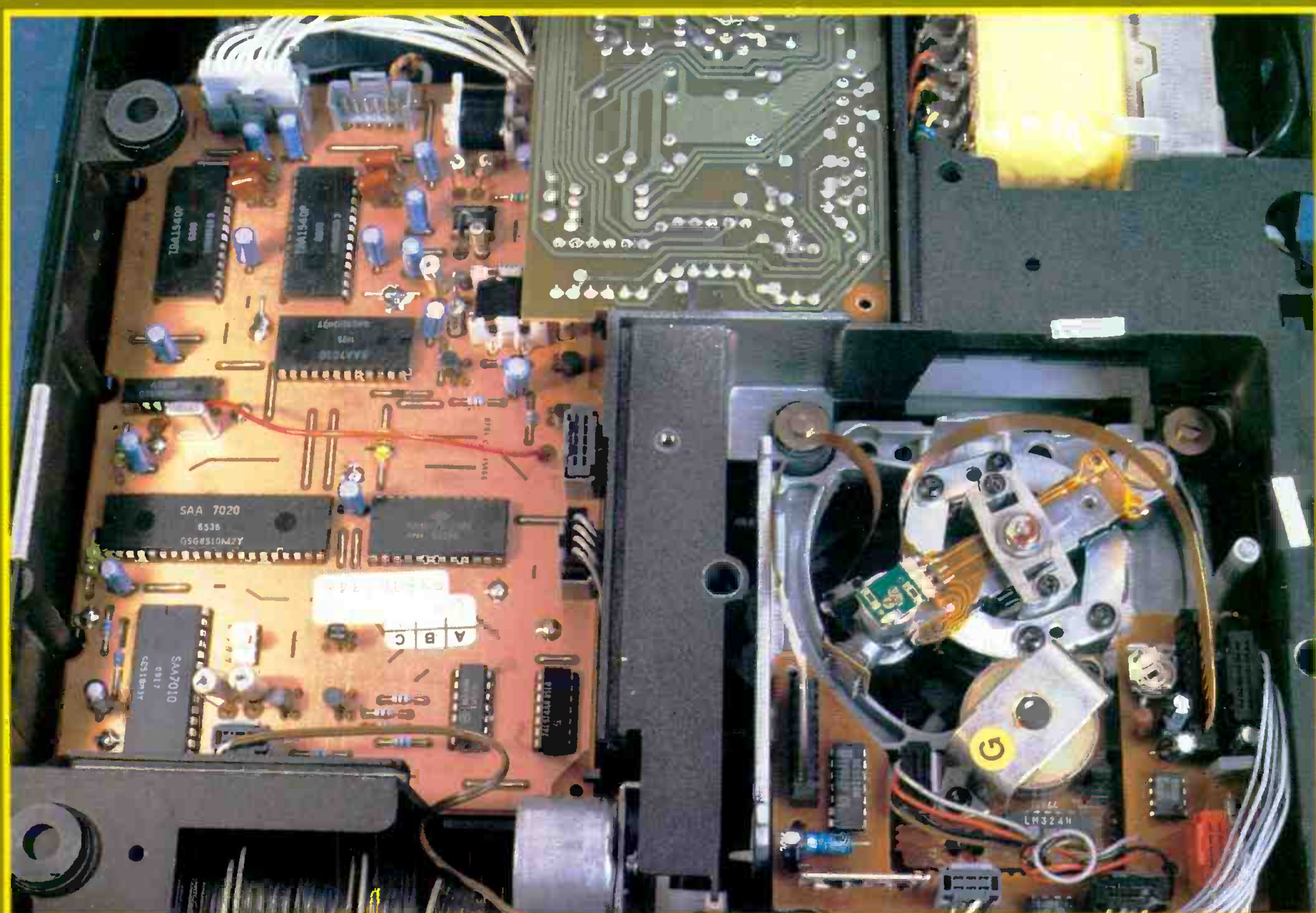
MAY 1992 £1·95

TELEVISION

SERVICING · VIDEO · SATELLITE · DEVELOPMENTS



Servicing the Philips CD104
Master-slave Switch-mode PSUs
Telephone Test Set • Test Report
1590 Chassis Power Supply Rebuild
Satellite TV Notebook • DX-TV
VCR Clinic • TV Fault Finding

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A Reed Business Publication

TELEVISION

May 1992

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On sale April 15th

CORRESPONDENCE
All correspondence regarding advertisements should be addressed to the Advertisement Manager, "Television", Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Editorial correspondence should be addressed to "Television", Editorial Dept., Reed Business Publishing Group, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

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

this month

OUR NEXT ISSUE DATED JUNE WILL BE PUBLISHED ON MAY 20

AAY32	9p
AC107	40p
AC125	30p
AC126	30p
AC127	30p
AC128	35p
AC128K	40p
AC141K	45p
AC142K	45p
AC176	22p
AC176K	28p
AC187	25p
AC187K	40p
AC188	25p
AC188K	40p
ACY18	48p
ACY19	48p
AD149	60p
AF125	50p
AF127	50p
AF139	30p
AF239	30p
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BA148	10p
BA154	8p
BA157	12p
BB105B	18p
BB205B	24p
BC107	8p
BC108	8p
BC109	8p
BC109C	10p
BC118	11p
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BFX89	60p
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BFY51	14p
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BFY64	28p
BFY90	45p
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BR103	37p
BR303	88p
BRY49	38p
BRY56	33p
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BSX20	15p
BSX26	18p
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BT116	80p
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BT146	99p
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ME8001	18p
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VN66AF	100p
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2N3054	40p
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2N3799	18p
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2N3866	68p
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2N5192	50p
2N5241	500p
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2N5296	30p
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2N5496	80p
2N6107	40p
2N6109	40p
2N6292	40p
2N6385	120p
2N6403	160p
3N143	65p

DIODES

Rectifier Diodes

BY100	40p
BY103	32p
BY127	8p
BY133	8p
BY164	40p
BY176	35p
BY184	32p
BY196	20p
BY206	11p
BY207	11p
BY208	15p
BY210	22p
BY225	120p
BY226	18p
BY227	18p
BY228	28p
BY296	20p
BY298	23p
BY299	22p
BYX10	15p
BYX55350	30p
BYX55600	22p
BYX70500	32p
BY70600	36p

OA47	10p
OA90	10p
OA91	10p
OA200	10p
OA202	10p
IN.914	2p
IN.4001	3p
IN.4002	3p
IN.4003	3p
IN.4004	3p
IN.4005	3p
IN.4006	3p
IN.4007	4p
IN.4148	2p
IN.5400	9p
IN.5401	8p
IN.5402	8p
IN.5403	8p
IN.5404	8p
IN.5405	11p
IN.5406	12p
IN.5407	12p
IN.5408	12p
RGP15	15p
RGP30	16p
SKE4F206	60p
SKE4F208	80p
SKE4F210	100p
SR2M	60p

I.C. SOCKETS

8PIN	5p
14PIN	6p
16PIN	7p
18PIN	10p
20PIN	12p
22PIN	13p
24PIN	14p
28PIN	16p
40PIN	18p

ZENERS

400 MW
BZY88 RANGE
2V7 to 39V 6p
1.3W
BZX61 RANGE
2V7 to 39V 10p

CRYSTALS

Freq in MHz

1.0	260p
2.0	200p
2.4576	180p
3.276	115p
3.579	95p
4.0	110p
4.194	130p
4.43	95p
5.0	130p
6.0	115p
8.0	125p
8.867	125p
10.0	140p
11.0	250p
12.0	120p
14.0	125p
14.756	200p
15.0	150p
18.0	150p
18.432	130p
24.0	250p
48.0	150p

VOLTAGE REGULATORS

7805	25p
7806	25p
7808	25p
7812	25p
7815	25p
7818	25p
7824	25p
7905	25p
7906	30p
7908	30p
7912	30p
7915	30p
7918	30p
7924	30p
78L05	24p
78L08	24p
78L12	24p
78L15	24p
78L18	24p
78L24	24p
79L05	35p
79L08	35p
79L12	35p
79L15	35p
7818KC	100p
7824KC	100p
LM309K	100p
LM317K	200p
LM317T	100p
LM323K	350p
LM723	35p
78H08KC	800p
78H12KC	700p
79HGKC	800p

VALVES

DAF96	100p
DAF96	80p
DL92	80p
DY86	70p
DY87	80p
DY802	90p
EABC80	85p
EB91	50p
EBF80	60p
EBF89	60p
ECC82	90p
ECC83	120p
ECC84	60p
ECC85	90p
ECH81	100p
ECH84	90p
ECL80	85p
ECL82	80p
ECL84	100p
ECL85	80p
ECL86	90p
EF80	80p
EF85	80p
EF89	85p
EF183	75p
EF184	85p
EL34	300p
EL36	90p
EL84	100p
EL95	85p
EL500	100p
EL504	130p
EY86	70p
EY87	70p
EY88	80p
EZ35	80p
EZ80	90p
EZ81	90p
PC97	100p
PCC85	80p
PCF80	100p
PCF200	135p
PCF801	110p
PCF802	80p
PCF806	115p
PCH200	100p
PCL81	65p
PCL82	80p
PCL84	60p
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	430p
PY81	100p
PY88	100p
PY500A	190p

LED's

3mm	
RED	5p
YELLOW	8p
GREEN	8p
5mm	
RED	5p
YELLOW	8p
GREEN	8p

RECTANG. LED's

5mm × 2.5mm	
RED	5p
YELLOW	8p
GREEN	8p

LINEAR IC's

AN203	210p
AN210	165p
AN214Q	170p
AN228	280p
AN240P	160p
AN241	135p
AN252	150p
AN259	250p
AN262	140p
AN271	230p
AN274	250p
AN301	330p
AN303	250p
AN304	360p
AN305	320p
AN315	210p
AN316	350p
AN360	100p
AN362	140p
AN366	150p
AN503	450p
AN610	160p
AN612	160p
AN3215K	650p
AN3310	350p
AN3312	350p
AN3320K	800p
AN3331K	900p
AN3792	400p
AN3794	450p
AN3795	600p
AN3821	800p
AN3821K	900p
AN3822K	900p
AN3830K	800p
AN3990K	300p
AN3991K	400p
AN5010	450p
AN5011	400p
AN5015	350p
AN5020	200p
AN5025	250p
AN5030	550p
AN5033	500p
AN5034	500p
AN5111	550p
AN5132	250p
AN5135	600p
AN5138	450p
AN6150	600p
AN5151	600p
AN5215	100p
AN5250	150p
AN5256	150p
AN5260	350p
AN5262	175p
AN5265	150p
AN5352	600p
AN5355	450p
AN5410	375p
AN5411	450p
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AN5753	170p
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AN5790	300p
AN5791	380p
AN5836	450p
AN5862	300p
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AN6247	200p
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AN6320	300p
AN6328	400p
AN6332	450p
AN6337	420p
AN6341	350p
AN6344	440p
AN6350	610p
AN6359	610p
AN6360	400p
AN6362	480p
AN6371	610p
AN6387	560p
AN6811	130p
AN6884	240p
AN7105	210p
AN7110	130p
AN7114	150p
AN7115	160p
AN7118	130p
AN7120	130p
AN7130	110p
AN7140	450p

AN7145	195p
AN7146	210p
AN7154	180p
AN7158	240p
AN7168	260p
AN7178	270p
AN7222	300p
AN7254	150p
AN7256	250p
AN7310	90p
AN7311	90p
AN7410	250p
AY3-1015	290p
AY3-1270	800p
AY3-1350	450p
AY3-8910	360p
AY3-8912	400p
BA301	65p
BA311	80p
BA313	60p
BA333	100p
BA340	150p
BA401	60p
BA402	60p
BA511	160p
BA514	160p
BA516	150p
BA521	160p
BA524	240p
BA526	180p
BA527	95p
BA532	140p
BA534	290p
BA536	180p
BA546	180p
BA612	160p
BA656	150p
BA658	380p
BA684	400p
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BA1310	160p
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BA1330	160p
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BA4403	220p
BA5101	400p
BA5102	220p
BA5204	200p
BA5402	230p
BA5406	280p
BA5408	180p
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CA3160	85p
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HA13007	400p
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HA13432	400p
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TC9150	425p
TC9152	425p
TC9153	300p
TC9154AP	275p
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LINEAR IC's – Cont.	
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NV788 £36.00
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NV850/NV950 £35.00
NV870/NV890/NV970 £39.00
NVG33 £38.00
NVG30/NVG31/NVG130 £20.00
NVG10/NVG11/NVG12/NVG14/NVG15/
NVG16/NVG120/NV250/NV280/
NV450/NV485 £16.50
NVG18 £25.00
NVG20/NVG21/NVG22/NVG25/NVG28/
NVG200/NVD48 £25.00
NVG50 £30.00
NVG45/NVG46 £30.00
NVH70 £50.00
NV688 £25.50
NV600 £23.00
NVH65 £50.00
NVG7/NVG9/NV230 £18.00

N.E.C.
N9011/N9012/N9013E/N9014E/N9014G/
N9015/N9016/N901A/N902A/N9033/
N9034/N9054/N9063/N9065/N9066/
N906A £20.00
N911A/N915A/N916A/N917 £27.00
PCV754/PV2300/PV2400/PV760/
PV794/PV770/PV774/PVC763E £18.00
N380/N381/N830/N831/N832/N833/
N834/N835/N836 £7.00
8261/AH1 £46.00

NORDMENDE
4609-460/V100/V140/V200/V250/
V304/V341/V450/V550 £7.00
V1001/V1005/V1015/V1025/V1035/
V1041/V1055/V1065/V1105/V2005 £18.00
V110/V333 £20.00
V101/V102/V103/V112/V141/V142/
V200/V300/V3005/V300/V301/V302/
V350/V500 £7.00
V1205/V1215/V1235/V1245 £20.00
V1305 £33.50
V380 £27.00
V502/V503/V5005 £37.00

ORION
VH3/VH555/VH600/VH700/VH844/VH900/
VH1000 (ALL MODELS) £13.00

PHILIPS
VR6460/VR6520/VR6920/64VR60/
VR6420 £8.50
VR6711 4 HEAD £41.00
6920/VR6440 £58.00
VR6441/VR6540/VR6541/VR6640/
VR6642 £14.00

RANK
BV6900AS £18.00
N830EA/RV300/RV310/RV320/RV330/
RV340/RV350/RV380 £7.00

REDSON
MR100 £17.00

SABA
2A10/2A70/2B20 £23.00
4A10/4B20 £33.50
6A10/6A70 £33.00
8A10/VR6038 £39.50
CVR6083/VR6006/VR6007/VR6008/
VR6009/VR7006/VR7007 £18.50
PVR6068/PVR6070/PVR8070/VR2000/
VR6000/VR6010/VR6012/VR7000/
VR9010 £7.00
VHR7000/VR5005 £15.00
VR6004/VR6005/VR6011/VR6013/
VR6014/VR6020/VR6022/VR8014/
VR6023/VR6024/VR7004/VR7011/
VR7014/VR7720/VR7730/VR8011 £7.00
VR6018/VR7018 £30.00
VR6028 £27.00
VR7016 £24.00

SAISHO
VR100/VR605/VR705/VR805/VR905/
VR1000/VR1100/VR1200/VR1600 £12.50
VR3300X/VR3600X/VR3650/VR3800 £14.00
VR3200/VR3500 £15.00
VR3300/VR3600 £15.00

SALORA
6500/6600 £21.50

SAMSUNG
SVX301/VB900/VB910/VVT510/VT320/
VT5600/VX510/VX511/VX520/VX616/
VX626/VX627/VX717 £19.00

SANYO
VTC5000/VTC5400/VTC6000/VTC6500/
VPR5000/VTC1500/VTCM10/VTCM11/
VTCM20/VTCM21/VTCM25/VTC2000/
VTC5100/VTC5150/VTC5300/
VTC5400/VTC5350/VTC5370/
VTCNX10/VTCNX15/VTCNX20/
VTCNX30 £18.50
VTC5500/VTC5550/VTC9100/VTC9300/
VTC9350/VTC9355/VTC9455/VTC9500 £19.00
VHR1110/VHR1150/VHR1300/
VHR1700/VHR2300 £16.00
VHR3200/VHR3270/VHR3100/
VHR3150/VHR3300/VHR3400 £18.00
VHR1100/VHR1200 £18.00
VHR1500/VHR2500 £28.00

SHARP
VC300/VC381/VC383/VC386/VC387/
VC388/VC482/VC483/VC486/VC3300/
VC8381/VC9100/VC9300/VC9500/
VC9700/VC9400/VC9600 £13.00
VC582/VC583/VC651/VC681/VC750/
VC780/VC781/VC683/VC684 £13.00
VC6000/VC6200/VC6300/VC7300/
VC7700/VC7750/VC8000/VC8300 £20.00

