaner	105p
Anti-Static	105p
Aerokleane	90p
Aero Duster	115p
Plastic Seal	105p

★ UNIVERSAL TRIPLERS 500p ★

★ SONY on/off SWITCHES 250p ★

VIDEO LAMPS

UNIVERSAL VIDEO LAMP 30p
12V. 60mA (300mm Wires)
RED OR BLUE
VIDEO LAMP FOR PANASONIC 60p

FLOPPY DISCS

5¼ inch DSDD (10 in box) Branded Name	£12.50
5¼ inch DSDD (bulk pack) 25	£10.00
3½ inch DSDD (10 in box) Branded Name	£21.00
3 inch CF2 Branded Name	£2.40
3 inch CF2D Branded Name	£3.00

ELECTROLYTIC CAPACITORS RADIAL LEAD

10 Volts	
22 MF	15p
47 MF	15p
100 MF	18p
220 MF	18p
470 MF	25p
1000 MF	35p
16 Volts	
10 MF	15p
22 MF	15p
47 MF	15p
100 MF	18p
220 MF	18p
470 MF	25p
1000 MF	50p
2200 MF	60p
4700 MF	110p
25 Volts	
10 MF	15p
22 MF	15p
47 MF	15p
100 MF	18p
220 MF	18p
470 MF	25p
1000 MF	50p
2200 MF	70p
35 Volts	
10 MF	15p
22 MF	15p
47 MF	15p
100 MF	20p
220 MF	25p
470 MF	30p
1000 MF	60p
2200 MF	100p
40 Volts	
10 MF	15p
15 MF	15p
22 MF	15p
47 MF	20p
100 MF	25p
220 MF	30p
470 MF	35p
1000 MF	50p
2200 MF	190p
50 Volts	
1 MF	15p
2.2 MF	15p
4.7 MF	15p
10 MF	20p
22 MF	25p
63 Volts	
0.47 MF	15p
1.0 MF	15p
2.2 MF	15p
4.7 MF	15p
10 MF	15p
22 MF	20p
47 MF	25p
100 MF	30p
220 MF	35p
470 MF	50p
1000 MF	100p
100 Volts	
0.47 MF	15p
1.0 MF	15p
2.2 MF	15p
4.7 MF	15p
10 MF	15p

ELECTROLYTIC CAPACITORS AXIAL LEAD

16 VOLTS	
47 MF	25p
100 MF	30p
220 MF	35p
470 MF	45p
1000 MF	60p
2200 MF	120p
4700 MF	160p
10 VOLTS	
470 MF	40p
1000 MF	50p
2200 MF	70p
25 VOLTS	
22 MF	25p
47 MF	35p
100 MF	35p
220 MF	40p
470 MF	45p
1000 MF	70p
2200 MF	125p
35 VOLTS	
10 MF	25p
22 MF	25p
47 MF	30p
100 MF	35p
220 MF	40p
470 MF	90p
1000 MF	110p
2200 MF	160p
40 VOLTS	
10 MF	25p
22 MF	30p
47 MF	35p
100 MF	40p
220 MF	50p
470 MF	60p
1000 MF	100p
2200 MF	160p
63 VOLTS	
1.0 MF	25p
2.2 MF	25p
4.7 MF	25p
10 MF	30p
22 MF	35p
47 MF	40p
100 MF	50p
220 MF	60p
470 MF	100p
1000 MF	160p
100 VOLTS	
1.0 MF	25p
2.2 MF	25p
4.7 MF	30p
10 MF	35p
22 MF	35p
47 MF	40p

SOLDERING IRON

ANTEX XS25W 240V Soldering Iron 240Vac	540p
Spare Element for XS25W 240V	260p
ANTEX C15W 240V Soldering Iron 240Vcm	540p
Spare Element for C15W 240V	260p

DESOLDERING PUMP

Desolder Pump	290p
Spare Nozzle	60p
SOLDER MOP	65p

SOLDER

18 SWG	500g	580p
20 SWG	500g	850p

SOLDERING IRON STAND

Soldering Stand	200p
Spare Sponge	40p

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SONY DSR-35R C20/C30/C40	£20.00
SONY DSR-43R	£20.00
HITACHI VT11/33	£20.50
SHARP VC387/9700 VC581/681	£21.00
TOSHIBA V21/V9600	£22.00
AMSTRAD VCR 4500 VCR 7000	£20.50
NATIONAL NV370	£21.00
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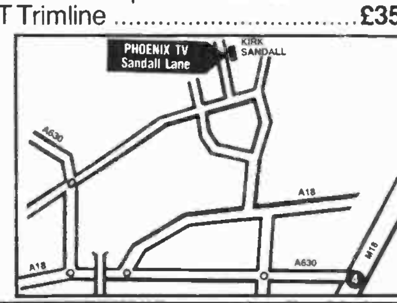

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3HSS(N)	£19.90
Fits model numbers: NV2000, NV2010, NV7000, NV7200, NV333, NV8600, NV8610.	
3HSS-UI(N)	£29.90
Fits model numbers: NV370 & Philips VR6460.	
3HSS(4N)	£46.50
Fits model number: NV366	
3HSS(4NB)	£54.60
Fits model number: NV730	

Ferguson

3HSS(V)	£19.90
Fits model numbers: 3V00, 3V16, 3V22, 3V29, 3V30, 3V31, 3V35, 3V36, 3V38, 3V39, HR2200 HR3300, HR3330, HR3360, HR7200, HR7300, HRD120, HRD130.	
3HSS4VB	£54.60
Fits model numbers: 3V32.	