SONY
DSR-19R (FOR SL-T 9ME) £39.00
DSR-35R (FOR C20/C30/C40/
SLF1UB/SLF1E) 2 PIN £15.00
DSR-43R (FOR SLC7 RANGE/SL5000/
SL5100/SL3000) 1 PIN £13.00
DSR-21R (FOR SLC8/C9) £30.00

TOSHIBA
V21/V31/V33/V50/V51/V53/V9600 £14.50
V55/V57 £7.00
V71/V73/V74/V75/V81/V82/V83/V84/
V85/V86/V87 £14.00
V63 £18.00
V93 £20.00
V9680 £42.00
V5470/V5480 £18.00
V8600/V8700 £38.00

TRIUMPH
VR9500/VR9501/VR9525 £13.00

VCR PINCHROLLERS

AKAI
VS9300, VS9500, VS9700, VS9800 £2.50
VS1, VS2, VS3, VS4, VS5, VS6, VS9,
VS10 £3.20
VS105, VS112, VS115, VS116, VS126,
VS244, VS245, VS247, VS248, VS515,
VS516 £2.50
VS201, VS301, VS303, VS304, VS603,
VS606, VS607, VP58-P82 £2.50
VS125, VS155, VS165, VS220, VS240,
VS250, VS512, VSX9 £2.50

AMSTRAD
VCR4500, VCR4600, VCR4600 MKII,
VCR4700 £2.50
VCR5200 £3.20
VCR7000 £3.20

FERGUSON
3V00, 3V16, 3V22, 3V23 £2.50
3V29, 3V30, 3V31, 3V32 £2.50
3V35, 3V36, 3V38, 3V39, 3V42, 3V43,
3V44, 3V45, 3V48, 3V53, 3V54, 3V55,
3V56, 3V57, 3V58, 3V59, 3V64, 3V65,
FV10, FV11, FV12, FV14 £2.50

FISHER
FVHP420, FVHP520, FVHP530 £3.20
FVHP615, FVHP710, FVHP715, FVHP716,
FVHP722, FVHP725, FVHP830 £3.20
FVHP905, FVHP970, FVHP980,
FVHP990 £3.20

HITACHI
VT11, VT33 £2.50
VT61, VT62, VT63, VT64, VT65, VT86,
VT88, VT110, VT122, VT120, VT128,
VT130, VT135, VT138, VT150, VT168,
VT220 £2.50
VT5000, VT8000, VT9300, VT9500 £2.50

ITT
VR3605, VR3905, VR3935, VR3985,
VR3986, VR3993, VR3994 £3.20
VR3913, VR3914, VR3943, VR3954,
VR3983, VR3984 £3.20

JVC
HR300, HR3330, HR3360, HR3660,
HR4100, HR7700 £2.50
HR7200, HR7300, HR7600, HR7610,
HR7650, HR7655 £2.50
HRD110, HRD111, HRD120, HRD121,
HRD140, HRD150, HRD160, HRD225,
HRD455, HRD565, HRD725 £2.50

MITSUBISHI
HS200, HS300, HS301, HS302, HS303,
HS304, HS310, HS320, HS700 £2.50
HS306, HS307, HS400, HS710 £2.50

NATIONAL
NV100, NV180, NV300, NV333, NV340,
NV366, NV600, NV688, NV777, NV788 £2.50
NV230, NV370, NV430, NV460,
NV730, NV810, NV830, NV850,
NV870, NV890, NV2000, NV2010,
NV3000, NV7000, NV7200, NV7800,
NV8600, NV8610, NV8620, NVG14 £2.50
NVG7, NVG19, NVG12, NVG18 £3.20
NVG21, NVG25, NVH65 £3.20

PHILIPS
VR6460 £2.50
VR2020, VR2021, VR2022, VR2023,
VR2024 £3.20

SANYO
VHR1100, VHR1300, VHR1500, VHR2300 £3.20
VTC5000, VTC5150, VTC5500, VTC9300,
VTCM10 , VTCM20 £2.50

SHARP
VC381, VC386, VC2300, VC3300,
VC7300, VC7700, VC8300, VC9100,
VC9300, VC9600, VC9700 £3.20
VC387, VC481, VC483, VC486, VC496,
VC581, VC582, VC583, VC585 £3.20
VC651, VC681, VC685, VC750, VC780,
VC781, VC785, VC787, VC793, VCT72 £3.20

SONY
SLC5, SLC6, SLC7 £3.20
SLC9, SLC20, SLC24, SLC30, SLC33,
SLC44, SLHF100, SLF1, SLF11, SLF25,
SLF30, SLF60, SLF100 £3.20

VCR BELT KITS

AKAI
VP7100 £1.60
VS-1 £1.50
VS2EG £1.00
VS4 £1.20
VS5EG £1.00
VS9300 £1.60
VS9500 £1.55
VS9700 £1.60
VS9800 £1.55

AMSTRAD
TVR1-2-3 £2.10
VCR4600 & MKII £2.10
VCR4700 £2.10
VCR5200 £2.10
VCR7000 £0.80

FERGUSON
3292, 3V00, 3V01, 3V16, 3V22 £1.50
3V23 £0.65
3V29, 3V30 £1.20
3V31, 3V32 £0.85
3V35, 3V36 £0.80
3V38, 3V39 £0.80
3V42, 3V43 £0.65
3V44, 3V45 £0.65
3V34, 3V54, 3V55 £0.65
3V58, 3V59, 3V64, 3V65 £1.40
8950, 8951, FV10, FV11, FV12, FV13,
FV14 £1.40

FISHER
VBS7000 £2.45
VBS9000 £1.20
FVHP520, FVHP530 £0.80
FVHP710, FVHP716 FVHP722, £1.20
FVHP905, FVHP906,
FVHP907, FVHP910 £1.30
FVHP615, FVHP715, FVHP725,
FHP830 £1.20

GEC
4005 £1.50

HITACHI
VT11, VT33 £1.00
VT5000 £1.20
VT5500 £1.30
VT8000 £0.60
VT8500 £0.60
VT9300 £0.50
VT9500 £0.50

HITACHI
VT9700 £0.60
VT14, VT17, VT19, VT35,
VT38, VT88, £1.20
VT52, VT62, VT64, VT65,
VT86 £1.50

ITT
VR3605, 3905, 3935, VR3985 £1.00
VR3913, VR3914 £1.00

JVC
HR3300, HR3330 HR3360,
HR3660 £1.50
HR4100 £1.80
HR7200 £0.70
HR7600 £0.80
HR7610 £0.95
HR7650 £0.75
HR7655 £0.90
HR7700 £0.77
HRD110, HRD111, HRD120,
HRD225, HRD250, HRD455,
HRD565, HRD566, HRD725,
HRD755 £1.00
HRD170, HRD180, HRD230,
HRD370, HRD430, HRD530 £1.30

MITSUBISHI
HS200 £2.00

NATIONAL
NV300 £1.60
NV333 £1.35
NV777 £1.00
NV2000 £1.50
NV3000 £1.60
NV7000 £0.95
NV7200 £0.90
NV8600 £1.60
NV7500, NV7800 £1.10
NV340, NV366 £1.40
NV600, NV788 £1.20
NV230, 250, 280, 370, NV380, 430,
450, 460, NV465, 600, 630, 730,
NV810, 830, 850, 870, NV890 £1.35

PHILIPS
VR6460 £1.70

SANYO
VTC5000 £0.75
VTC5300 £1.00
VTC5500 £0.95
VTC9300 £2.20
VTC1100, 1300, 1500 £1.00

SHARP
VC381, VC383, VC386 £1.25
VC6300 £1.50
VC7300, 7700, 7500 £1.50
VC8300 £1.50
VC8381, VC9100 £1.25
VC9300, VC9500 £1.35

SONY
SL-C5, SL-C6 £1.40
SL-C7 £1.40
SL-C9 £1.65
SL8000, SL8080 £2.00

TOSHIBA
V55, V57 £0.85
V5250, V5280 £2.30
V5480 £2.10
V5475 £1.60
V7540 £1.60
V8600 £1.50
V9600 £0.85

SOLDERING IRON

ANTEX XS25W 240V
Soldering Iron 240Vac £6.50p
Spare Element for XS25W
240V £3.40p
ANTEX C15W 240V
Soldering Iron 240Vcm £6.50p
Spare Element for C15W
240V £3.40p

DESOLDERING PUMP

Desolder Pump £3.50p
Spare Nozzle £0.60p

SOLDER MOP £0.65p

SOLDER

18 SWG 500g £5.00p
20 SWG 500g £6.50p

SOLDERING IRON STAND

Soldering Stand £2.60p
Spare Sponge £0.55p

FLOPPY DISCS

5¼ inch DSDD (10 in box)
Branded Name £6.00
5¼ inch DSDD
(bulk pack) 25 £10.00
3½ inch DSDD (10 in box)
Branded Name £11.00
3 inch CF2 Branded Name £2.10
3 inch CF2D Branded Name £2.50

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MOD KIT TAPE CREASING FOR AMSTRAD
VCR450, 4600, 4700 450p
★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

SERVICE KITS

Each Kit Contains
Belts Set, Pinch Roller,
Tension Band & Idler Tyres

NATIONAL
NV300/NV340 £5.80p
NV7000/NV7200 £5.50p
NV2000 £6.25p

JVC & FERGUSON
3V35-36,38-39 £5.50p
3V29/30 £6.25p
HRD110/111/120/225 £5.50p
HR7200 £6.25p

HITACHI
VT11/VT33 £6.25p

FISHER
SERVICE KIT £5.50

HITACHI T.V.
OUTPUT MODULE HM 6251
REF: 2370551 £6.50

SERVICE AIDS

SERVISOL PRODUCTS
V. HEAD CLEANER 140p
SWITCH CLEANER 150p
SILICONE GREASE 170p
FREEZE IT 170p
FOAM CLEANER 170p
ANTI-STATIC 170p
AEROKLEANE 140p
AERO DUSTER 170p
PLASTIC SEAL 160p
GLASS CLEANER 160p

If you purchase more than one Servisol product postage will be £2.00

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UNIVERSAL TRIPLERS 450p
★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

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SONY ON/OFF SWITCHES 200p
★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★
SONY THYRISTOR
SG264A 550p
SG613 800p
★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★
PHILIPS SWITCHES
150p
K30, K35, K40, KT3, KT4
★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

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IDLERS & PULLEYS REPLACEMENTS

AMSTRAD

Model	Part	Reference	Price
VCR7000		150280	£1.50

AKAI

VS1-2, VS4-5, VS15	FF-REW IDLER	M1327773	£4.50
VS1-2, VS4-5, VS15	T-UP IDLER	BV327815	£6.00
V9700	IDLER	BV321979	£6.00
VS125, 126, 155, VS165, 240, 244, VS245, 247, 248, VS250, 512, 515, 516	IDLER ASSY	MZ366960J2	£11.00

FERGUSON

3V16-22	T-UP IDLER	PU47752	£4.50
3V16-22	T-UP IDLER	PU49280	£6.30
3V23, 3V29-30, 3V31-32, 3V35	REEL IDLER	PU48967	£3.00
3V23	ROLLER ASSY	PU49042A	£4.00
3V29-30, 3V31-32, 3V35-36, 3V38-39, 3V49	T-UP IDLER	51402	£1.45
3V29-30,3V31-32	T-UP CLUTCH	PU51380	£2.60
3V35-36, 3V38-39, 3V49	REEL IDLER	PU55374	£2.85
3V35-36, 3V38-39, 3V49	T-UP CLUTCH	PU55373	£2.25
3V58-59, 3V64-65, FV10-11, FV12-13, FV14	IDLER ARM	PU58645	£2.50
3V42	CLUTCH ASSY	PU55822	£13.50
3V44	CLUTCH ASSY	PU57658	£11.50
3V42, 43, 48, 53, 56	T-UP CLUTCH	PU56043-1-4	£2.80
3V42, 43, 48, 53, 56	SUPPORT CLUTCH	PU56044-1-5	£2.80

FISHER

FVHP520, FVHP530	FF-REW PULLEY	HI638531	£1.00
FVHP615	COMP. IDLER ASSY	FI1430420400300	£3.30
FVHP615	GEAR IDLER ASSY	FI1430490400900	£5.50
FVHP840	REEL T-UP ASSY	FI1430410400900	£6.50
FVHP905, 906, 908, FVHP910, 916	GEAR IDLER ASSY	FI1430490402400	£6.20
FVHP975, 990, 999, FVHP5000, 5100	IDLER	FI1430420400700	£5.20

GOLDSTAR

	IDLER	435038A	£2.50

HITACHI

	FF-REW IDLER	6886971	£1.50
	PLAY IDLER	V-6861482	£3.20
VT11-33, VT63-64, VT14, 17, 19, 38, 57, VT86, 88	CLUTCH ASSY	6879515	£7.50
VT120-220	CLUTCH ASSY	6886824	£7.50
VT8000-8300, VT8500-8700	FF-REW IDLER	6413663	£2.80
VT8000-8300, VT8500-8700	PLAY IDLER	6414221	£3.60
VT8000-8300 VT8500-8700	FF-REW PULLEY	6383531	£0.80
VT9300-9500	FF-REW IDLER	8681471	£3.30
VT9300-9500	PLAY IDLER	6861482	£3.20
VT9300-9500	IDLER	681505	£3.00
	IDLER	687043	£3.80
VT11-33, VT63-64	FF-REW IDLER	6886971	£1.50

HINARI

VXL3, VXL20	REEL IDLER	40000009	£1.50

ITT

VR3905, VR3906	T-UP IDLER	PU51402	£1.45
VR3906	REEL IDLER	PU55374	£2.85
VR3913, VR3943	REEL IDLER	PU48967	£3.00

JVC

HR330, 3660, 4100	T-UP IDLER SML	PU49280	£6.00
HR7200, HR7600, HR7650, HR7655	T-UP CLUTCH	PU53462A	£3.00
HR7200, HR7600 HR7650, HR7655,	REEL IDLER	PU48967	£3.00
HR7700	ROLLER ASSY	PU49042A	£4.00
HR3300, 3660, 4100	T-UP IDLER LRG	PU47752	£4.50
HR7200, 7600, 7650 HR7655, HRD110, HRD120-121, HRD225	T-UP IDLER	PU51402A	£1.45
HRD110, HRD120-121, HRD225	T-UP CLUTCH	PU55373	£2.25
HRD110, HRD120-121, HRD225	IDLER ARM	PU55374-3-8	£2.85

MATSUI

VX730, 735, 750, 755, VX810, 820, 880, 990	CLUTCH	850A00005	£6.50

MITSUBISHI

		Reference	
HS306, 307, 318, 319, HS410, 710	GEAR ASSY.	522P00201	£6.25

IDLERS & PULLEYS REPLACEMENTS — Cont.

NATIONAL

NV322, NV600, NV688, NV777, NV788	IDLER UNIT	VXP0463	£3.00
NV333	IDLER ARM	VXL0997	£3.60
NV333, NV366	IDLER UNIT	VXP0401	£0.75
NV333, NV366	PLAY IDLER	VXP0433	£3.00
NV333, NV3000	ACTION GEAR	VDG0016	£0.60
NV333, NV2000, NV3000 NV7800	LOADING GEAR	VXP0325	£2.00
NV333, NV2000, NV3000,	INTERMEDIATE GEAR	VXG0017	£0.65
NV333	CAM GEAR	VXG0158	£1.00
NV366	IDLER ARM	VXL0997	£3.60
NV370, NV430, NV730, NV830, NV850, NV870, NVG7, NVG10, NVG12, NVG18	IDLER ARM	VXP0521	£1.70
NV370, NV430, NV870, NV730, NV830, NV850	CAM GEAR	VDG0200	£1.20
NV730	IDLER UNIT	VXP0581	£2.50
NV2000, NV3000	IDLER UNIT	VXP0331	£1.20
NV2000, NV3000	IDLER UNIT	VXP0329	£1.20
NV2000, NV3000	CAM GEAR	VDG0069	£1.00
NV2000, NV3000	ACTION GEAR	VDG0016	£0.60
NV7000, 7200, 7800	IDLER UNIT	VXP0344	£1.00
NV7000, 7200, 7800	CLUTCH	VXP0343	£5.50
NV8400, NV8600, NV8610, NV8620	IDLER UNIT	VXP0245	£1.20
NV8600, NV8610, NV8620	PLAY IDLER	VXP0243	£1.20
NV8620	CLUTCH	VXP0343	£5.50
NV600	IDLER	VXP0488	£3.50
NVG21-25, NVG40-45	PULLEY UNIT	VXP0767	£5.80

ORION

VH200-201 VH555-700, VH844-900, VH1000-1500, VH1800,	IDLER	850A200004	£3.50
VP200, VH530 VH535-630, VH635-640, VH893-1440, VH2500-2600, VH2700-4010, VH5010	IDLER	850A200005	£6.50

PHILIPS

DV464, VR6462, VR6463, VR6660, VR6860	IDLER	52220334	£2.50
VR6460, VR6520, 6920	IDLER ARM	40340162	£1.70
DB532, VR6542, VR6843	REEL IDLER		£7.50

SANYO

VHR110, VHR1300, VHR1500	IDLER	1430662T14730	£5.00
VTC5000, VTC5150	FF-REW IDLER	1430741T20001	£3.00
VTC9100, VTC9300	IDLER	1430551T01400	£1.20
VTC9300	FF ROLLER ASSY	1430547T00200	£2.20
VTCM10-20	REEL DRIVE PULLEY	1430662T10350	£5.00
VHR2100, VHR2300	IDLER	6130374899	£5.00
VTC5000, VTC5150	PULLEY	143-0-662T-01201	£5.20
VTCM10	PULLEY	143-0-662T-10350	£5.50

SHARP

VC651, VC681, VC685	IDLER ASSY	NPLYV0107GEZZ	£6.15
VC7300, VC7700	PLAY IDLER KIT	NPLYV0041 + NDA1V1007	£5.00
VC381, VC383, VC386, VC8381, VC9100, VC9300, VC9500, VC9700	IDLER	NIDL0005GEZZ	£1.50
VC300, VC387, VC481, VC482, VC483, VC496, VC571, VC585	IDLER	NIDL0006GEZZ	£1.50
VC780-781, VC785-787, VC793-VCT72	REEL IDLER	NPLTV0111GEZZ	£7.00

SAISHO

VR1100, VR1200, VR1200HQ, VR1600, VR2500, VR3300, VR3500, VR3600	CLUTCH	850A20000	£6.50

SAMSUNG

VT510-511, VT520-610, VT611-616, VT620-621-626	IDLER WHEEL	65224704220	£1.50
VT510-511, VT520-610, VT611-616, VT620,621, 626	IDLER COMPLETE	69000250330	£4.50

SONY

C6	IDLER KIT ASSY	A 6706391	£3.50
C7	IDLER ASSY	X 36533100	£3.80
SL-C5, SL-C7	REW PULLEY	A-6706-348-B	£4.00
SL-C6	REW PULLEY	A-6706-391-A-B	£3.00

CASSETTE DC MOTORS

6V MOTOR	£2.00
9V MOTOR	£2.00
12V CW MOTOR	£2.00
12V CCW MOTOR	£2.00
13.2V CW MOTOR	£2.90
13.2V CCW MOTOR	£2.90

CASSETTE TAPE HEADS

MONO HEAD	£0.90
STEREO HEAD	£1.50
MINI HEAD	£2.30
AUTO REVERSE HEAD	£2.60

VIDEO MOTORS

AMSTRAD

VCR 7000	REEL MOTOR	£17.00

FERGUSON & JVC

PU 45979, 3V16, 3V22, HR3300, HR3660	CAPSTAN MOTOR	£21.00
PU 55371V, 3V35, 3V36, 3V38, 3V39, 8943, 8944, HRD110, HRD120, HRD121, HRD225	CAPSTAN MOTOR	£19.50
PU 46414, 8904, 8922, HR3300, HR3320, HR3330, HR3360, HR3600, HR3660	DRUM MOTOR	£19.50
PU 51381V, 3V39, 3V30, 8930, HR7200, HR7300	REEL MOTOR	£26.50
PU 58635V, 3V58, 3V59, 3V64, 3V65, 8950, 8951, FV10B, FV11R, FV12L, FV13H, FV20B, FV21R, FV22L, HRD170, HRD180, HRD230, HRD370, HRD430	CAPSTAN MOTOR	£29.00
PU 58636W, 3V58, 3V59, 3V64, 3V65, 8950, 8951, FV10B, FV11R, FV12L, FV13H, FV14T, FV20B, FV21R, FV22L, HRD170, HRD180, HRD230, HRD370, HRD430, HRD530	REEL MOTOR	£18.00
3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V56, 3V57, 8945, 8947 8948, HRD140, HRD150, HRD455, HRD565, HRD725, HRD755, HRP50, R73AF	LOADING MOTOR	£8.00

MITSUBISHI

288P02801, HS300, 301, 302, 310	MOTOR REEL SPOOLING	£33.50
288P02806, HS303, 304, 320, 330, 700	MOTOR REEL SPOOLING	£31.50
288P03401, HS303, 700	MOTOR REEL TAKE-UP GEN	£21.00

NATIONAL

MYN 135V5L, NV332, NV333, NV340, NV366	REEL MOTOR	£13.50
VEM0212, NV730-NV770	MOTOR REEL GEN	£30.00

SANYO

4-529V-10800 (RM11), VTC5000, VTC5150	REEL MOTOR	£6.30

SHARP

RMOTV 1008GEZZ, VC200, VC381, VC384, VC385, VC386, VC483, VC3300, VC8381, VC9100, VC9300, VC9500, VC9700	REEL MOTOR	£13.50
RMOTV 1007GEZZ, VC387, VC483, VC486, VC585	REEL MOTOR	£16.50
RMOTV 1010GEZZ, VC300, VC402, VC471, VC477, VC481, VC482, VC488, VC496, VC500, VC571, VC581, VC582, VC583, VC584, VC5F3, VC8481, VC8581	REEL MOTOR	£16.00

SONY

BHF 1100D, SLC7	CAPSTAN MOTOR	£25.00

CASSETTE HOUSING

FERGUSON & JVC

3V38, 3V39, 8943, 8944, 8951, 3V35, 3V36, HRD110, HRD120, HRD121, HRD225	£24.00
3V42, 3V43, 3V44, 3V45, 8945, 8947, HRD140, HRD141, HRD150, HRD455, HRD725	£24.00
8948, 8950, FV10B, FV12L, FV13H, FV14T, FV20B, FV21R, FV22L, HRD230, HRD430, HRD530	£24.00
3V58, 3V59, 3V64, 3V65, FV11R, HRD170, HRD180, HRD370	£24.00

VIDEO LAMPS

UNIVERSAL VIDEO LAMPS 12V 60mA (300mm WIRES)	£0.30
PANASONIC VIDEO LAMPS	£0.50

SONY FLYBACK TRANSFORMERS

Part No.	Models	Price
1-439-216-00	KV-2002E, 2010E, 2200E, 2015, 1820E, 2010SE, KV-2012ME, 2016ME, 2015ME, 2010ME	£14.00
1-439-256-11	KV-2704EC, 2704UB, 2704ET, 2704E(A), 2704E	£40.00
1-439-286-21	KV-2215UB, 2217UB, 2215EI, 2215FE, 2212EX, 2215ET	£30.50
1-439-289-21	KV-2705F, 2705FE, 2705UB, 2705E, 2706UB, 2720EC	£40.00
1-439-303-00	KV-2064EC, 20PS1, 2082ME7, 2056EC, 2060SA, KV-2062E(ESP)	£22.75
1-439-311-00	KV-1440AEC, 1440AS MK2, CPS-14CD3, CPV-14CD2, KTX-1350NF, KTX-1430UB	£22.00
1-439-332-21	KV-2756, 2730EC, 2730FE, 2764EC, 2752UB, 2752F	£30.00
1-439-333-00	KV-1882EC, 1882UB, 1882F, 1882CH, 1882AEB, 1882AM, KV-1882ME3, 1882HK, 1882AS, 16TR1, 882EC(PS), 1770R	£21.50
1-439-363-21	KV-19HT1A, 19FX1MT, 18G2, 1602M7, 1602GE, ADM-16B, KV-2092UB, 2096UB	£22.00

NATIONAL LINE OUTPUT TRANSFORMER

TLF 146-11B	£19.00
TLF 15542F	£25.00
TLF 14568F	£26.00
TLF 14567F	£26.00
TLF 14715F	£27.00
TLF 14749B	£20.00

NATIONAL TRANSFORMERS

TLF 6609B	£23.00

HITACHI TRANSFORMERS

2434274	£20.00

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AERIAL ACCESSORIES

Coax L/connector	.18
Coax Plug	.18
F Connector	.20
Fly Lead 2m	.75
Video Lead 2m	.75
Y Splitter	.95
4 Way Distribution Amplifier Mains	21.75

CAPACITORS

0.0091uf/1500v	1.25
0.1f 5.5v (back-up)	2.50
1uf at 250v	.20
1uf at 400v	.25
1uf at 400v	.25
4.7uf at 250v	.25
4.7uf at 400v	.35
10uf at 250v	.35
10uf at 400v	.75
22uf at 250v	.40
33uf at 250v	.55
47uf at 250v	.65
100uf at 250v	1.25

(All the above are pcb mounting)

DIODES

TYPE	PRICE
R2M	.95
BY133	.15
BY227	.20
BY229/800	.95
BY299/800	.35
1N4007	.10
1N5408	.20
BZX61C (1.3 Watt) 5v6, 6v8, 7v5, 9v1, 12v, 15v, 24v, 33v, 68v, 120v, 130v (5 per Value)	1.00

E.H.T. TRAYS

Continental 30AX Focus	8.95
DECCA 120/130	7.95
GRUNDIG CUC2410 14"	19.75
GRUNDIG CUC2410 18"/26"	19.95
ITT CVC20/30	6.95
PHILIPS KT3	7.95
RBM T20/22A	7.95
THORN 9000	8.00
UNIVERSAL	5.95

FUSES

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

INTEGRATED CIRCUITS

TYPE	PRICE (£)
CNX62A	4.75
CNX83A	3.95
HA1377	2.95
HA13001	4.50
HM6251	5.95
HM6232	5.95
LA4445	2.45
LA4460	2.45
LA4461	2.45
LA7800	2.95
LA7801	2.95
M293B1	7.95
M491BB1	14.75
M58401I/84RS	12.95
MC13002P	4.95
SAA1293-02	6.95
SAA5000A	4.95
SAA5012	4.95
SL1430	1.95
SL1432	1.95
STK5325	7.95
STK5331	6.95
STK5332	6.95
STK5333	12.50
STK5335	6.95
STK5421	7.95
STK5422	6.95
STK5471	8.75
STK5481	8.95
STK5482	8.95
STK7308	7.95
STK7348	7.95
STR441	6.75
STR4090	8.95
STR4211	4.50
STR5412	4.95
STR40090	8.95
STR50020	7.95
STR50103A	6.50
STR54041	9.95
STR55041	6.95
STR58041	6.95
STR6020 (KIT)	5.95
TA7227P	2.95
TBA120U	1.95
TBA820M	1.75
TDA1035T	2.95
TDA1037	2.75
TDA1044	2.95
TDA1170S	1.95
TDA1510	3.80
TDA1512	3.50
TDA1515	4.50

TYPE	PRICE (£)
TDA1516	7.75
TDA1518	5.50
TDA1670A	4.50
TDA1770A	3.70
TDA1908A	1.95
TDA2004	2.95
TDA2005	2.95
TDA2030	1.95
TDA2170	3.95
TDA2270	3.95
TDA2530	6.95
TDA2541	2.95
TDA2560	2.50
TDA2576A	3.25
TDA2577	3.75
TDA2577A	3.95
TDA2578A	3.95
TDA2579	3.75
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TDA2591/3	2.95
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TDA2600	6.50
TDA2653AQ	3.95
TDA3330	3.95
TDA3560	4.95
TDA3561A	4.95
TDA3562A	5.50
TDA3562A (TFK)	6.75
TDA3565	4.95
TDA3571BQ	7.95
TDA3576B	7.50
TDA3651	2.75
TDA3651AQ	4.75
TDA3652 Genuine	9.95
TDA3653	3.95
TDA3653A	4.95
TDA3654A	3.95
TDA4500	3.95
TDA4501H	5.95
TDA4503	3.95
TDA4505E	6.95
TDA4600/2	2.95
TDA4600/2D	3.95
TDA4601	3.50
TDA4601DIL	4.75
TDA8180 (Genuine)	8.50
TDA9503	3.75
TEA1014A	3.95
TEA1039	2.95
TEA2018A	2.95
UPC1365C	3.95
UPC1378H	3.95
UPC1394C	2.95
UPC1420CA	8.50

LINE O/P TRANS

Decca 100	9.95
Ferguson TX85	21.75
Ferguson TX90 (14")	19.75
Ferguson TX90 (20")	21.50
Ferguson TX99	22.75
Ferguson TX100 90D	19.95
Ferguson TX100 110D	19.95
Ferguson TX100 110D FST	23.50
Fidelity ZX2000 + Mod)	12.50
Fidelity ZX3000	11.50
Fidelity ZX 22"/36"	21.50
Hinari CT4/5	19.95
Hinari CT6/7	19.95
Hitachi CPT1446	22.95
ITT Compact 80	19.95
ITT CVC25/30/32	9.95
ITT CVC800/1/2/3	23.95
ITT CVC830	19.95
ITT CVC1100	19.95
ITT CVC1150	21.50
ITT CVC1200/1	19.95
ITT CVC1204	14.75
ITT CVC1215	19.95
ITT Monoprint 110D	22.50
ITT Monoprint B	22.50
Matsui C1410/1420	26.95
Matsui C1480A	26.95
Philips CF1	23.50
Philips CP90	22.95
Philips CTX 14"/20"	21.50
Philips K30	23.75
Philips K35	22.95
Philips K40	23.75
Philips 2A	23.50
Saisho CT141X	26.95
Sharp C1410	24.95

ON/OFF SWITCHES

TX9/10 Standard	1.00
TX9/10 Remote	1.75
TX90/100 Standard	1.50
TX90/100 Remote	1.75
Fidelity CTV140	1.50
Fidelity CTV14R	2.95
Fidelity CTV14S	2.95
Grundig CUC731	3.50
Philips G11 Standard	1.35
Philips G11 Remote	1.75
Philips KT3 Remote	1.75
Philips KT4/CTX Remote	1.75
RBM T20A 3K3 Volume	3.95
Sony Universal	3.75
Sony KV1612 Remote	3.95
Sony KV2022 Remote	3.95
Thorn Universal	1.00

REMOTE CONTROLS

Ferguson T725	12.95
Ferguson T734	14.95
Ferguson T742	14.95
Ferguson T785	12.50
Ferguson T789	12.50
Ferguson TX10 Non Text	12.95
Ferguson TX10 Text	12.95
Ferguson TX10 Stereo	12.95
Ferguson 3V23	14.95
Ferguson 3V32	14.50
Ferguson 3V35	14.50
Ferguson 3V45	14.95
Ferguson 3V43	14.95
Ferguson 3V55	15.75
Fidelity CTV14S	13.95
Fidelity CTV22T	14.95
Granada Universal	12.95
Grundig TP400 Text	13.95
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Hitachi CPT2038	15.95
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Hitachi CPT2246	15.95
Hitachi CPT2508	15.95
Hitachi CPT2888	15.95
Hitachi VT63/64	14.95
Hitachi VT120E	14.95
ITT FS9/10 Digivision	14.95
ITT RG305	12.95
ITT RG306	12.95
ITT VS4	14.95
ITT VS5 Text	14.95
Panasonic EUR51200	14.95
Panasonic TNQ1411/2	14.95
Panasonic TNQ1419	16.95
Panasonic TNQ1621	14.95
Panasonic NV730	15.75
Philips G11 I/R N/Text	12.95
Philips G11 I/R Text	12.95
Philips KT3/30 N/Text	12.95
Philips KT3/30 Text	12.95
Philips KT4/CTX Text	12.95
Philips RC5991	12.95
Philips VR6362/7	15.95
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Rediffusion MKIV	13.95
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Sony RM604/606	14.95
Sony RM615/632	14.95
Sony RM670	15.95
Tatung RC31	22.95
Tatung RC40/45	15.95
Tatung RC42	14.95
Tatung RC60	14.95
Tatung RC70	17.95

TRANSISTORS

TYPE	PRICE
BC307	.10
BC327	.10
BC337	.10
BC547/8	.10
BC557/8	.10
BC639	.20
BC640	.20
BD238	.40
BD677	.65
BF337	.30
BF422	.35
BF423	.35
BF458	.35
BF460	.95
BF757	.70
BF871	.95
BR103	.75
BT151/800	1.35
BU126	1.95
BU208A	1.45
BU208D	1.95
BU326A	1.95
BU426A	1.45
BU500	2.00
BU508A	1.50
BU508AF	1.95
BU508D	1.95
BU508DF	2.50
BU508V	2.75
BU705	2.95
BU807	1.75
BU826A	2.95
BU907	2.95
BU908	2.95
BUT11AF	2.75
BUT12A	2.95
BUT56A	2.75
BUX84	.80
R4050	2.95
T9053V	3.50
T9054V	3.50
T9064V	1.95
TIP29E (TD168V)	.75
TIP41C	.50
TIP42C	.50
TIP112H (TD167V)	.75
TIPL791A	1.95
2SC1942	2.95
2SC3156	2.95
2SD725	4.95
2SD1398	2.50
2SD1453	2.95
7805	.50
7812	.50