Sharp

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

Toshiba

PS3B(T)	£31.90
Fits model numbers: V9600, V31B, V33B.	

Hitachi

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

Sony

PS3B(S)	£24.90
Fits model numbers: SLC5, SLC6, SLC7, SL3000 also various NEC models.	
P84B(2S)	£34.50
Fits model numbers: SLC20, SLC30, SLC40, SLF1.	
PS5B(3S)	£44.20
Fits model numbers: SLC9, SLT50, SLC8, SLF60.	

Amstrad/Saisho

3HSS(R)	£29.50
Fits model numbers: VCR7000 and all models using Orion chassis.	
3HSS(FI)	£34.50
Fits model numbers: VCR4500, VCR5200, VCR9000 etc.	

Fisher/Fidelity

3HSS(SF)	£29.90
Fits model numbers: FVHP615, FVHP710, V1000.	

GENUINE HEADS

Panasonic	
NV2000, NV2010	£44.00
NV7000, NV7200	£44.00
NV333, NV370	£44.00
NV366	£64.50
NV688, NV777, NV788	£64.50
NV730	£67.50
All others available P.O.A.	
Ferguson	
3V00, 3V16, 3V22	£59.90
3V29, 3V30	£59.90
3V32	£66.90
3V35, 3V36, 3V38, 3V39	£59.90
Sharp	
VC7300, VC7700, VC7750	£69.90
VC8300	£69.90
VC9300, VC9500, VC9700	£62.00
VC381, VC383, VC386	£62.00
VC482	£62.00
All others available P.O.A.	
Sanyo	
VTC5000, VTC5150	£39.90
VTC5300, VTC5400	£39.90
VTC9300	£39.90
Sony	
SLC5, SLC6, SLC7	£49.50
SL8000, SL8080	£49.50
SLC20, SLC30	£54.50
SLC9	£54.50
Toshiba	
V9600	£59.90
V8600	£69.90
V31, V33	£59.90
V55, V56	£59.90
Hitachi	
VT5000, VT5500	£49.50
VT6500, VT8000, VT8300	£49.50
VT8500, VT8700	£49.50
VT9300, VT9500, VT9700	£49.50
VT11E, VT14E	£45.50
VT17E, VT19E	£54.60
VT33E	£49.50
Philips	
VR6460	£44.00
VR6462	£44.50

Please call if your model is not listed.

BELT KITS

GENUINE

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NV2000, NV2010	£6.50
NV7000, NV7200	£6.50
NV333, NV366	£6.50
NV370, NV830, NV850	£2.80
NV688	£6.50
NV777, NV788	£4.70
NV8600, NV8610	£6.50
NV730	£1.90
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NV870, NV810	£2.80
Ferguson	
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3V23	£3.90
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VTC5300, VTC5400	£4.50
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Sony	
SLC5, SLC7	£6.50
SLC6	£7.50
SL8000, SL8080	£6.50
Sharp	
VC7300, VC7700, VC7750	£6.50
VC8300	£6.50
VC9100, VC9300, VC9500	£6.50
VC381, VC383, VC386	£6.50
Hitachi	
VT5000, VT5500	£6.50
VT8000, VT8300, VT8500	£2.90
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VT11E, VT14E, VT17E, VT19	£6.50
VT33E	£6.50
Akai	
VS9700	£6.50
VS2, VS3, VS4, VS5	£4.90
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Many others available

REPLACEMENTS

Panasonic	
NV2000, NV2010	£3.50
NV7000, NV7200	£3.00
NV333, NV366	£3.00
NV8600, NV8610	£3.95
Ferguson	
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3V23	£2.90
3V29, 3V30	£3.50
3V35, 3V36, 3V38, 3V39	£2.90
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VTC5300, VTC5400	£2.50
VTC9300	£4.25
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Sharp	
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VC8300	£3.90
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All Hitachi	£1.80

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Sharp VC8300	£26.40
Hitachi VT5000	£24.80

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Sharp VC7300, VC7700	£29.30
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Ferguson/JVC 3V35, 3V36, etc.	£25.80
Hitachi VT5000	£24.80
Hitachi VT8000, 8500, etc.	£34.50
Hitachi VT9300, 9500, etc.	£34.50
Hitachi VT11, VT14, VT17	£26.80
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HR3300, HR3360, HR3660, HR2200	£4.95
3V29, 3V30, HR7200, HR7300	£4.95
3V35, 3V36, 3V38, 3V39 HRD120	£4.95
Sanyo	
VTC9100, VTC9300	£4.95
VTC5000, VTC5150, VTC5300, VTC5400	£4.95
Sony	
SLC5, SLC7	£5.95
SLC6	£5.95
SL8000, SL8080	£5.95
Sharp	
VC7300, VC7700, VC7750	£4.95
VC8300	£4.95
VC9100, VC9300, VC9500	£4.95
VC381, VC383, VC386	£4.95
VC651 etc.	£4.95
Hitachi	
VT5000, VT5500	£5.95
VT8000, VT8300, VT8500	£4.95
VT9300, VT9500, VT9700	£4.95
VT11E, VT14E, VT17E, VT19	£4.95
VT33E	£5.95
Akai	
VS9700	£6.95
VS2, VS3, VS4, VS5	£6.95
VS9300, VS9500, VS9700	£4.95
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NV777, NV788	(Genuine)	£4.50
NV730	(Genuine)	£4.50
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Sanyo		
VTC9100, VTC9300		£1.90
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VTCM10 Reel drive pulley		£9.90
Sony		
SLC5, SLC7	Rewind kit	£4.95
SLC6	Rewind kit	£4.95
Sharp		
VC9100, VC9300, VC9500 (Genuine)		£3.90
VC381, VC383, VC386 (Genuine)		£3.90
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VC9300, 381 etc. (Equivalent)		£2.98
Hitachi		
VT8000, VT8300, VT8500		£4.72
VT9300, VT9500, VT9700		£4.75
VT11E, VT14E, VT17E, VT19		£3.96
VT33, VT63, VT64, VT65		£3.96
Akai		
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BA532	£1.60
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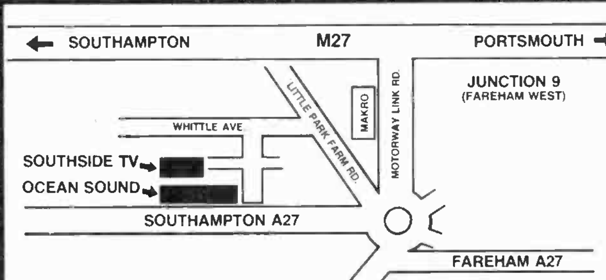