VIDEO HEADS

Alba 4000X	21.50
Alba 5000X	21.50
Amstrad 4500/9000	18.75
Amstrad 4600/4700	18.75
Amstrad 6000	19.95
Amstrad 7000	19.95
Ferguson 3V00/39	9.50
Ferguson 3V32	24.95
Ferguson 3V42/55	19.50
Ferguson 3V43	32.50
Ferguson 3V65/FV11	23.50
Fisher 615/910	17.50
Hitachi 8000/9700	17.50
Hitachi VT11/33	17.50
Hitachi VT17/19	34.95
Hitachi VT63/64	22.50
Hitachi VT65	34.95
Hitachi VT120E	24.95
Hitachi VT130E	29.95
JVC HRD250	29.95
Matsui VX730	22.95
Matsui VX735A	22.95
Mitsubishi HS301/302	24.95
Mitsubishi HS303/305	24.95
NEC 9034/9053	22.50
Panasonic NV230	22.50
Panasonic NV333	9.50
Panasonic NV366	24.95
Panasonic NV370	12.50
Panasonic NV430	19.95
Panasonic NV688	33.50
Panasonic NV730	23.95
Panasonic NV777	27.50
Panasonic NV788	38.50
Panasonic NV2000/7000	9.50
Panasonic NVG7/9	19.50
Panasonic NVG10/12	19.95
Panasonic NVG18	29.95
Panasonic NVG20/21	29.95
Panasonic NVG30/40	24.50
Philips 6460/6520	12.50
Philips 6462/6560 Genuine	42.95
Philips 6467	37.95
Philips 6760 Genuine	39.95
Samsung VX520/710	19.95
Sanyo VHR1100/1300	19.50
Sanyo VHR2300/3200	19.95
Sharp VC9300/381/481	17.50
Sharp VC581/681	17.50
Sony C5/6/7	14.95
Toshiba V73/83B	21.50
Toshiba V93B	23.95

ALBA VIDEO SPARES

VCR4000	
Belt Kit	1.95
Capacitor Back-up	2.50
Pinch Roller	3.95
Reel Idler	3.95
Reel Pulley	1.95
Video Head	21.50
VCR5000	
Belt Kit	1.95
Pinch Roller	3.95
Reel Idler	3.95
Reel Pulley	1.95
Video Head	21.50

AMSTRAD VIDEO SPARES

VCR4500/4600	
Belt Kit VCR4500	1.95
Belt Kit VCR4600	1.95
Modification Kit	6.95
Video Head VCR4500	18.75
Video Head VCR4600	18.75

FERGUSON VIDEO SPARES

3V00/22	
Belt Kit	2.50
Pinch Roller	3.95
Take-Up Clutch (Large)	5.95
Take-Up Clutch (Small)	5.95
Video Head	9.50
3V29/30	
Repair Kit	12.95
Belt Kit	1.80
Capstan Motor	32.50
Cassette Lamp	.80
Loading Belts (5)	1.95
Pinch Roller	3.95
Reel Idler	2.95
Take-Up Clutch	2.95
Take-Up Idler	1.85
Tension Band	2.45
Video Head	9.50
3V35/39	
Repair Kit	12.95
Belt Kit	1.95
Capstan Motor	22.95
Cassette Housing	25.95
Cassette LED	1.95
Loading Belts (5)	1.95
Mains Transformer	23.95
Pinch Roller	3.95
Reel Idler	2.95
Remote Control	14.95
Take-Up Idler	1.85
Take-Up Clutch	2.95
Tension Band	2.45
Video Head	9.50

FERGUSON VIDEO SPARES

3V44/45	
Repair Kit	14.95
Belt Kit	1.50
Cassette Housing	25.95
Clutch Assembly	12.95
Pinch Roller	3.95
Remote Control	15.95
Video Head	19.50
3V65/FV11	
Repair Kit	11.95
Belt Kit	1.75
Capstan Motor	27.50
Cassette Housing	29.95
Pinch Roller	3.95
Reel Idler	2.75
Reel Motor	15.95
Video Head	23.50

FISHER VIDEO SPARES

FVH615/720	
Belt Kit	1.95
Clutch Assembly	5.95
Pinch Roller	4.50
Reel Idler	5.95
Video Head	17.50
FVH905/910	
Belt Kit	1.95
Clutch Assembly	19.95
Reel Idler	5.95
Video Head	17.50

HITACHI VIDEO SPARES

VT8000/8700E	
Belt Kit	1.95
FF/REW Idler	2.95
FF/REW Pulley	.95
Play Idler	3.95
Video Head	17.50
VT9300/9700E	
Belt Kit	1.95
Capstan Motor	31.95
FF/REW Idler	2.75
FF/REW Pulley	.95
Play Idler	3.95
Remote Control	15.95
Video Head	17.50
VT11/33E	
Repair Kit	17.95
Belt Kit	1.95
Capstan Motor VT11E	26.95
Capstan Motor VT33E	29.95
Clutch Assembly	7.95
FF/REW Idler	2.50
Pinch Roller	3.95
Tension Band	2.95
Video Head	17.50

HITACHI VIDEO SPARES

VT63/64E	
Belt Kit	1.95
Capstan Motor	27.50
Clutch Assembly	7.95
FF/REW Idler	2.50
Pinch Roller	3.95
Repair Kit	17.95
Video Head VT63/64E	22.50
Video Head VT65E	34.95
VT120/130E	
Belt Kit	1.95
Clutch Assembly	7.95
FF/REW Idler	3.75
Pinch Roller	3.95
Repair Kit	18.50
Video Head VT120E	24.95
Video Head VT130E	29.95

PANASONIC VIDEO SPARES

NV230/430	
Repair Kit (Genuine)	12.95
Belt Kit	1.95
Mode Switch	3.95
Pinch Roller	3.95
Reel Idler (Genuine)	2.95
Tension Band	2.45
Video Head NV230	22.50
NV333/366	
Repair Kit (Genuine)	13.75
Belt Kit	1.95
Pinch Roller	3.95
Play Idler (Genuine)	4.95
Reel Idler (Genuine)	1.25
Reel Motor	17.95
Tension Band	2.45
Video Head NV333	9.50
Video Head NV366	24.95
NV370	
Repair Kit (Genuine)	12.95
Belt Kit	1.95
Mode Switch	3.95
Pinch Roller	3.95
Reel Idler (Genuine)	2.95
Tension Band	2.45
Video Head	12.50
NV730	
Repair Kit (Genuine)	12.95
Belt Kit	1.95
Mode Switch	3.95
Pinch Roller	3.95
Reel Idler (Genuine)	3.95
Reel Motor	29.95
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Video Head	23.95

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Repair Kit (Genuine)	12.95
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Reel Idler (Genuine)	3.95
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Reel Idler (Genuine)	3.95
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Pinch Roller	3.95
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video Head	17.50
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Pinch Roller	3.95
Reel Pulley (Genuine)	7.95
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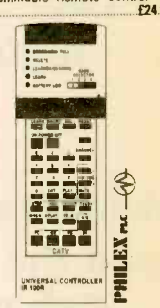

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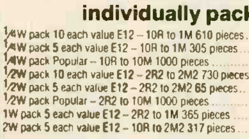

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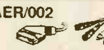

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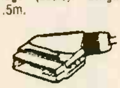

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VT3000	VID/2511	15.85
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N.E.C.		
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SHARP	NIDL 0006 GE22	2.05

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ECC82	2.75
ECC83	3.05
ECC84	0.75
ECC85	1.85
ECC88	3.60
ECC189	3.60
ECF80	1.55
ECF82	1.45
ECF83	2.10
ECH35	4.30
ECH42	1.70
ECH81	1.30
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ECL82	1.35
ECL84	1.30
ECL85	1.30
ECL86	3.10
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EF80	0.60
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PCF82	0.80
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PCF87	1.50
PCF200	3.10
PCF201	3.10
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PCL83	3.95
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PCL86	1.40
PCL88	2.05
PCL805	1.50
PD500	5.90
PFL200	2.10
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PL84	1.30
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Band width	40MHz-860MHz
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(signal cross modulation	6dB
Noise	6dB
Isolation between outputs	40dB mm
Power	240Vac/500Hz
Dims	250 × 100 × 60 mm

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COVER PHOTO
This month's cover photograph shows the internal layout of the Philips CD104 CD player – see servicing article on pages 486-490.

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TELEVISION

Standards Again

It is difficult to know exactly what to make of the unfolding widescreen TV saga, which seems to be yet another example of failure to agree to a TV standard. Is it perhaps simply an attempt by the European TV industry to snatch a temporary advantage over Far Eastern manufacturers? Certainly it's the European tubemakers that have developed the technology. But if this is the case the question that has to be asked is whether widescreen TV is a further example of an attempt by technology rather than consumer demand to drive the market forwards? If so it could well be a mistake. People won't buy technology for the sake of it: they'll buy only what suits them.

The 16:9 aspect ratio sets that have been announced so far are a mixed batch. Nokia has opted for 625-line PAL, Thomson has opted for 1,250-line PAL while Philips has decided on 625-line PAL with a 100Hz field rate. Nokia feels that the wide screen is the important thing rather than any change to basic TV standards. The company points to the cost advantage of using a standard chassis to drive the new type of tube. But even here the wide screen presentation is seen as essentially a top of the range phenomenon. In this case why not go the whole hog? With a chassis that features digital signal processing, why not take advantage of the opportunity to improve the definition and get rid of flicker once and for all? There are arguments as to exactly how much better a picture you get for your money at higher timebase frequencies. What this seems to boil down to is that compromises, as always with TV, have to be accepted. The argument is over what compromise to accept. It's a rather pointless argument really and one can't help but feel that the motivation behind it is simply a matter of gaining marketing clout rather than achieving the best in good picture reproduction. There is much to be said for the view that a well set up display using conventional technology and a decent aerial system, with no corner-cutting in circuit design, will with the presently available transmissions provide as good a picture as any for the viewer rather than the technology buff.

Representatives of the main Japanese manufacturers in the UK have been making disparaging comments about widescreen TV. The case was put forcibly by Mark Todd, Toshiba's marketing director. He hit the headlines with coments that widescreen TV was "premature" and "a joke", but rather more to the point he suggested that instead of buying a set that is "too big" and "too expensive" the consumer would be better off with a 34in. Nicam set featuring surround sound. The money saved could, he added, be invested in a building society. The debate has been clouded by dispute over what programming is available. At present it seems to be limited to a few tapes and Continental satellite channels transmitted in D2-MAC form. Not much really to justify lashing out on a set that costs a few thousand pounds.

Since some rather rude remarks about the 16:9 picture format on this page a few months ago I have been somewhat severely taken to task over what is and what isn't a natural display based on the characteristics of human vision, in particular by John Dagg (January) who quoted a considerable amount of research. The fact that human eyes are horizontally displaced, giving perception somewhat elongated in the horizontal plane compared to the vertical plane, looks a clincher. But this rather overlooks the reason for us having two eyes in the first place – to achieve bifocal vision. The images from the two eyes are superimposed to give us a three-dimensional field of view. It's nothing to do with aspect ratio!

The aspect ratio debate continues in our columns and I've been gratified by some support amongst more recent letter writers. A particularly interesting letter has come in from Geoff Darby who makes some pertinent, down-to-earth comments. It arrived too late for this issue, but watch this space as they say. What does rather intrigue me in all this is whether sight is really a scientific matter. It is, of course, as a subject for study. But as an aspect of natural history it seems more akin to disciplines such as economics rather than pure science. Those who take an interest in the endless economic debate, with one plausible argument after another seeming to establish opposite points of view, will appreciate this. The problem of course is that you can't conduct conclusive experiments with the subject matter of economics. You can't say right, call a halt, go back five years and see what happens if we alter the conditions. Anything of an historical nature can only be observed and, in a more or less helpful manner, explained. That seems to be the case with human perception. You can't experiment with different vision systems. You have to understand as best you can the one we've ended up with.

However that may be, the TV industry is not doing itself any great favours with its continual change. To the 4:3 and 16:9 aspect ratios we now have a proposed compromise 14:9. It's not easy of course to arrive at decisions with absolute certainty. Technological evolution continuously and often suddenly shifts, and new possibilities have a habit of coming at times that are inconvenient for the standards decision makers. Perhaps we should give up worrying about TV standards and accept the fact that there have always been and always will be different ways of going about things, with various advantages and disadvantages. Let's just sit back and watch the thing unfold. It would be nice to take a relaxed view like that. But of course there's more at stake. Sets have to be manufactured to standards, broadcasters have to observe system parameters and, at our end of things, the public has to be presented with a good case for buying what's available. It doesn't help the salesman to have to work in an atmosphere of continuing uncertainty.

Letters

OPERATING CONSUMER ELECTRONICS

I feel that the frequent complaints about poor instruction books and over complex products in the consumer electronics field have been rather over done. Because of familiarity many people regard cars as being easy to drive. They forget that it took many lessons, hours of practice and a test to be declared "proficient" to drive, though still with a lot to learn. If the driver seldom uses his car, skill and confidence are lost and safety is adversely affected. And when a car is exchanged for another model a familiarisation period is required. The user's handbook supplied with a car is very basic. It explains where the controls are and what they do, but very little else. Actual driving isn't explained. Driving skill comes with practice. Nobody complains about the book!

VCRs today generally have a complex microcomputer control system. Anyone who uses a computer in the office or at home will remember that it took several hours of learning to master the system. When the computer is replaced with a newer/different type a learning period follows. No one complains!

A VCR's control processes have been simplified, but practice and continual use are required before the customer can operate his machine without thinking.

There is nevertheless some truth in the general complaint. Very often a VCR's instruction book has been written in a certain way, language and form that suits the market in its country of origin. It is then translated, sometimes very badly, into another language. It seems that time and resources don't allow the transformation to be done properly. But manufacturers and distributors can do something about this!

The educational system is not without blame in relation to these problems. Since the early Sixties, when teaching methods were "liberated", the art of proper composition and proficiency in the use of language has declined. Most of those responsible for preparing instruction books are part of the "suspect" generation. Combine this with the general lack of comprehension that goes hand-in-hand with falling educational standards and it's easy enough to understand why some customers find products difficult to operate.

P. Milligan,
Birmingham.

CHANNEL FIVE

My letter on Channel 5 in the January issue was concerned mostly with the problems of modifying commercial and domestic u.h.f. distribution systems so that Channel 5 reception won't cause interference to existing arrangements. I wrote to the ITC about this and received a full and interesting reply. The all-important question of course is who pays? It seems that the scepticism expressed in my letter was well founded. The bottom line is as follows. If the Channel 5 licencee comes across a system that needs any more than a tweak, all he needs to do to fulfill his responsibilities is to fit a notch filter. This removes the Channel 5 signal and so removes the problem. What about customers who complain that they can't get Channel 5? Hard luck! This might be reasonable with a large SMATV, but not in the case of a domestic system. In the latter case we've always worked on the assumption that channels 35-38 are exclusively for locally-generated channels. Domestic VCRs, satellite TV receivers etc. continue to be supplied with modulators whose output is restricted to these and nearby channels.

The channel allocations will apparently be as follows:

Channel 35: Mounteagle, Durris, Perth, Selkirk, Black Mountain, Burnhope, Winter Hill, Belmont, Oxford, Chelmsford, Huntshaw Cross, Plympton and Fawley.

Channel 37: Tay Bridge, Black Hill, Londonderry, Cambret Hill, Emley Moor, Sutton Coldfield, Presely, Tacolneston, Mendip, Croydon, Redruth and Fenham.

Other frequencies: Craigkelly, Caldbeck, Sheffield, Nottingham, Sandy Heath, Churchdown Hill and Storeton.

The ITC calculates that channels 35 and 37 will provide coverage for 70 per cent of the UK population. The transmitters on "other frequencies" will add only another four per cent. As an interesting comparison old hands will recall that in the 405-line days five Band 1 channels were needed to give national BBC-1 coverage. This was at v.h.f., where fewer fill-in stations were required. Even here, BBC-1 eventually had to spread to channels 6 and 13, though this was partly because of interference from the Continent in Band 1.

Readers might like to study the ch. 35 and 37 transmitter lists and consider likely levels of co-channel interference in their parts of the country. The ITC's coverage map suggests that in most cases the power levels and radiation patterns will be similar to those of the existing four services. Channel reuse will however be far greater than we have previously experienced in this country. There will be high-powered transmitters that use the same channel not so very far apart.