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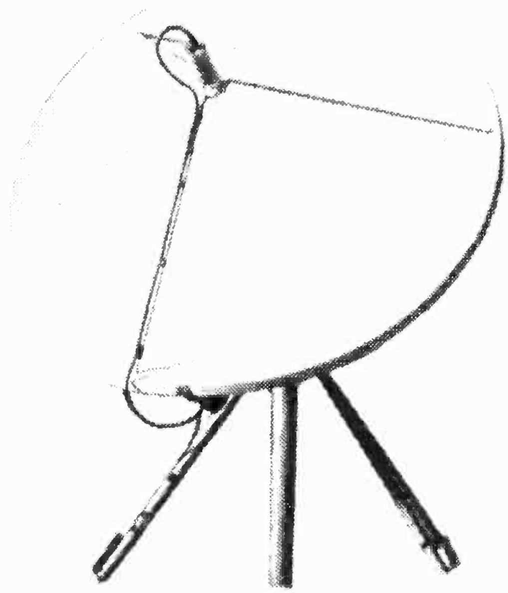

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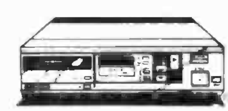

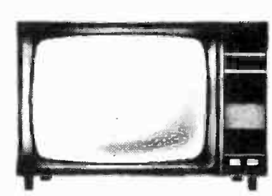

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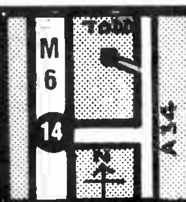

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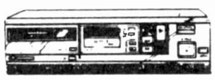

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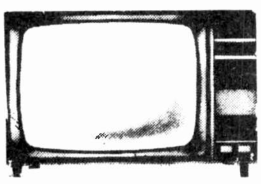

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AN6912	125p	TA7222AP	140p	STR380	575p
AN7060	250p	TA7223P	230p	STR440	575p
AN7105	250p	TA7225P	340p	STR441	575p
AN7110	150p	TA7227P	220p	STR451	575p
AN7116	150p	TA7229P	330p	STR2012	675p
AN7117	100p	TA7230P	200p	STR4090	675p
AN7118	150p	TA7232P	290p	STR6020	675p
AN7130	130p	TA7233P	290p	UPC1001H	250p
AN7140	225p	TA7240AP	290p	UPC1018C	200p
AN7143	295p	TA7241AP	290p	UPC1025H	250p
AN7145	250p	TA7269P	650p	UPC1031H	200p
AN7146	250p	TA7270P	275p	UPC1032H	80p
AN7156	275p	TA7271P	275p	UPC1158H	90p
AN7161	325p	TA7272P	300p	UPC1181H	150p
AN7168	295p	TA7273P	325p	UPC1182H	150p
AN7213	150p	TA7274P	300p	UPC1185H	275p
AN7218	125p	TA7280P	375p	UPC1188H	280p
AN7220	175p	MB3705	180p	UPC1225H	280p
AN7222	350p	MB3712	150p	UPC1230H	250p
AN7223	150p	MB3713	160p	UPC1263H	250p
AN7224	150p	MB3714	300p	UPC1277H	270p
AN7310	125p	MB3722	350p	UPC1278H	270p
AN7311	125p	MB3730	250p	UPC1363H	275p
AN7410	300p	MB3731	350p	UPC1364H	600p
AN7812	175p	M51102L	375p	UPC1365H	360p
BA527	175p	M51104L	375p	UPC1387H	275p
BA532	175p	M51516L	280p	UPC1391H	175p
HA1199	180p	M51517L	280p	TDA1515A	400p
HA1319	275p	STK011	395p	TDA1908A	175p
HA1366W	180p	STK014	725p	TDA2002	100p
HA1366WR	180p	STK015	550p	TDA2003	150p
HA1367	325p	STK016	850p	TDA2004	200p
HA1368	180p	STK020	575p	TDA2005	250p
HA1368R	180p	STK025	750p	TDA2006	175p