As we all know, u.h.f. signals often surprise us by appearing at usable strength in odd pockets well outside the nominal service area. Many places where a second ITV service can be easily received are going to be problem areas for Channel 5. I would expect some problems in a large area south of Sheffield where signals from Emley Moor and Sutton Coldfield are often receivable well into each others' service areas. Occasional interference due to unusual atmospheric conditions is going to be a real problem with such extensive channel reuse. In many parts of North Yorkshire for example large high-gain aerials and amplifiers are needed. The aerials point south towards Emley Moor, but this means that they are also pointing roughly towards Sutton Coldfield, which is only about a hundred miles away. Without the directional properties of the aerial to help, bouts of severe co-channel interference seem to be a distinct possibility in such a case even if the two transmissions have opposite polarities.

It seems that there will be pockets of occasional or permanent co-channel interference all over the country. Many locations well inside the nominal service area of a transmitter will suffer from impaired pictures in varying degrees, especially if they are screened from the "local" transmitter but clear in the direction of another one that uses the same channel. In the light of all this I think that the 70 per cent coverage figure may well prove to be optimistic – unless it's accepted that many viewers will suffer from degraded reception.

The national four-channel u.h.f. system, carefully planned in the Sixties, has served us well. Coverage is well nigh 100 per cent, with co-channel interference and other reception problems minimal in the vast majority of locations. In most areas one small aerial gives good reception of the four channels. In addition we've had in the

middle of the band the boon of a group of channels that have been clear almost everywhere. As VCRs and satellite TV have become more popular, this has been invaluable. It was too sensible to last, wasn't it? Something that will go against everything the four-channel plan stood for is to be brought in. It will add greatly to the clutter of aerials that even now is a far more prevalent eyesore than are satellite dishes. It will bring with it a plethora of tuning and aerial problems, taking us some way towards the level of electromagnetic chaos that reigns in Italy and the USA. And all for what? For one more channel serving perhaps half the population. With so many people having access to satellite and cable systems, isn't one more terrestrially radiated channel a bit of an irrelevance? No one really wants this channel, except maybe the advertising agencies.

In the years that I've been in this industry the picture quality produced by colour sets has improved enormously. Even within the limitations of the 625-line PAL system we can now give people lovely sharp, clear pictures. But pulling the other way are those forces that, for one reason or another, want us to compromise. We lost BSB, which in Marco Polo and D-MAC had the best way of getting good-quality pictures and clear sound into people's homes. Now we have most satellite viewers watching the grotty, slightly sparkly, Videocrypt-degraded pictures that £199 buys. Sad that so many people now regard this "sub-PAL" reception as the norm.

The introduction of Channel 5 will inevitably leave a percentage of viewers with some degree of reception impairment on VCR playback, satellite and/or Channel 5 itself, thus on average reducing people's expectations still further.

As we approach the 21st century, we should expect any system for delivering pictures and sound to the home to give perfect or near perfect reception: this is the ideal that manufacturers, installers, broadcasters and regulatory bodies should be working towards. Admittedly the viewer is often his own worst enemy – he'll buy the cheapest possible satellite TV equipment and make do with a hopelessly inadequate aerial installation. At this level it's usually a waste of breath arguing, but at the broadcasting regulation level standards should be going up all the time, not down. In my opinion the plans for Channel 5 represent a decline in broadcasting technical standards in the UK and as such are much to be regretted.
Bill Wright, Wright's Aerials,
Rotherham, South Yorkshire.

GRUNDIG VS200

The suggested cure for a clock that cannot be reset in a Grundig VS200 VCR (Service Bureau, February issue) might be right – but a shorted memory battery is rather more likely.
Philip Blundell, AMIEIE.,
Great Barr, Birmingham.

MICROWAVE OVENS

The article on a high-voltage tester for use with microwave ovens (April issue) calls for comment. It's not true to say that there's no point in having a hand in your pocket "because the high voltage is earthed". This implies that with one hand holding and adjusting the probe there's no danger in contacting the chassis with the other hand. But the potential difference exists between chassis and the magnetron's cathode. A fault in the tester could place the user straight across the low-impedance 4kV source. With the oven not producing energy and the magnetron not drawing current this could mean full whack for the engineer – and possibly death.

Any experienced microwave oven engineer will confirm that there's rarely need to measure the voltage in this circuit. I feel that Ian Rees is thinking in terms of TV practice, which won't do.

What is particularly alarming is the thought that DIY enthusiasts could be encouraged to dabble in microwave oven repairs without realising the very great dangers.
Jim Garrod,
Sandown, Isle of Wight.

NOT A SQUARIAL

There was an editorial amendment to my letter last month. Unfortunately the "square-ish" Marconi dish aerial I referred to was changed to a Squarial antenna, which is quite different. It means that the references to a boom and to declination will be confusing to anyone aligning a Squarial which has no boom and is inclined not declined to the vertical.
Colin McCormick,
Plymouth, Devon.

SAISHO CT142RX

Now come on Donald about this Saisho CT142RX you dabbled with (April). Was that really the end of the story? I've dealt with a lot of these sets and the first thing I check when one comes in dead as you described is the avalanche diode D508 (type SR-2M). If this is short-circuit and F501 and R501 have expired it's odds-on favourite that some other component has also gone to meet its maker. You might have been in luck, but if that was all you had to replace it was an unusual situation. Every time I've tried replacing this safety component the line output transformer has seen it off along with the fuse and the resistor.
Mark Thomason,
Stretford, Manchester.

Editorial note: Sorry, the faulty diode was D506, not D508, but thanks for the tip.

SERVICING CHARGES

With reference to Mrs. Rabble's Toshiba VCR, Donald Bullock's column last month, we're in the business to make a good living: £15 for an immediate repair plus a load of insults is far too cheap. Our price would be £20 for the repair, £15 for the insults, as the VCR could soon be back again. In comparison with many others this business is full of stress and strain. To balance everything up we give good, guaranteed service and charge well for it (no freebys) unless under guarantee.
E.R. Webb, KTV Warehouse,
Camborne, Cornwall.

SERVICING VALVE RADIOS

I found Stanley Johnson's article (March) on restoring valve radio receivers comprehensive and interesting. Although relevant his reference to valve manufacturers' data could be misleading as the figures they give are not always typical operating conditions. One has to be careful in interpreting such data. Nevertheless if you are going to do a number of restorations a comprehensive valve manual is of real use.

I would also like to make the point that measuring a valve's anode current to ascertain its gain will not in itself give a figure for mutual conductance, which is the relationship between anode current change and grid voltage variation. In practice however anode current measurement can give a good indication of the condition of a valve. It's often possible to calculate the total valve current from the cathode voltage and the value of the cathode bias resistor (where one is present). This avoids having to disconnect wiring or components.

A circuit diagram can be useful, particularly if it carries valve voltages. Some advertisers in *Television* can go back quite a long way. Other sources are *Radio Servicing* and the earlier volumes of *Radio and Television Servicing*. Some public libraries in larger towns carry a full set of these books.

Mr. Jackson's reference to signal injection gave me a smile and took me back to the "old days" when test equipment was a bit thin on the ground. We used to reckon that the i.f.s wouldn't be far out and would set the dial pointer to a weak station in the middle of the medium waveband. We then tuned the i.f.s for either maximum sound or minimum voltage across the cathode resistor (if fitted) of the i.f. amplifier valve – this voltage varies with the a.g.c. action. After checking that the dial pointer was correctly positioned, we would tune in two stations of known frequency at either end of the band so that they appeared in the correct position. The LW band was similarly treated. We finally adjusted the r.f. circuits for maximum sound or minimum voltage, like the i.f. circuits. If the i.f.s were badly out we "signal injected" the i.f. from another set for initial rough tuning, then followed the usual procedure. Rough and ready maybe, but it worked very well!

Eric G. Kempshall,
Hove, East Sussex.

HINARI SPARES

I recently had some difficulty in finding a source of spares and service information for the Hinari Model HIT51T TV receiver. Spares for this model are not available from CPC. They are available from Tosumi Spares and Service, PO Box 277, Acton Grange Distribution Centre, Birchwood Lane, Moore, Nr. Warrington, Cheshire WA4 6XL (telephone 0925 56770). This company is a division of Hamilton Electrical Distributors Ltd.

A. Robertson, Enterprise TV,
Abram, Wigan.

BETAMAX VCRs

Pete Hills asked in the March issue whether there were any other Beta enthusiasts out there. I have several Sony Beta machines, Models SLC5/6/7. It seems that the public is quite happy to give or even throw these machines away when the heads require replacement.

Since pattern heads are available for under £20 these machines are usually well worth repairing, though an engineers' dial gauge must be used to align the head concentrically before tightening the screws. The results obtained are excellent, putting to shame the pictures produced by even the most expensive standard VHS recorders. Electronic faults seem to be very rare, most problems being caused by slipping idlers and belts. The SLC5 and SLC7 can suffer from a worn audio/control head however. The symptoms are poor sound and/or intermittent muting of the video signal with own recordings. In my experience the SLC6 range doesn't seem to suffer from this problem.

Incidentally worn out or chewed up Beta cassettes can be refilled with new VHS tape. Fit the empty Beta spools temporarily inside a VHS cassette in order to wind the tape. Use the correct splicing tape to join the tape to the stop foils at either end. It's not worth doing this if new Beta tapes are still available in your area. But I never discard old cassettes for this reason.

Martin McCluskey,
Billingham, Cleveland.

SMOKING SETS

I read with some amusement John Hopkins' account (March) of a customer phoning to say that his set had just caught fire. At least his customer had switched the set off before calling. It reminded me of a time about fifteen years ago when I was working late at the small workshop where I was employed and the phone rang. It was rare for us to work late and our customers knew this, so I answered the

phone out of interest to see who it could be. The voice of an elderly lady came on and said "I'm so glad there is someone in as my TV is on fire. Could you please send an engineer?". This lady rented a Bush TV315 from us and lived about four miles away. I asked her if she'd switched off and she replied that she was afraid of getting a shock. Not as big a shock as having your house catch fire I thought. Thinking fast, I persuaded her to call in a neighbour who disconnected the set from the wall socket and poured plenty of water into it. When we examined the set we found that it wasn't on the point of combustion. All that had happened was that a shorted PL504 line output valve had seen off its screen grid feed resistor.
Joe Cieszynski,
New Moston, Manchester.

MANUFACTURERS' SERVICE POLICIES

With reference to Mr. Goldring's letter on Grundig policy (March), I feel he has lost sight of the fact that it's the customer who has made the important commitment in purchasing a particular brand of equipment and that it's the customers as a whole who keep the manufacturer in business. Every product sold has profited the manufacturer. Mr. Goldring's purpose should be to provide damage limitation to the reputation of the brand, which may have already suffered because a repair is required. Making information on faults, whether obscure or stock, inaccessible does nothing to pacify the customer.

Television's offer to help manufacturers by disseminating official fault information would seem to overcome an understandable reluctance to overburden their technical support facilities whilst still satisfying the overall objective that the public receives speedy, low-cost repairs to defective products, limiting the damage to manufacturers' reputations/standing.
John Whitehouse,
Park Hall, Walsall.

INTERFACING PROBLEM

Some editorial changes to my letter on a Scart interfacing problem (March issue) made the situation difficult to follow. The third paragraph was altered from the past to the present tense, making it incompatible with the final (current) situation described at the end of paragraph four. Paragraph three was written in the past tense originally because the Nicam decoder change, which restored the TV and VCR sound to the same levels (except when playing prerecorded tapes), followed the change described in paragraph three.
Keith Cummins,
Holbury, Hants.

DECIBELS

The old problem of dBs has come up in Keith Cummins' letter (March issue) – I refer to confusion between voltage and power levels and the related impedances. Decibels are used to express power ratios, whether electrical, acoustic, optical, electromagnetic or even (though I can't think of any examples) mechanical in nature. Voltage ratios cannot be expressed in dBs unless another value, the impedance of the load, is known.

Keith states that "0dBm is the r.m.s. signal that causes 1mW to be dissipated in a terminating load of 600Ω, i.e. 775mV". This is not really true: 0dBm is the level (a.c. or d.c., though normally used for a.c.) that is equal to 1mW, which in a load of 600Ω is equivalent to 775mV r.m.s. The same level, 0dBm, would give 4·472mV into a 50Ω load. It's not possible to express voltage levels in dBm, or even dBV, dBμV etc., unless the system impedance is known and thus the power can be calculated.

In the case of Keith's VCR, the quoted output level of −3·8dBm should probably have been quoted as 500mV, which it clearly is. I suspect that the "specification" was written by someone who, wanting to make the rather uninteresting data look more exciting by adding a few more sophisticated technical terms, fell headlong into the same trap. "How can I make 500mV look better? I know, call it dBm. Now 0dBm is 775mV, and to get dBs you just do 20*log 10 (V/0·775V) and, presto, −3·8dBm." This may of course be true if the source impedance is known (or very low, and hence the voltage is unaffected by the load impedance) and the load impedance is also known. In the case of the TV set the load impedance is not known. Even if the scart specification defines it I doubt whether many manufacturers, no doubt for cost reasons, stick to the required impedance. Also, for reasons of short-circuit protection, I doubt whether the VCR's output impedance is very low. Thus −3·8dBm cannot mean anything useful. So we must work with the voltage level, assumed to be 500mV, and also assume that the TV set's input impedance is high in relation to the VCR's output impedance. Thus Keith has added a straightforward potential divider (voltage division by two) and not a −6dB attenuator, which would give division by some value greater than two when the input and output impedances are taken into account. By now it should be clear that Keith had really attempted to make a "6dB attenuator", as the minus sign would have implied amplification, but perhaps this is labouring the point somewhat.

All this may be unnecessary however as from what Keith describes the tape with which he noticed the problem seems to have been faulty – unless other prerecorded tapes showed the same symptoms, in which case the VCR's record level had been incorrectly set low and the playback level increased to compensate. Unlikely perhaps, but not impossible. I recently bought a Hitachi VCR to go with an older Hitachi TV set (Model CPT2176, fitted with the G6P chassis – it suffered from a short-circuit line output transistor after about three years...). The first machine had very poor still and long-play performance. It went back the next day, though most consumers would probably have thought it behaved as it was meant to do. The second machine obtained works fine but shows distinct signs of incorrect head switch timing. This VCR has a scart connector but the TV set, dating back to the Stone Age of 1986, has a 7-pin DIN connector for the video input (it may not be standard DIN). One day I'll get round to wiring it up. In the meantime I'll use the r.f. connection which gives fine, though of course mono, sound and picture.
C.J. Boyce, B.Sc.,
Godshill, Isle of Wight.

TUBE CHANGES

It's always a pleasure to read George Wilding, whether for information or nostalgia. I would like to add a note to his article (February) in which he mentions the difficulty with substituting round Mullard tubes for Mazda types. In our area (Staffordshire) in the mid-Fifties sets employing the Plessey five-channel chassis with 9 and 12in. Mazda tubes abounded. Although the 9in. sets were usually binned on tube failure, a number of 12in. models, such as the Regentone Big 12 and Marconiphone VT75A, came in for

attention because of faded pictures – often when a Band 3 converter was being fitted. It was the boss's standard policy with these sets to replace any failed Mazda CMR121A or B tube with the Mullard MW31-74, which he felt gave a better picture. As the youngster in the workshop, it was my lot to do the swaps.

I recall no serious problems. We managed to fit the scan coils, changed the base to a B12A type and transferred the tube's heater supply to a 6·3V tapping on the mains transformer. Set up the picture, tweak the ion trap magnet and you were soon in the van. Perhaps the Plessey coils had a looser fit, or perhaps the cool running of these sets was a help as the plastic material in scan coils does shrink with heat and age - I've come across the odd Philips and Stella set where the scan coils couldn't be moved at all.

The only real drawback with this chassis was the lack of a boost h.t. rail for the tube's first anode, but taking the supply from the h.t. rail itself produced a picture that was at least equal to that provided by the CRM tubes, probably better. We experimented with tapping pulses from the anode of the EL38 line output valve and stick rectifiers, but the improvement wasn't worth the effort. On one occasion an old hand mounted a 6U4 efficiency diode on the chassis and modified the circuit to give a genuine boost h.t. supply. I can't imagine the servicemen of today having the time to experiment like this!

Alistair Jones,
Shrewsbury, Shropshire.

1590 Chassis Power Supply Rebuild

J. LeJeune

A relative recently handed me an Ultra 6816 12in. monochrome portable with low width and wavering edges to the picture. These are the classic symptoms of regulator circuit failure and a voltmeter check quickly confirmed that regulator's output was at 8·5V instead of 11·6V.

The set is fitted with the Thorn 1590 series chassis, which was produced in large quantities in the early Seventies. There were two different versions of the series regulator circuit, one with a germanium power transistor in position VT21 and the other, later version with a silicon power transistor. Whichever is used, replacement transistors are becoming hard to obtain. The set is also designed to operate with a nominally 12V battery, and the regulator has to take this into account. It means that the dissipation in the regulator circuit is fairly high on mains operation. One consequence of this is that after a long, long time failures occur. Fig. 1 shows the original version of the circuit.