TDA2020	160p
TDA2030	160p
TDA2170	300p
TDA2571	450p
TDA2593	300p
TDA2581	300p
TDA2600	575p
TDA2653A	400p
TDA3505	550p
TDA3540	400p
TDA3541	400p
TDA3560	400p
TDA3561A	525p
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2SA-490	60p	2SB-560	40p	2SC-1214	45p	2SC-2550	75p
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2SA-496	45p	2SB-566	120p	2SC-1226	80p	2SC-2564	250p
2SA-564	25p	2SB-568	40p	2SC-1317	25p	2SC-2565	280p
2SA-608	15p	2SB-595	80p	2SC-1318	30p	2SC-2575	25p
2SA-673	20p	2SB-596	85p	2SC-1327	25p	2SC-2557	125p
2SA-677	60p	2SB-647	40p	2SC-1328	25p	2SC-2579	130p
2SA-683	25p	2SB-648	65p	2SC-1345	30p	2SC-2611	50p
2SA-684	40p	2SB-649	65p	2SC-1368	40p	2SC-2551	280p
2SA-720	20p	2SB-681	250p	2SC-1383	40p	2SC-2944	150p
2SA-726	25p	2SB-688	125p	2SC-1384	40p	2SC-3078	40p
2SA-733	20p	2SB-705	250p	2SC-1403	150p	2SC-3182	250p
2SA-748	100p	2SB-716	40p	2SC-1413	300p	2SC-3284	150p
2SA-765	300p	2SB-717	70p	2SC-1445	125p	2SC-3298	150p
2SA-769	150p	2SB-718	80p	2SC-1446	75p	2SC-3506	230p
2SA-771	150p	2SB-757	130p	2SC-1447	60p	2SC-3519	150p
2SA-794	60p	2SB-772	50p	2SC-1454	350p	2SC-8050	25p
2SA-798	60p	2SB-837	60p	2SC-1509	45p	2SD-198	200p
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2SA-817	25p	2SC-352	70p	2SC-1568	60p	2SD-235	40p
2SA-844	15p	2SC-372	15p	2SC-1577	770p	2SD-288	80p
2SA-850	30p	2SC-380	25p	2SC-1550	60p	2SD-299	160p
2SA-893	30p	2SC-458	20p	2SC-1514	75p	2SD-313	40p
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2SA-916	30p	2SC-495	65p	2SC-1586	550p	2SD-325	45p
2SA-921	10p	2SC-496	80p	2SC-1627	30p	2SD-352	50p
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2SA-992	30p	2SC-710	25p	2SC-1756	60p	2SD-389	100p
2SA-1048	20p	2SC-717	45p	2SC-1760	85p	2SD-400	20p
2SA-1060	150p	2SC-733	30p	2SC-1775	15p	2SD-401	50p
2SA-1062	120p	2SC-738	30p	2SC-1815	15p	2SD-426	150p
2SA-1094	190p	2SC-741	195p	2SC-1819	75p	2SD-428	150p
2SA-1102	190p	2SC-783	110p	2SC-1845	20p	2SD-438	50p
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2SA-1110	45p	2SC-828	25p	2SC-1906	35p	2SD-478	100p
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2SA-1145	60p	2SC-839	30p	2SC-1914	30p	2SD-526	75p
2SA-1147	190p	2SC-929	20p	2SC-1922	250p	2SD-600	90p
2SA-1156	60p	2SC-930	20p	2SC-1941	65p	2SD-612	40p
2SB-545	150p	2SC-941	30p	2SC-1942	270p	2SD-613	100p
2SB-546	100p	2SC-945	20p	2SC-1986	60p	2SD-669	45p
2SB-548	40p	2SC-959	65p	2SC-2003	60p	2SD-716	125p
2SB-555	150p	2SC-998	60p	2SC-2022	60p	2SD-718	125p
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		2SC-1050	320p	2SC-2236	30p	2SD-761	50p
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		2SC-1106	210p	2SC-2275	60p	2SD-845	275p
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		2SC-1116	290p	2SC-2335	125p	2SD-859	100p
		2SC-1162	40p	2SC-2371	60p	2SD-869	320p
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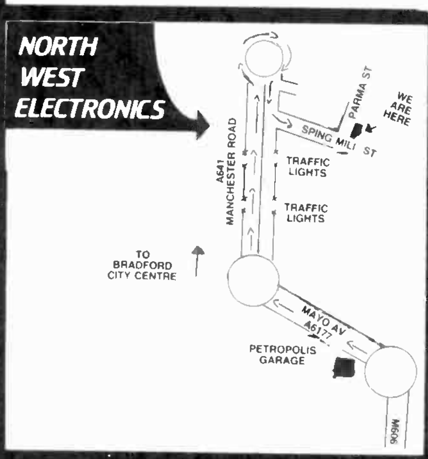

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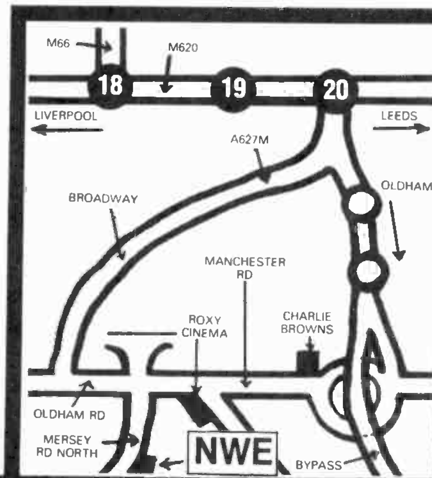

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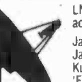

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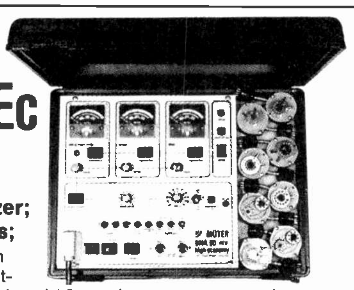