Two types of failure can be diagnosed immediately from the regulator's output voltage, which is labelled HT1 in the official circuit diagram. If the voltage has fallen to about 8·5V you will find that R99 (10Ω, 5W), which is connected in parallel with VT21 to provide a start-up feed and share the dissipation, is running very hot while VT21 is switched off. The usual reason for this is that R100 has gone open-circuit. If on the other hand the circuit's output voltage is high, at over 15V, then VT21 is defective or the error sensing/driver transistor VT22 is for one reason or another switched off.

Apart from the regulator fault the set before me on the bench seemed to be in good condition. It seemed a shame to scrap it, but I didn't want to spend too long sorting it out. I decided that the best solution was to rebuild and slightly redesign the regulator, and ended up with a circuit that works beautifully and doesn't get too hot. The original circuit didn't have a lot of gain, which reduced the tightness of the regulation somewhat. So extra gain and tighter regulation became design requirements.

Modifications

The modified circuit is shown in Fig. 2. To carry out the modification, proceed as follows. Remove the following components from the original circuit: R99, R100, R101, R102, R106, C83, C86, W17 and VT21. If VT22 is o.k., leave it in place. Fit a 560Ω, 0·25W resistor in the R100 position and a 470Ω resistor in position R106. Refit the zener diode W17 in the position previously occupied by R102, with its cathode to the emitter of VT22. Fit an 0·1μF, 63V capacitor in the place vacated by C86, to decouple VT22's base. This completes the modifications to the printed circuit part of the regulator.

An extra transistor VT23, type BFY50, is introduced to increase the circuit's current gain. This results in the circuit's series element (VT21/23) taking the form of a Darlington pair. The modified circuit is conventional, using very common devices.

VT23 is wired to a five-way tagstrip: the arrangement is shown in Fig. 3. The strip's centre, mounting tag is secured by one of the screws that holds VT21 to the heatsink. This provides VT23 with a 20V feed. Also mount a 100μF capacitor (use the previously removed C83 if you like) on the tagstrip to provide a slow-start action. The wire from

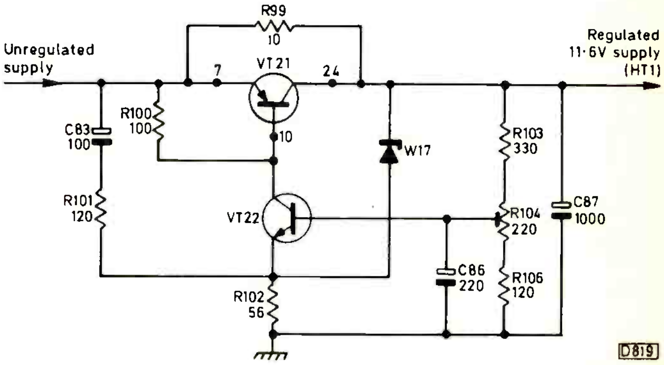


Fig. 1: The original series regulator circuit with germanium power transistor.

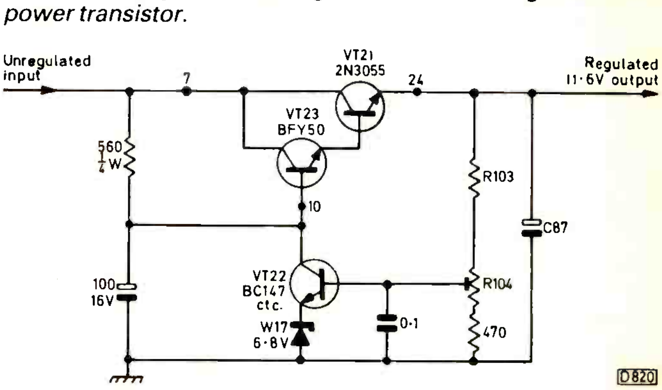


Fig. 2: The modified circuit, with 2N3055 power transistor. Note that the 100μF electrolytic is mounted on the tagstrip though not shown in this way above.

tag 10 on the PCB goes to the base of VT23. The wire from the 11·6V output tag 24 goes to the emitter of VT21, which is now a 2N3055. The wire from tag 7 goes to the collectors of VT21/3 – for convenience to the tagstrip's centre tag.

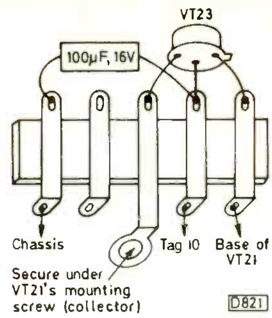
This completes the rebuilding and you are now ready to switch on. Before doing so rotate the slider of the set-voltage control R104 to the R103 end of its track, i.e. fully clockwise. Switch on and bring the output voltage up by turning R104 anticlockwise. If you're not too happy about doing this with the rest of the circuitry connected unsolder the wire (usually purple) to tag 24 and instead connect it to chassis via a 12V, 6W car bulb to act as a test load. When you are satisfied that you have 11·6V, reconnect the lead to the rest of the circuitry. The regulator should set up to provide 11·6V with the slider of R104 reasonably near the centre of its track. The 0·1μF capacitor connected to the base of VT22 is there to prevent h.f. oscillation.

Alternative Circuit

Those who want to try a simpler, non-adjustable version of the supply will find that VT22 and W17 can be removed and a 13V zener diode used in their place, see Fig. 4. This arrangement will give almost exactly the correct output voltage on load, but it's not suitable for battery operation. With the full circuit battery operation will be satisfactory down to 12·5V. Below that the regulation stops and the output voltage falls.

Performance

All the dissipation you get with a series regulator is with this circuit within VT21: the 2N3055 will handle it easily provided there's good thermal conduction between the transistor's case and the heatsink. Use a *thin* smear of thermally conductive grease on each side of a mica insulator or one of the grey plastic mounting pads. With normal care over the construction, the new regulator should provide trouble-free performance for a long period before any attention is required. The extra components can all be found in the average TV repair workshop. With a little common sense, alternative semiconductor devices can if necessary be selected using characteristics tables.



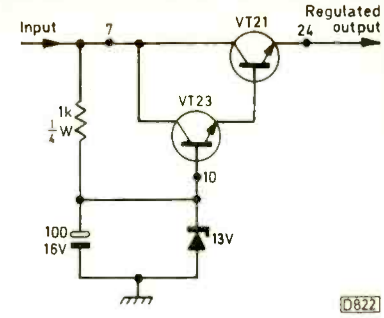


Fig. 3 (left): Method of mounting the extra transistor VT23.

Fig. 4 (right): Alternative, non-adjustable circuit for mains-only operation.

The modified circuit copes with a wide variety of mains input voltages. I found that the set still worked normally with an input of only 190V a.c. If a mains only version is required the simplified fixed regulator works very well, providing regulation with inputs down to 210V a.c. The ability to cater for different mains voltage inputs varies with different transistor gains and component tolerances. The upper limit is around 260V a.c. Above this the regulator becomes very hot!

The circuit will put life back into a very sturdy and reliable monochrome receiver.

HELP WANTED

Can anyone supply 2SC867 and 2SC1316 transistors for a Sony 1340UB portable CTV? Also a PSU for a Dragon 32 computer. M. Staunton, 61 Adderley Gardens, Saltley, Birmingham B8 1LB.

Can anyone supply a circuit diagram for the Panasonic KX-P1180 printer? Will pay costs. 2 Heol Vaughan, Burry Port, Dyfed SA16 0HF.

Can anyone supply at a reasonable cost a service manual for the Telequipment D66 oscilloscope and a c.r.t. for the Philips PM3240 scope, type D14-125GH/08? P. Garrett, 21 Wychbury Road, Finchfield, Wolverhampton WV3 8DN (0902 762 346, evenings).

Can anyone supply an SG629 GCS (Q602) and R608 (820Ω, 2W) for the Sony KV1810UB CTV? Two each required, please state price. Are there any equivalents for the GCS? Can anyone advise on a protection circuit to prevent Q603 and Q510 going short-circuit? V. Jeremy, 7 Tai Penyard, Penyard, Merthyr Tydfil, Mid-Glamorgan CF47 0LP.

Can anyone provide the name and address of a supplier of service manuals for the Osaki and Hinari range of VCRs? – data for only a few models is available from the distributor listed in the 1991 *Television* spares guide. J. Edwards, 49 Fairmead, Bromley, Kent BR1 2JT (081 462 6894).

Has anyone a copy of *Television Servicing 1987-88*, published by U-View, that they would be willing to sell? Express TV, The Mill, Mill Lane, Rugeley, Staffs WS15 2JW (0889 577 600).

Does anyone have a working transformer (T001) for the chopper PSU panel of a Novex colour monitor, Model NC-1414-CL-UK? I understand that this monitor was mainly produced for use with the BBC-B computer. Phil Nichols, 57 Grange Road, West Bromwich, West Midlands B70 8PB (0902 321 991 daytime only).

Wanted, early colour TV sets in any condition for restoration, particularly dual-standard types e.g. Philips G6, ITT CVC1, RRI CVC25 etc., also single-standard sets of special interest, e.g. Philips K70, K80 and ITT CVC2. Richard Gregory, 12 Leonard Close, Manor Top, Sheffield S2 1HH (0742 640 141).

Wanted – old Philips N1500 VCR. Mine has just packed up after twenty years' use but the heads are still in good condition. Steven Morland, 77 Deerland Avenue, Parson Cross, Sheffield S5 7WS.

Wanted – Sanyo VTC5000 VCR with service data or Sony SL8000UB or a Module PU47154 for the 8922 Baird VCR (MultiBroadcast) or any Beta VCR. My thanks to those who helped with the Hartley CT436 scope. Donald Bills, 69 Greenfields Road, Kingswinford DY6 8EG.

Can anyone supply circuits for the Pierre Cardin Ambiance 16 cordless telephone/clock radio, manufactured by Far East United Electronics Ltd., and a Radio Shack telephone – this doesn't appear to have a model number, but the PCB is marked Tandy (c) 1979 1700105C. We also require an idler wheel for a Philips AG1015/95 autochanger or a source for the rubber tyre if it's replaceable. S. Shaw, PO Box 1404, Randfontein, 1760, S. Africa.

Servicing the Philips CD104 CD Player

Mike Leach

The Philips CD104 compact disc player has been around in various guises since the mid-Eighties. Amstrad for example used the basic machine in some midi systems while Mission put it in a smarter looking box. In addition to machines that come into the workshop with specific faults, some can come in because they have been part-exchanged for a more recent model and require certain checks and adjustments to ensure reliable operation before being resold. The purpose of the following notes is to provide guidance on basic servicing and some of the fault conditions likely to be encountered.

Layout

One excellent feature of these machines is the general design and layout. There are various PCBs that are all separate and pluggable. This can help when there's an awkward fault since it's easy to interchange boards with those in a working machine. As I've said on previous occasions, we're all allowed to cheat occasionally. In this connection it's particularly helpful that each board does a specific job, e.g. power supply, decoder, servo, tray control, laser preamplifier etc. In contrast most modern machines have just about everything mounted on a single PCB which has several surface-mounted chips interconnected by very fine print. Thus if you have limited experience of CD players the CD104 is an ideal machine to practice on – provided you gen up on the Philips single-beam laser and tracking system that's used instead of the usual Japanese three-beam laser with sled drive.

Fig. 1 shows a basic block diagram of the CD104. It illustrates the way in which the various functions are split up between the boards. It's worth noting at this point that the focus and radial motors are both incorporated within the laser assembly.

The first thing you see when you remove the top cover is the servo board. It can be hinged up after removal of the two torx ten screws to give easy access to the decoder board beneath. To gain access to the component side of the decoder board and the laser preamplifier board the bottom cover has to be removed. The tray control PCB is mounted alongside the servo board at the top of the machine while the control/display board is on the front panel. Fig. 2 shows the PCB layout.

You can run the machine on its side when fault finding. I don't recommend this however as it's all too easy to press the open/close button by mistake and jam the disc in the carriage mechanism. If it happens to be a Philips test disc you say goodbye to £35 straight away.

Circuitry and Abbreviations

Before delving into particular sections of the machine it's worthwhile familiarising yourself with the terms and abbreviations that Philips use. This helps you to understand what's going on between the various chips, particularly those in the decoder section. These terms may seem to be of little consequence at the moment if you don't have a circuit diagram to hand: if you do have a circuit take a quick look at it and pick out some of the terms listed below.

Basically each chip has a particular function and name. For example the decoder PCB has on it a demodulator (DEMOD) chip, an error-correction (ERCO) chip, an interpolator (concealment, interpolation and muting – CIM) chip, a filter (FIL) chip and two digital-to-analogue converter (DAC) chips. Each chip has to "speak" to others, and in most cases each data line has its own abbreviation. Thus the data line from the demodulator to the error correction chip is called the DADE signal line – it stands for Data from Demodulator to Error correction chip. Some of the main data lines relevant to routine fault finding are listed below. You may find this list of help when you take a look at the circuit diagram for the first time. Since it's difficult to print inversion bars, where relevant we'll precede the abbreviation with a slash (/).

/CLDE = clock from DEMOD to ERCO chip.
/CLEC = clock from ERCO to CIM chip.
CLOX = clock output from the CIM chip (system clock).
DADE = data from the DEMOD to the ERCO chip.
/DEEMPH = de-emphasis.
DLCF = data (left) from the CIM to the FIL chip.
DRCF = data (right) from the CIM to the FIL chip.
FSDE = frame sync from the DEMOD to the ERCO chip.
FSEC = frame sync from the ERCO to the CIM chip.
HF = h.f. input to the DEMOD chip (eye pattern).
HFD = h.f. detector for demodulator.
MCES = motor control from the ERCO to the SERVO chip (turntable motor).
/MUTE = mute signal.
UNEC = unreliable data flag from the ERCO to the CIM chip.

These lines are generally easy to find on the various panels – in most cases you can go to one pin of a particular chip.

The Laser Unit

The laser unit used in these players is pretty reliable. Some years back when I was at Serviscope we had to replace some of them but on the whole not many. In recent times they've proved to be very good, unlike the later type used in the CD150/160 series machines. Tolerances may change with age however, and the laser supply should be checked in every machine that comes into the workshop. It's possibly a good idea to adjust the laser supply only when you are sure that it's wrong or been got at by a broddler. If the machine is not spinning the disc for example or has some other fault, try to explore all other possibilities first or you could end up with two faults instead of one. I usually check the laser supply once the machine is basically working.

The official, accurate way of checking/adjusting the laser supply, laid down in the Philips service manual, is as follows: Insert the Philips test disc no. 5, part no. 4822 397 30096 (the disc without defects). Connect a d.c. voltmeter across R3308 on the servo PCB or between the emitter of transistor 6239 and the earth line. Play track one and adjust R3180 for a voltage reading of 575mV ±75mV.

That's fine if you have a Philips test disc. But many workshops don't. So we need to find a reasonably accurate

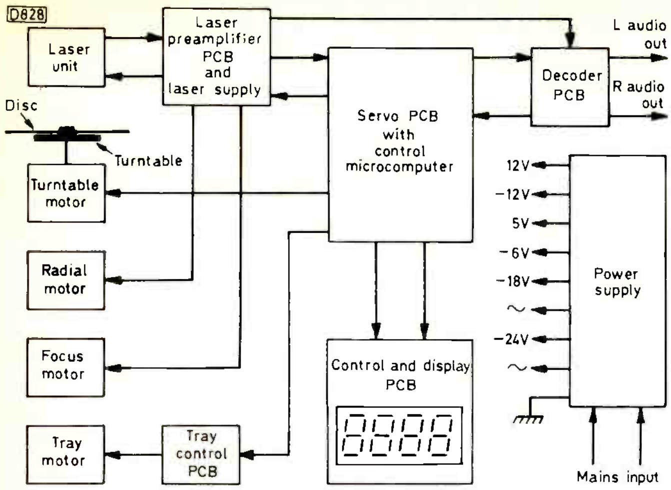


Fig. 1: Basic block diagram of the Philips CD104.

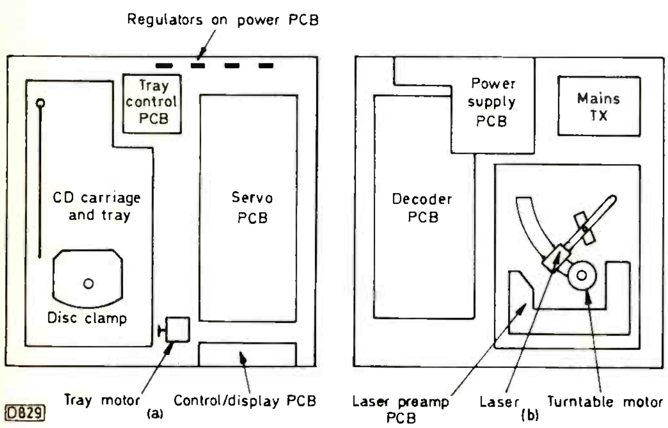


Fig. 2: Top layout (a), bottom layout (b).