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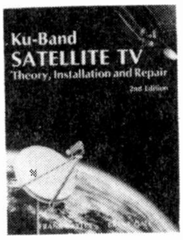

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Mains lead & two pin socket for radio cassette	35p
T/V loop aerial	75p
Radio Telescopic Aerial	£1.00
Philips Neon Lamps for TV sets	5p
Freeze Philips	£1.20
Foam Cleaner Philips	£1.20
Contact Cleaner Philips	£1.20
Cans of Anti Static, Degrease Cleaner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

HILLS

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

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

PYE 6 Key Switch & Panel
G11 Front Panel £10

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

GEC Decoder Panel PC772A3
PC446A5 £6

12 Volt Mains Trans 500M/A £1.00

Double 1.5 Digital Display. High brightness 20p

Quantity Reductions

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

100 Fuses	£2.00
100 W/W Res.	£1.50
BF 199	20 for £1
10 × 20 Turn 100k pots. Rank	£2
BF 470	20 for £2

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

Mixed Packs

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

Red & Green LED on Panel 1p each

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

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

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

300 Mixed Diodes £2

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

12v DC relay 1½×1½×2 print type 10 amp D.P. change over £1

SENDZ COMPONENTS
TO ORDER SEE BACK PAGE

G11 Spares

SENDZ COMPONENTS

TO ORDER SEE BACK PAGE

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

Thorn Spares

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

Mains Droppers

Pye 731 3+56+27R	50p
Thorn 50/17/1K5	£1.00
120/20/20/48/117	£1.00
270/10/6 for Thorn 4000	50p
18/320/70/39	£1.10
Thorn 50-40R-1K5	50p
Ae Socket & Lead	
GEC, ITT, Philips, Pye	25p
7×3¾ Thorn	£1
Thorn 1600-1700	£1.50
Rank ~~Toshiba Tube Bases~~	30p

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

Hand Sets
Fidelity All Types
£15 to £35

KT3-K30

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

DIODES

BY 126	10p
BY 127	10p
BY 133	10p
BY 134	10p
BY 176	25p
BY 179	40p
BY 184	25p
BY 187	10p
BY 190	40p
BY 196	30p
BY 198	10p
BY 204/4	8p
BY 206 – BY 407 Eqv.	8p
BY 208/800	8p
BY 210/400	5p
BY 210/800	10p
BY 223	60p
BY 224/600: 4.8A/600v bridge	50p
BY 226	15p
BY 227	15p
BY 228 1500v	20p
Flat BY229 black	15p
BY 299 Red	20p
BY 229/400	30p
BY 299/60p Tag	30p
BY 237	5p
BY 254	10p
BY 255	30p
BY 298	10p
BY 299	10p
BY 406	8p
BY 527	20p
BY 407a	10p
BY 448	10p
BY 527	10p
BY 602	10p
BYV 26C	10p
F 247	10p
GP20G	5p
GRP80G (TX10)	30p
XK 3102	50p
BYV 28/200	20p
Bridge TX10 800/3 amps	30p
KBPC35-02 Bridge	£1.50
Bridge Rec. D35B10	40p

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

Plug In

K4 Focus Pot	£1.00
Fidelity Tube Base with transitor & focus pot	£1.50
Bush Tube Base on panel	£1.00
TX10 Tube Base on Panel	£3.00

Line Transformers

Line O P Trans Mono T.X. 12"-14" Philips	
27482	£10
4822	£10
10273	£10
Thorn 1690 LOPT	£7.50
2 J/Pots 3,500 1 off each type	£3.00
G8 Trans Philips	£7.00
G11 Split Diode	£12.00
CVC820 Split Diode ITT	£10.00
Thorn B/W AD5308F + Stik + Lead	£1.50
GEC 2040	£3.00
GEC 2110	£7.00
Mullard AT 2036	£1.50
Pye 169 Line Trans	£3.00
Pye mono	£3.00
Rank mono T704A	£3.50
Split Diode Trans	£7.00
GEC 20 AX Rank Z522	£3.00
Rank L.O.P.T. Z970	£3.00
CVC32	£6.00
CVC30 ITT	£7.00
CVC32 Line Tran	£7.00
CVC800 Line Trans	£6.00
CVC825 Split Diode	£10.00
CVC 45	£5.00
GEC Portable G1OT2041	£3.00
GEC Portable G1OT2046	£3.00
EHT Split Diode Leads ITT	£1.00
3500 L.O.P.T. & HT Trans	each £2.00
LOPT Rank Z763	£5.00
K35 Split Diode 3122/13835930	£10.00