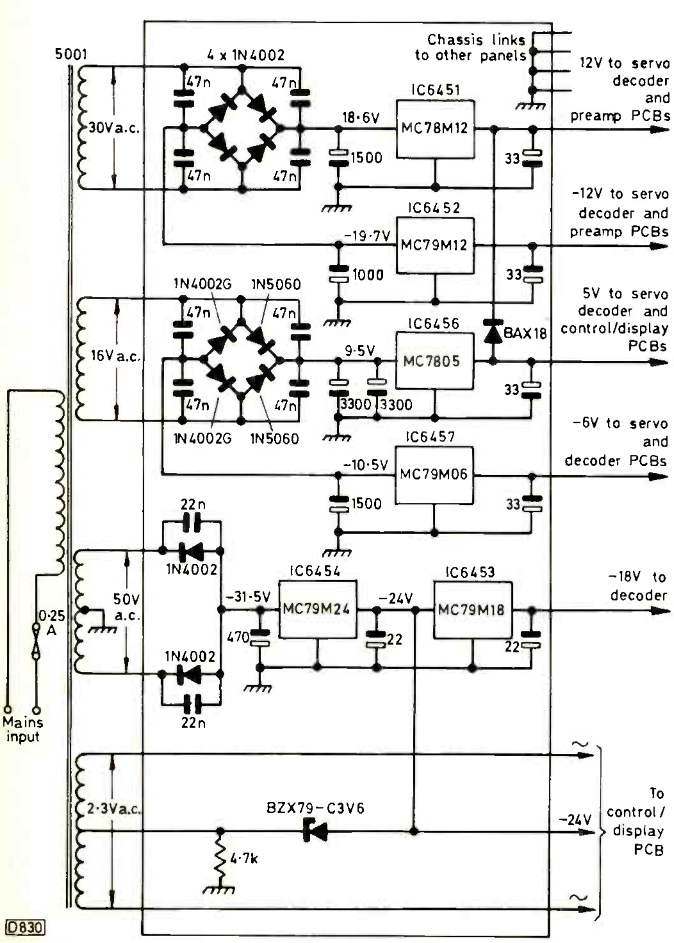


Fig. 3: The power supply circuit.

way of setting the laser supply in the absence of this disc. When a machine has been set up and is in good working order the r.f. eye pattern at pin 7 of the SAA7010 demodulator chip on the decoder board is, with the test disc, at approximately 1·4V peak-to-peak. On most other discs you'll find that this waveform is at approximately 1·2V p-p. So with most domestic discs it's a good idea to set the r.f. waveform to 1·2V p-p. I stress that this is only a rule of thumb, but I've found it to be reasonably accurate.

One thing that can have a significant effect on the laser supply is the cleanliness of the lens. Quite often you can check the supply and find that it's in the region of some 300mV. Clean the lens and you're quite likely to find that it has risen to 400mV. Try this with the next machine that comes into the workshop. So remember, always clean the laser before adjusting its supply.

Power Supply

Fig. 3 shows the power supply circuit used in the CD104. As with most CD players, there are no frills. Basically just straightforward 78 and 79 series regulators and a couple of bridge rectifiers. The power supply does however give rise to a few problems, mainly because of dry-joints rather than component failure. The bridge rectifiers seem to be adequately rated and seldom give trouble. There are no switched supplies, so voltage checks can be made without a disc in the tray. It's best at this point to work with the machine on its side and the bottom cover removed and no disc in the tray. Before you try to locate the cause of a power supply fault note that when the player is switched on and no disc is inserted a normal working machine will show only two dots in the left-hand side of the display window.

The following is a list of some of the power supply faults you could encounter:

(1) Display lights normally (two dots in the window) but the tray moves extremely slowly and when it's fully loaded the disc doesn't spin. Check the MC78M12 12V regulator 6451 which could be faulty or dry-jointed. If the voltage on the 12V line is low check for a fault on the servo panel. The 12V supply feeds the servo, decoder and laser preamplifier panels.

(2) Display lights normally. Very loud hum is present and the disc doesn't spin. Check the −12V line. The MC79M12 regulator 6452 could be defective or dry-jointed.

(3) No functions and no display. Check the 5V regulator 6456 (MC7805).

(4) Display o.k. but no laser light and the disc doesn't spin. Check the −6V regulator 6457 (MC79M06).

(5) Display lit dimly. All functions o.k. but no sound. Possibly a low noise in the background. Check the −24V regulator 6454 (MC79M24).

(6) All functions o.k. but no sound. Check the −18V regulator 6453 (MC79M18). (See also decoder faults.)

If there's a power supply fault you'll usually find yourself with one of the conditions listed above. I've never had to change any of the smoothing capacitors so I can't comment on faults that could be caused by the electrolytics.

The Decoder

Most incorrect sound symptoms are due to a fault on the decoder board. Fig. 4 shows a simple block diagram of the decoder and the basic data lines. The decoder is obviously far more complex than this, but it does show that when the fault is confined to one channel you can start at the SAA7000 CIM chip and follow through to the relevant audio output stage.

The h.f. signal (eye pattern) from the laser preamplifier board enters the SAA7010 demodulator chip at pin 7. This chip performs various functions. It supplies demodulated data and timing signals to the SAA7020 error correction chip and subcode information to the subcode processor chip on the servo panel. The EFM (eight-to-fourteen modulation) decoder is also in the demodulator chip. The data output (DADE signal) is taken from pin 27 from which it goes to pin 5 of the error correction chip.

The SAA7020 error correction chip is responsible for deinterleaving and unscrambling the off-disc data signal. It detects and corrects small data errors. It also generates the MCES (turntable motor control) signal which stabilises the input data rate via the turntable motor servo system, thus eliminating wow and flutter. The UNEC signal that appears at pin 36 is known as the unreliable data flag: this signal warns the CIM chip that unreliable data is on the way.

The SAA7000 CIM chip unscrambles the data and separates it into the left and right channels. By means of interpolation it replaces small errors with good audio data – when it comes to unreliable data it replaces this with good data taken from adjacent information. The interpolation system enables the CIM chip to conceal error bursts of up to 12,304 bits. The left and right channel outputs appear at pins 13 and 15 respectively.

Next comes the SAA7030 digital filter chip. Left and right data enters this chip at pins 20 and 17. The chip contains two identical filters which have a sampling rate that's four times the digital audio sampling frequency, i.e. 44·1kHz times 4 = 176·4kHz. This helps to filter out any unwanted frequencies that don't form part of the original audio signal. The outputs at pins 3 and 10 are fed to the two digital-to-analogue converter chips.

The TDA1540 is a 14-bit mono DAC: it has a 14-bit input shift register with output latches. Input is at pin 1 and output at pin 22. Following the DACs the signals are once again in analogue form. From here they go to the player's audio stages.

Decoder Fault Finding

By now it's common knowledge that the decoder suffers badly from dry-joints. The fault symptoms can be varied, the most common one being no TOC readout. On occasions I've had to repair a machine that has obviously been soldered up before. So a good job is required. It can take some time to do properly.

If the machine powers up and spins the disc but doesn't read the TOC the most likely cause is dry-joints on the earth-through connections on the decoder and servo panels. The most efficient cure is as follows. Note the small solder blobs on the decoder and remove the solder from both sides of the panel until a small hole can be seen through the board. Insert a thin piece of tinned copper wire through the hole. Solder well on both sides of the panel. If the solder bubbles up, it's likely that not all the original solder was removed. Although this is time consuming I've found that this is the most effective method of repairing these earth-through connections. The same job must be done on the servo board.

It's good policy to carry out this soldering even when the machine works all right – it's a good base from which to start. These drys can cause many fault symptoms. If you still have say a no TOC fault after soldering up you can forget about drys and get down to the nitty gritty as it were.

I've had to replace the SAA7010 demodulator chip on a couple of occasions. In each case the disc spun very fast and of course couldn't read the TOC. A quick scope check on the eye pattern at pin 7 of the chip can tell you quite a lot. For instance is the waveform clean? Is it approximately 1·2-1·4V peak-to-peak? If the waveform appears to expand and contract, the turntable servo could be at fault. Fig. 5 shows the turntable spindle waveform at pin 4 of the error correction chip. You may find that this waveform contracts slightly with each revolution of the disc. Two transistors, 6233 (BC635) and 6234 (BC636), on the servo board drive the turntable motor. They rarely fail. It's always worth a solder up here as part of routine servicing. More on the turntable servo when we get to the servo board – and more on TOC problems.

The cause of a one channel dead fault is usually on the decoder board. The first check to make ought to be on the reed switches in the audio output stages. The TDA1540 DAC chips rarely fail, but always check the −18V supply to these chips at pin 11. If the −18V regulator chip IC6453 on the power supply panel fails the supply can go high or low. I've had this supply rise to about −23V and affect one channel only, making the relevant DAC suspect. Thus if one channel is missing or distorted, always check this supply.

The one channel missing fault can also be caused by the CIM and filter chips. Follow through the data lines with a scope as described earlier (Fig. 4). I've had both these chips fail and can't say which is the more common fault.

The surface-mounted resistors and capacitors on the decoder panel don't seem to give any trouble. Failure of any of these is unlikely though there's always a first time.

I've never known the SAA7020 error corrector chip or the associated RAM chip IC6512 fail and would put them at the bottom of the list of suspects in the event of an unusual fault.

If the player appears to work only when pressure is applied to the decoder or servo board and all relevant dry-joints have been resoldered there's a good chance that the cause of the problem may be to do with the crimped leads at the edge of the relevant board. The boards themselves rarely suffer from cracked print but the various plugs can be suspect. Be careful of these.

The Servo Board

One of the most common faults is no TOC readout. Rarely do CD104s skip and jump like most modern players. A fault on the servo panel can also be responsible for the no TOC symptom. All three servos – turntable, focus and radial – are on the board, under the control of a microcomputer chip. This chip, IC6201, can vary from player to player though you will usually find that it's an MAB8440-D041 (or -D061). Some players were fitted with the -D034 version which gives the no sound symptom in service mode B – more on this later. Fig. 6 shows a simple block diagram of the servo systems on the board.

Service Modes

A fault in any of the three servos will give the no TOC symptom. Use of the service mode enables the servo systems and the display PCB to be checked. Service loop A provides a check on the focus and turntable servos plus the display section of the machine. Service mode B switches on

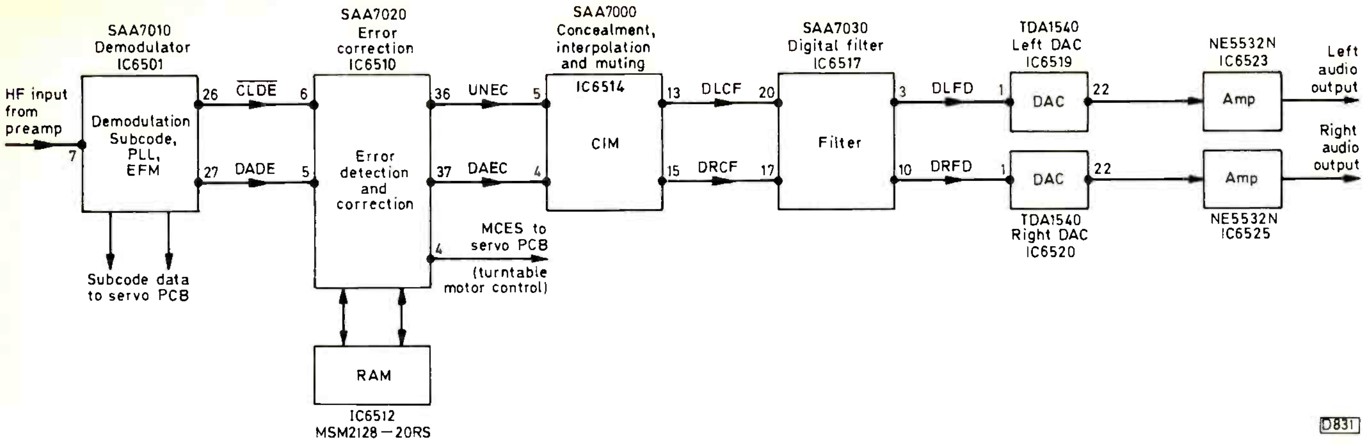


Fig. 4: Block diagram of the decoder section, showing the signal paths from chip to chip.

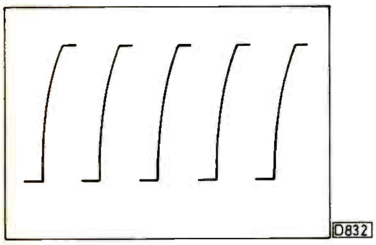


Fig. 5: Turntable motor spindle waveform (MCES). Scope settings 50μsec, 0·1V per graticule division.

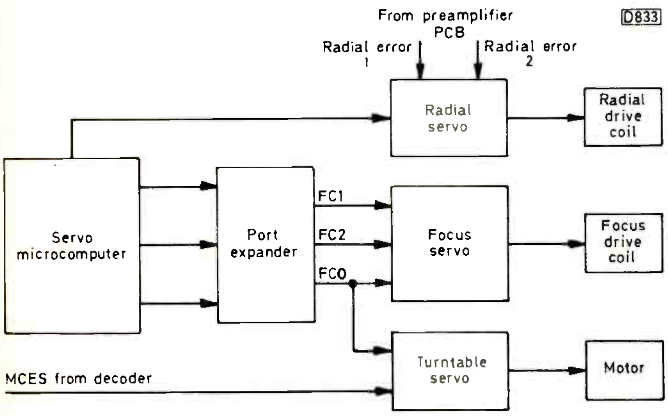


Fig. 6: Simplified block diagram of the servo panel.

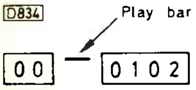


Fig. 7: The display in service loop A: the play bar can be seen between the two sections of the display.

the radial servo: if the player is left in this condition for a minute or so music can be heard. Although not essential, it's a good idea to scope pin 7 of the SAA7010 demodulator chip on the decoder board when you try the service mode. You can then look at the eye pattern and see the waveform differences at each level of the service mode: as the servo systems are turned on in the service mode the eye pattern changes.

For service loop A, proceed as follows. Place a disc in the machine: tray closed, mains off. Press stop, next and pause simultaneously and switch on the mains supply. You should see the eye pattern start to appear, but blurred. At this stage the laser and focus control are working and the turntable should be rotating. The laser will stay permanently under the lead-in section of the track. Numbers should be visible in the display: they will start at 00 – 0102 and increase, shifting to the left.

Now press the search reverse key for approximately one second. The error, repeat and pause LEDs will light. The play bar in the display (see Fig. 7) will light. The radial servo is switched off. If search reverse is pressed again the player will revert to the previous mode.

To use service loop B, first obtain service loop A. Then press search forward for approximately one second. The pause and error LEDs light and the play bar will go out but the repeat LED will stay on, indicating that service loop B has been found. The r.f. eye pattern will have become clearer. The radial servo has now been switched on, irrespective of the subcode and P bit. Music will be heard after about a minute. This may vary depending on the length of the run-in section of the track. As the music is played a normal r.f. eye pattern will be seen.

That's it. Quite an easy service mode really. If play is pressed while music is playing in service loop B the player will leave the service mode and revert to normal operation. Two bars will appear in the display's left-hand window. If play is pressed again the machine will play normally.

Note that if the servo microcomputer chip is type MAB8440-D034 music will not be heard in service loop B. To obtain music, the mute line to pin 39 of the ERCO chip must be interrupted and linked to the +2 supply line (5V). Most of the players I've come across have type -D041 or -D061 micros however: both allow music to be heard in the service mode.

This is all very well with a working player. But what we're interested in is a player that doesn't work and for one reason or another the service loops can't be found. What to do?

In the service manual several pages of arduous test procedures are set out to determine which section of the player may be faulty when a service mode can't be reached. We've neither the time nor the space to cover all this, so we'll keep to first-line servicing and possible causes of problems, based on my own experience.

Let's assume that the player won't read the TOC and that the decoder and servo panels have been checked for dry-joints and the supplies are in order. We'll also assume that the machine won't initiate service loop A and worked all right prior to the onset of the fault condition, also that nobody has tampered with the player. Four questions need to be asked:

(1) Is the laser producing light?

(2) Is the laser producing enough light?

(3) Does the laser focus?

(4) Does the turntable rotate?

If the answer to any of these questions is no, the player won't initiate service loop A.