Universal Tripler

with small focus pot. Green type	£7.00

Black Triplers

KT3 Triplers	£6.00
S.T.C Universal Tripler	£6.00
11 TJT	£2.50
11 TGA	£2.00
ITT CVC 5-8-9	£3.50
Rank T25LE Tripler	£2.00
Rank 11TCP A823	£3.50
TU 25 30K Rank	£3.00
11 TEZ Rank	£3.00
G9 Philips	£4.00
GEC 2110	£4.00
3500 Thorn	£3.00
8500 Thorn	£4.00
9000 Thorn	£7.00
9500 Thorn	£4.50
9600 Thorn	£4.00
2040 GEC	£3.50
GEC TVM25 Tripler	£2.00
Universal Tripler	£5.00
G8 Tripler	£5.00
CVC20-32	£5.00
Decca 80 100	£4.50
Grundig TVK 52	£2.50
11TBQ Pye 731	£3.00
11THY	£4.00
D22 for Pye 18" colour portable	£4.00
LP 1193/63	£4.00
BG 100/41	£3.25
ERO Tripler print type with foacs PO7	
BG2087	£5
T/text ultrasonic rec'r panel	£14.00
12-14V. **20 for £5.00** **200 for £25.00**	
GEC 8 touch unit assy complete with all I.C.'s + pots	£4.00
G11 E W. Transformer	50p
G11 E.W. coils	£1.00
G11 Transient Suppressors 245V	20p
G11 Scan Coils	£5.00
G11 100K tuner pots	12 for £1
KT3 IF panel	£6.00
KT3 line OSC transformer	£1
KT3/K30 infra-red receiver head	£1
K30 drawer unit with IC's (home)	£10
K30 drawer unit with IC's (export)	£10
KT3 AE Sockets	50p
KT3 receiver panel	£8
KT3 line driver transformer	50p
Pye, K30, GEC, etc Pre-mains stand-by switch	£1
Decca 80/100 IF panel	£5
NPN PNP 80V 6 Amp TO66 O.P. Trans.	pair 25p
5 button touch tuner BBC1/2 ITV1/2 video with ic SAS 560T/570T	£7.00
Control panel 5 sliders + mains lead	£1.50
G11 8 touch button unit replaces old 6 P.B.U.	£24
Tube base + base unit for 820 Euro chassis	£4.00
GEC Line O/P Trans. & Rec Stick for Portable	£3.00
CVC 20/25/30/35/40 decoder panel	£10
CVC 20/25/30/35/40 decoder panel (untested)	£5
CVC 40/45 IF panel	£5
40K Transducer	50p
PHILIPS NE511N	£1.20
LM337M Reg.	30p
20 GEC Black Spark Gaps	£1.00
KT3 Front Panel Control Assy.	£2.50
BTW 30/50	50p

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

G8 LOPT Panel	£12.00
Rank T20 Z136 Panel	£6.00
NEW GEC 20AX Power Supply Switch Mode	£12.00
Field + Jungle panel for GEC 3133/3135	£1.50
GEC 2110 line panel with transformer	£7.00
GEC 2110 tuner unit + IF Panel	£12.00
Pye/Chelsea Line op panel	£12.00
Pye 205 T/unit	£3.90
Pye 713 IF panel and tuner	£7.00
Pye 713 Chroma	£10.00
Pye/Chelsea Timebase panel with LOPT	£10.00
Pye 731 Frame Panel	£5.00
Pye 731 Convergence Panel	£5.00
Pye 731 Chroma	£10.00
Pye 731 IF panel + tuner	£10.00
GEC portable chassis + LOPT 2114 New	£4.00
G9 Power Panel	£6.00
Mono RANK Chassis 127A NEW	£10.00
NEW G9 Frame Panel	£4.00
NEW G11 IF Panel	£10.00

25% OFF ALL PANELS

G8 Tuner Unit + Panel	£4.00
G8 IF & Chroma	£6.00
G8 Chroma	£3.00

G11 IF Detector	£3.00
G11 Selector gain module	£3
Complete CVC 825 Chassis	£15
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 TBA1205B TCA2705Q	£2.50
K35 IF	£6.00
Z743 RANK IF Panel Export 5.5MHz 3 I.C.'s TBA750+SC9504P+SC9503P	£1.50
Pye G11 Front panel with transducer, pots, tuner pots, 6 pb switch+lead	£5.00
Pye 6 button switch portable	£1.00
GEC V/cap VHF/UHF tuner and IF+ sound O/P PC 706B3 (Export)	£12.00
GEC Line O/P PC 659B3	£6.00
2110 GEC Power Panel	£8.00
CVC 20 Front panel with sliders + mains input panel	£4
CVC 40 PUSH BUTTON ASSY with sliders: complete with lamp assy + pots 8 button units	£9.00
CVC9 slider pots panel	50p
Universal Focus. Fits Pye, Thorn and Decca Units.	
T147 Rank tube base on panel	£1.00
Z718 Focus Unit	£1.50
T20 Focus Unit	£1.00
Large Type	75p
Decca Small	75p
KT3 Focus Unit	75p
K30 Focus Pot	75p
K30 Tube base on panel	£1.00
TX10 Focus Units	£8.50
CVC 32 Focus Unit	75p
Fedility Focus Unit 14R-14S	30p
3500 Thorn Focus Unit	£1.00
ITT Small for use with Split	
Z718 Bush Focus	£2.00
Diode	50p
Remo TV12SP	50p
1600 Thorn EHT Rec and Lead	50p
TV14	50p
TV20	£1.00
TV45	50p
Thorn 14/1500 rec stick	5p

TX10 8 Button Unit	£10.00
TX10/TX100 16 Button	£10.00
G11 drawer ASS 3 pots Mains switch and lead	£2.00
K30 Drawer Ass with pots cable forme	£1.00
TX10 Drawer with 8 way pots ass.	£2.50
TX10 Ex. port with band switch drawer)	£2.50

PHILIPS BATTERIES (Small Types) HAND SETS

WATCH BAT SERIES

SR41	25p
SR43	25p
SR44	25p
SR54	25p
LR43	25p
LR44	25p
LR54	25p
CR2032	25p
10 500PF 2KV	20p
22/1000	20p
TAA7750	£1.00
HA411485	£1.00
UPC1373	50p
M50143	£1.00
M491BB1	£1.00
M58657P	25p
M50441/550	3p
M58658P	£1.00
Delay Line TDK Small Gray	10p
TDK Blue Type	50p

420M 400V	£1.00
470M 380V	£1.00
220/400V	£1.00
1200PF 15KV	10p
.01 2KV	10p
1+1 MFD Mains Filter ITT 3 Pin	15p
1/100 × 10	30p
22/100	10p
4.7M/100	5p
470/100	20p
4700/100	75p
47/160	10p
300 300/300V	80p
800/160	50p
.1/250 Pulse	5p
2.2 250v	10p
7N5 1500V	15p
3n3/250 A.C.	10p
.33/250V	20p
.39/250V	10p
4n7/250 tested 5KV	25p
22/250	15p
47/250	10p
100/250	20p
G11 470/250V	£1.75
GEC600/250	60p
700/250	£1
300+300 MFD 350v	£1.00
800/250	40p
32/300	20p
4/350	5p
8/350	8p
4.7M/350v	10p
33/350	20p
220/350	40p
300/350	30p
400/350	50p
22/375	15p
220/385 (ITT)	75p
330/385 CVC 820ITT	60p
0.1/400	15p
KT3 E/W .39/400	10p
.56K/400v	20p
4700pf/400	10p
.22/400	10p
8/400	15p
33/400	20p
400/400	40p
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	15p
.22/1000	20p
.047/600	15p
0.047/1000	10p
0.01/1000	10p
0.1/1000	10p
.47/1000v	65p
.47/250V A.C.	10p
.001K/1250	10p
0.0047/1500	10p
.005/1500	10p
.005/1500	10p
1n8/1500	15p
2n2/1500	15p
.01/1600	15p
G11 .8200/2KV	15p
0.1/2KV	20p
3n9/2KV	15p
0.0015/2KV	10p
6n2/2KV	15p
2n2/2KV	15p
470pf 4KV	10p
7500pf/2KV	10p
3000PF/3000V	10p
4n7/2KV	15p
6n2/2KV	10p
7n1/1500V	10p
8n2/1500V	10p
9n1/2000V	10p
8n2/2KV	15p
0.0082/2500	15p
150/3500	10p
1800/4KV	5p
4.7nf/5KV	10p
170/8KV	10p
180/8KV	10p
210/8KV	10p
1000/10KV	10p
.47/100V	80p
Tube Thermopath 167	£1.00
Rank Segam Decoder Panel UHF & VHF 2115A	£13.00
10 off .91 CAP G11	£2.00
Philips K4 CAP 150M/385V	50p

CVC 20-25-30 Mains Switches	60p
Infra Red and Ultrasonic G11 Teletext Decoder Panel	£30
RANK & ITT Mains Remote On-Off Switch (720R)	£1.50
RANK & ITT Remote Switch 2800 ohm	£1.50
G11 Mains Switch	50p
4 amp Mains Switch	25p
GEC Mains Switch 4 amp	30p
KT3 Mainswitch	£1.00
G8 Mains Switch	75p
G11 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
2000 Chassis Fidelity Mains Switch (4 TAG)	60p
250V/4A White Lorlin Mains Switch	60p
KT3-K30-K35 Full Remote Mains Switch (6 TAG)	£1
Teletext Adaptor Kit TY-500 Panasonic	£12
Philips Battery Tester All Types and charger vis	£6

Multi-Caps

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

ITT 8 and 6 Push Button	£1.00
Pye 725 LOPTS	£6.00
Pye 731 LOPTS	£6.00
Thorn 8500-8800 LOPTs	£5.00
CMC 301 front panel	£5.00
CMC 303 front panel	£5.00
CMC 302 Panel with TC mains switch etc	£5.00
CMD 800 Decoder	£8.00
G11 ITC Receiver Panel	£1.50
3 I.C. Power Supply G11 Full Remote Receiver Panel	£3.00
PHILIPS SBC 469 Stereo Microphone	£23.00
Meters Hills 520	£17.00
Meters Hills 420	£10.00
Hills HD5000 Digital Meter 1000V DC 750AC 10 Amp 20 MRG Rangers	£28
HT100 Multimeter	£6.75
HT300 Multimeter	£7.75
HT500 Multimeter	£9.00
HT700	£15.00
HD1000 Digital	£20.00
HD3000 Digital	£25.00
HD5000 Digital	£25.00
HD5500	£29.00
HD6000 Digital	£32.00
HD8000 Digital	£37.00
HD9500 Digital with capacity Temp Trans Volts Ohms and Amps ranges	£60

Infra Red Hanset Tester

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

Repaired Handsets

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

TOSHIBA HAND SETS

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

THORN

VCR Front Display Panel	£7.00
Large type ITT TV and VCR Handset	£15.00
GEC Ultrasonic 8CH Full Remote	£10.00
G11 Full Remote Ultrasonic	£32.00
G11 Ultrasonic Teletext Handset	£20.00
8 CH. Ultrasonic GEC Full Remote C2014H/C2219H	£15.00
New Replacement for G11 Ultrasonic Full Remote	£12.00
Thorn 4000 insert with 7 buttons	£5.00
Decca RC 11	£14.00
Decca RC 12	£14.00
G11 Infra-red full teletext	£20.00
Dynatron-Full remote CTV 62, 63, 64	£19.00
Hitachi infra red handset	£18.00
Philips full remote KT3, 16C928/20C934, 7228/7324, K12 26C 797/1ST 66K 1826	£12.00
G11, Full remote top button assy	£12.00
G11, Full remote repair service (exchange unit)	£18.00
GEC infra red full remote 8 channel (I C SAA1250)	£14.00
Philips infra red full remote 9 channel for 60 CP2605	£6.00
Philips infra red full remote 12 channel for 60 CP2605	£12.00
K35	
KT3/K30 T/Text	£15.00
KT3/K30 Full remote	£15.00
KT3 Power supply	£4.00
GEC infra-red 2236-2026	£4.00
GEC 8 button full remote	£14.00
GEC push pad handset button blobs each	10p
Pye & Philips handset KT3-K30 chassis. No RC5150-RC5176-RC5171-RC5177. Special Price	£13.00
RC4001 KT3 and Teletex	£14.00
IT CVC 32 handset repaired	£15.00
CVC 32 Hand Set	£15.00
CVC 45 3 and 2 Pin	
TX10 Hand Set Text	£12.50
TX9 with Text	£12.50
TX9 & TX10 button print	£2.00

ITT

T/V & Video Processor 1200 Type	£10.00

PHILIPS
UNIVERSAL HAND SET £12.00 RC5
KT3 – K45

We have all parts for Philips Handsets

RC5353	£15.00
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BC139	10p
BC140	30p
BC141	25p
BC143	25p
BC147	10p
BC148	10p
BC149	10p
BC153	10p
BC154	10p
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BC172	5p
BC173	5p
BC174	5p
BC183	5p
BC184	5p
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BC207	5p
BC212	5p
BC213	5p
BC214	5p
BC237	5p
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BD508	30p
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TDA3083	£2.00
TDA3190	£1.00
TDA3300B	£5.00
TDA3301B	£4.00
TDA3505	£3.00
TDA3560	£4.00
TDA3561A	£3.00
TDA3562A	£3.00
TDA3566	£3.50
TDA3564	£3.00
TDA3571A	£2.75
TDA3581	£3.00
TDA3590	£3.00
TDA3591	£1.00
TDA3592A	£3.00
TDA3650	£3.50
TDA3651	£3.00
TDA3651AQ	£3.50
TDA3653AQ	£2.00
TDA3654Q	£2.00
TDA3710	£3.50
TDA3800	£4.00
TDA3180	£2.00
TDA4260	50p
TDA4505N4	£3.00
TDA4420	£2.00
TDA4600/2D Dil	£1.00
TDA4600-2 Flat	£3.00
TDA8190	£3.00
TDA9403	£3.00
TDD1610S	50p
TD6306P	£2.00
TEA1009	50p
TEA1039	£2.00
TEA2017	£2.00
TEA5114	£1.00
TDA3300B	£6.00
SN74LS 125AN	30p
SN74LS 248	50p
SII.4516	50p
SN16861NG	50p
SN16862AN	£1.00
SN16964AN	50p
SN29764AN	£1.00
UA721	40p
UA7300	40p
MPS43A	25p
MJ13005	30p
MJE51T	25p
MJE340	28p
MJE660	25p
MJE661	25p
MJE3055	£1.00
MJE2801	30p
MJE2955	50p
MJE13005	50p
Sanikron Diode	30p

Power FET

VN88AF	50p

Transistors

A1222	25p	BF181	20p
A1223	25p	BF182	20p
AC106	25p	BF184	20p
AC121	25p	BF194	10p
AC124	25p	BF195	10p
AC128	25p	BF196	10p
AC137	25p	BF197	12p
AC151	25p	BF198	10p
AC131	25p	BF199	10p
AC138	25p	BF200	20p
AC152	25p	BF222	10p
AC153K	25p	BF224	15p
AC142K	25p	BF238	20p
AC169	25p	BF240	16p
AC176	25p	BF244	40p
AC178K	25p	BF245b	20p
AC179	25p	BF255	20p
AC186	25p	BF256	20p
AC188	25p	BF257	20p
ACY21	25p	BF258	25p
AD143	50p	BF262	15p
AD149	50p	BF263p	25p
AD161/162		BF264	15p
pair	40p	BF271	10p
AF17A	25p	BF273	10p
AF139	25p	BF274	10p
AF181	£1.00	BF324	25p
AF239	25p	BF337	50p
AF367	25p	BF355	30p
AL102	£1.75	BF362	20p
AU110	£1.50	BF363	15p
BLY49	50p	BF367	15p
BF115	20p	BF391	15p
BF121	20p	BF394	10p
BF127	20p	BF419	30p
BF137	20p	BF422	15p
BF157	20p	BF423	15p
BF160	20p	BF448	30p
BF161	20p	BF470	30p
BF164	60p	BF471	30p
BF179	30p	BF597T	10p
BF180	20p	BF694	10p

Thorn Transformers

DT2076/78	£10
90D3-035-003	£10
90D4-106-003	£1
90D3-038-001	£5
OT204130	£3

Thorn Panels

7 off mixed	£5

Rec IC KT3-K30

H044-8328 SAB 3013	
SAA3027	£3 pack
Large EHT Cap and Lead	25p

I.C. Holders

MA721PC	£1.00	UPD114LC-2	£1.00
M50430-8505P	£1.00	MN1250BJC	£1.00
TD6359P	£1.00	M50441-5505P	£1.00
M58657P	£1.00	M491BB1	£1.00
PCD8572	£1.00	HA513385	£1.00
HD74HC86P	£1.00		