If there's no light, check the laser supply. If this is o.k., it's very likely that the laser is faulty. If light is emitted, check with the laser power meter. I've found that good working players give a reading in the region of 0·1mW. If the reading is significantly lower than this, again suspect the laser – but try cleaning it first!

If the objective lens doesn't move up and down, check the focus drive waveform at pin 2 of plug 23 on the servo board and press play. The d.c. level should rise and fall three or four times. If this is o.k., check the connections on the h.f. preamplifier panel underneath the deck. Also check the flexi PCB connections to the laser assembly. If all is o.k. here, suspect a faulty laser assembly.

If the drive waveform isn't present at pin 2 of plug 23, check the waveform at pin 1 of the MC1458 chip IC6208. Presence of the waveform at this point suggests a fault in the region of the focus drive transistors 6231/2, types BD135 and BD136 respectively. If there's no waveform at pin 1 of IC6208, check the supplies at pins 4 and 8. If these are o.k., check the FC1 and FC2 waveforms at pins 13 and 12 of the HEF4094B chip IC6202. Also check the FCO (focus control on) waveform at pin 14 of IC6202. Absence of this waveform will affect the focusing – the objective lens will rise only very slightly. The absence of this waveform will also stop the turntable rotating, which is part of service loop A. The FCO line should be at 5V in the stop mode and 0V in play or TOC. If there are no waveforms at pins 12, 13 and 14, suspect IC6202 or possibly the servo microcomputer chip IC6201.

Turntable Servo

Turntable servo faults are rare. If a turntable servo fault is present the cause is likely to be in the driver stage or the motor. The motor can seize up – I've had this one on several occasions. Fortunately it's easy to strip the motor down to service it. To do the job properly you'll need to remove the loading carriage to gain access to the turntable.

To remove the bottom half of the motor, just take out the torx 10 screws that hold the bottom bearing in place. The centre screw is for adjusting the turntable height: provided the locking paint on this screw has not been broken adjustment shouldn't be necessary. A small drop of oil on the long motor spindle and a small blob of grease on the bottom bearing should put a seized or noisy motor to rights. I always go through this procedure when skipping and jumping is the problem with a CD104, especially when the motor has become noisy, although again this is fairly rare.

If after servicing the motor you find that the turntable is still unstable or jumping and skipping are experienced, check the r.f. eye pattern to see if it's stable. The most likely cause of skipping is when the waveform is contracting to the right-hand side – you may find that the condition gets worse as the laser moves across the disc. If the waveform is stable the turntable servo is likely to be o.k. When the waveform is contracting, check by substitution the two 2V zener diodes D6261/2 in the turntable drive stage: also check C2220 (33μF) by substitution. You get very few faults in the turntable motor drive circuit which is generally speaking very reliable. If the waveform still contracts, replace the turntable motor.

Radial Servo

Fortunately the radial servo is also free of common faults: it's a very complicated circuit, and fault finding is difficult. Arriving at the diagnosis that the radial servo is at fault can itself be difficult. The service loop can be of use here. In service loop B the radial servo is switched on: if no music is heard after one minute the radial servo is likely to be at fault and a service manual will definitely be required. Obviously the radial drive transistors T6240/1 are suspects.

If a radial servo fault is present there's a good chance that the TCA240 chip IC6216 is defective. It's readily accessible, but a word of warning is required here – make sure that you obtain the correct chip. Recognising the number, I once dived into a scrap Philips VR2020 VCR which has a TCA240V on one of its subpanels. Beware of this: the V version is different and doesn't work in the CD104. When dealing with sticky faults in the servo system it's also worth trying a replacement servo microcomputer chip (IC6201) if you have one to hand.

The Mechanics

The CD104 has a very robust metal carriage which, unlike modern players, doesn't fall to bits or go out of sync. The tray in/out switches often need cleaning as part of a routine service, and of course the loading belt. The only item that's likely to break is the tray itself. I once had to replace a tray due to a customer's heavy-handed approach to fault finding! This item is easy to fit but not so easy to obtain – CPC eventually managed to get one for me. Presumably all mechanical and electrical parts should be readily available to those with a direct Philips Service account. Some useful part numbers are listed later on.

The disc clamp can also cause niggly problems. I've known one or two to be noisy, and in extreme cases the clamp can produce a skipping effect.

That's about it with the mechanics: no real problems here. Really the only time you may have to work on the carriage is when a player has been dropped or abused.

Summary

When all is said and done the CD104 is an extremely reliable, good-quality player. As a secondhand machine it's a far more viable proposition than one of the Japanese types from the same era. A reliable laser, accessible components, robust design and excellent sound quality combine to provide one of the best home CD players of the Eighties. If you've just taken one in as a part-exchange item and find that it doesn't work, hopefully this article will provide a clue and insight into fixing it.

Most of the major spares suppliers either have in stock or can still obtain any parts likely to be required. Here are some useful part numbers:

Tray	4822 444 40113
Disc clamp	4822 526 10261
Loading belt	4822 358 30335
SK2 in switch (tray in)	4822 276 10863
SK3 out switch (tray out)	4822 276 11277
Turntable motor	4822 361 20484
Play button (CD104/30)	4822 410 23971
Tray front	4822 443 40148
Reed relays (decoder)	4822 280 20115
TCA240 chip	4822 209 80629

Model CD304

Finally note that the Philips CD304 is in many ways similar to the CD104 but has remote control and other features. Many of the panels are not interchangeable with those in the CD104. The control and display board is completely different.

What a Life!

Donald Bullock

"Now that we've got a nice new carpet, what about mending our television?" complained Greeneyes the other day. "Not only is it the oldest set in the city, it's been intermittent for over six months."

It's a Philips G11 and the trouble of course is dry-joints on the line panel. The screen keeps going dark and the picture twists into an hour-glass shape: now and again you get line collapse. I really must find time to mend it before she calls in Snoddies.

Walter's Philips GR1-AX

One customer of mine, Walter Wingnut, is a wizened little chap with protruding ears. He called in the other day with his Philips colour portable. It's a 14GR1221/05B, which uses the GR1-AX chassis. Walter had bought it for a song from someone who'd won it, and he wasn't too sure about the guarantee situation. The trouble was that it displayed a bright red screen from switch on. It was the first GR1-AX I'd encountered and I didn't have a manual. I did however notice that it had a TDA3565 colour decoder chip. So I ordered a manual and a TDA3565 from Manchester. The spares arrived that afternoon – delivered by the firm's director. "I just happened to be passing" he said. Then Wingnut phoned to find out how I was doing.

"The spare part has just arrived" I said, "it'll be ready shortly."

A Brace of Bush 2020Ts

Just then a customer I'm always glad to see called in. Old Miss Catchem. She's portly, tweed-clad, full of life and as bright-eyed as a sparrow. Travels around in an old shooting-brake packed with guns, fishing rods, gaffs and waders. As down-to-earth a lady as they come. She hauled out a couple of Bush 2020T television sets and plonked them on the bench. "Dead as doornails, both of 'em" she said. "Try to fix them fast" she added as she departed.

I took the back off the first one and saw that the fuses were all right. So I busied myself around the power supply, which is of the TDA4601 type. The 4·7Ω, 5W surge limiter resistor R816 looked groggy and when checked produced a reading of about 500kΩ. So I fitted a replacement and switched on. Still dead. My next check was on the BU508A chopper transistor Q801 which was short-circuit. Fitting a new one again made no difference. It was time to look out the circuit and do a little thinking. The high-value, low-wattage resistor connected to pin 4 of the chip is of course notorious in TDA4600-type power supplies. In this circuit its value should be 270kΩ. I made a bee-line for it and found that it had increased in value to almost a megohm. A replacement brought the set back to life and after refitting the back I settled down to the other one.

This one had a heavy short – at switch-on the relay clicked for five or six seconds. I went straight to the line output stage and checked the output transistor and just about every semiconductor device I could find, using the component tester built into my Hameg scope. But I failed to find anything amiss here. Eventually I resorted to the ruse of running the set until the relay stopped clicking, then repeatedly switching off, waiting a second or two and switching on again, thus achieving some degree of continuous operation. After a few cycles of this I felt the line output transformer. It was hot. Fortunately I had one in stock. Fitting it restored normal operation. I put both sets near the door in anticipation of Miss Catchem's return visit. Then the phone rang.

Smoke

"D'you sell reconditioned sets?" a raucous voice asked. "My old mum's set billowed smoke and frightened her to death. It's finished I think."

"I'd best take a look" I replied, "sometimes there's smoke without fire."

The set was brought in shortly afterwards. I took the back off and peered inside. It was one of the earlier Matsuis, a 1460. The trouble centred around choke L403 in the line output stage. What had started off as dry-joints had progressed to carbonised holes in the PCB. I took out the choke, cleaned off and tinned the contacts, cut away the carbonised parts of the panel and cleaned away the soot. Then I made good the printed wiring with sturdy jumpers and refitted the choke. The result was a perfectly good picture.

"You're magic" the raucous one said when she came to collect it. "Have an extra fiver on me."

The G11 Sorted Out

Just then Greeneyes looked in. "That set of ours has really given up the ghost this time. Do I lift the phone or are you going to mend it?"

So I carted it back to the workshop and spent ages mopping up the dried out solder on the line panel, scraping and retinning the wirewound resistor leads and generally resoldering it back into good shape. This cured the intermittencies and I thought that for good measure I'd set it up nicely. I soon noticed that a half inch strip of the raster pulled to the left and was slowly travelling downwards, kinking the picture as it went. I spent ages checking through the power supply panel, even to the extent of removing the diodes, including the zeners, for testing, but couldn't find anything wrong.

After a while I recalled that I'd had this fault before. Time to refer to the card index I keep on obscure faults. Sure enough there was a reference to it. The cause was listed as the 27V zener diode D4021 in the active smoothing circuit. But I'd tested the power supply diodes, including this one.

I decided to investigate. After removing D4021 I fitted a replacement. This cured the fault. Then I compared the meter readings with the original diode and the new one. Identical. Scope traces using the component tester were then compared. The new zener diode produced a perfect right angle while the faulty one produced a right angle with a very slightly upturned tail at one end.

TDA3562A Chips

While I was reflecting on the vagaries of our trade Alan Humphries of Fast Fix phoned. He's the compiler of the card index system of collated *Television* magazine faults and their remedies.

"Just had a game with a Matsui 1580 colour portable" he said. "Vision was intermittent at switch on. Changing the TDA3562A colour decoder chip made no difference except that when there was a picture it now had a green cast. I spent many frustrating hours before I discovered that the cause of the fault was indeed to do with the TDA3562A chip. The one I'd taken out bore the legend TFK (Telefunken) whilst the replacement I'd used was of Philips manufacture. There's a difference, and this set wouldn't work properly until I'd fitted a Telefunken replacement."

"I'll pass the tip on in *Television*" I said. "Do get it into future editions of your *Index*: could save hours of soul-destroying searching for some poor soul like me."

I refer to Alan's excellent *Index* almost daily, as I do the *ECS book Index* compiled and produced by Mike Lyons. And dealer Dave of Criccieth TV, Gwynedd, North Wales has sent me an advance copy of a five-year *Television* index he's compiling.

The nature of my business means that I have to try to service just about every make of VCR and TV set under both the Eastern and Western suns (except for Philips VCRs). It's obviously not possible to have a thorough knowledge of them all, nor to have every manual. These indexes not only save me time but often enable me to repair sets that would otherwise prove too daunting. I'm working on an article that describes their usefulness in my workshop of late.

A Tube Dodge

Time to return to Walter's GR1-AX. I fitted the replacement TDA3565 chip and switched on. The screen came up as red as ever. So I worked on from the TDA3565 towards the tube. The red output transistor's collector voltage was of course low – about 12V instead of 115V. When I swapped over the red and green output drives to the tube the voltage drop was also transferred, which pointed to a short inside the tube. I switched off and checked the resistance between pin 7 (red cathode) and pin 6 (the grid). It was only a few ohms. The tube was useless – or was it?

I recalled a little dodge we used to get up to with monochrome tubes. As there was nothing to lose I took off the tube base, wired pin 6 of the tube to the negative side of the set's h.t. reservoir capacitor C2606 (output from the mains bridge rectifier) and pin 7 to a spare meter probe. Then I switched the set on and dabbed the probe on to the positive side of C2606. Just once. There was an odd noise in the tube's neck. I dismantled my wiring, reconnected the tube base and switched on. Up came one of the nicest, and most welcome, pictures I'd seen.

I phoned Wingnut and told him what had happened. "It's all right now" I said, "come and get it."

Nannie's Rank Z718

There was one further call that afternoon. Nannie Finch squeezed through the door carrying a Murphy MC6301 colour set – the Rank Z718C chassis.

"Wherever did you find that, Nannie?" I asked, "thought I'd long since seen the last of them."

"It's the sound" she said, "quiet, distorted and peaky. A loose wire I 'spex."

I took the back off and gave the audio output stage a tap or two. This brought me to the BD166 transistor 3VT15, which is actually a constant-current source in this rather unusual circuit. I resoldered its legs and up came the sound. Time to bid Nannie goodbye and shut shop.

Teletopics

Satellite TV

At a meeting held at the International Telecommunication Union on March 11th Eutelsat and SES agreed to conduct a joint series of tests to assess potential interference between transmissions from the Eutelsat II-F3 and I-F5 satellites, at 16°E and 21·5°E respectively, and Astra 1B at 19·2°E when 60cm dishes are used for reception. Tests have already been carried out by Eutelsat and a number of TVRO manufacturers in France, Germany, Switzerland and the UK. According to Eutelsat these have established that there is no noticeable interference to Astra 1B reception provided the 60cm dishes are aligned with reasonable accuracy. The narrower beamwidth and higher gain of an 80cm dish gives greater protection against interference and better quality pictures of course.

According to the *Financial Times* satellite TV monitor some 78,000 dishes were installed in February. Apparently exclusive coverage of World Cup cricket by Sky Sports helped to boost sales. On March 9th BSkyB announced that it had made its first operating (excluding interest costs) profit – £100,000 for the week after subscription revenue of £3·8m and advertising/other revenue of £1m. This compares with a loss of £10m a week back in November 1990 when BSB and Sky Television merged. When financing charges are taken into account BSkyB is still making a loss of around £200m a year.

Space and Scientific Ltd., First Base, Beacontree Plaza, Gillette Way, Reading, Berks RG2 0BP (44 734 311 881, fax 44 734 753 051) has introduced a C band Yagi aerial system that's designed to give the same forward gain as a 2·4m dish aerial. The system consists of a dual Yagi aerial, LNB and indoor receiver. A phasing harness is available for four arrays if required. Advantages are ease of installation, small size and reduced wind loading.

CD-I Launch

The UK launch of the Compact Disc Interactive (CD-I) system is to be at the end of the month (April). Philips has announced that there will be a "rolling programme", with the first CD-I players available in London and the South East. These early machines are expected to retail at between £500 and £600 and will not have full-motion video (FMV) capability. In mid-March, however, Philips for the first time demonstrated full-screen, full-motion video at a multimedia conference in San Francisco. The 12cm disc also had stereo sound and a dedicated chip set was used for the decoding. Philips will be launching FMV CD-I decks later in the year and there will also be an FMV upgrade cartridge, costing around £175, to slot into the back of early CD-I decks. Forty to fifty CD-I titles are expected to be available at the launch, with prices ranging from £15 to £50. Two to five new titles will be released a month.

Philips plans to market the CD-I players as "super CD" decks that can handle CD-I, audio CD, Photo CD and CD-ROM-XA bridge discs. The UK is to be the first European country in which CD-I is on sale. A September launch is planned for Holland and France, with October scheduled for Germany, Austria and Switzerland while early in 1993 is the expectation for Spain, Italy, Portugal and the Scandinavian countries. Players have also been developed by Pioneer, Matsushita (Panasonic), Sanyo, JVC, Yamaha and Sony.

Philips and Motorola have established a joint venture to produce CD-I chip sets. The price of CD-I is expected to fall significantly over the next few years.

CD News

Kodak has announced that its Photo CD system is to be launched in the UK this summer. A set of prints, negatives and a Photo CD disc will cost the consumer about £17. The system is backed by Boots, Supasnaps, Agfa, Fuji and co-developer Philips. Three decks will be released by Kodak, a basic model at about £300, a model with effects like picture zoom and panning at £350 and a multidisc machine at £400. Toshiba, Philips and Pioneer have announced plans to market Photo CD compatible CD-ROM drives while Kodak and the computer company Apple are co-developing Photo CD software.

JVC has launched a "multi-amusement" player with a built-in CD-ROM drive in Japan, Model RG-M1. The player, called the Wondermega, has been co-developed with games company Sega and allows users to play 16-bit TV games recorded on a CD-ROM, music CDs and compact discs encoded with graphics or MIDI (musical instrument digital interface). It comes with a control pad, a.c. adaptor, signal cable, video cable and CD-ROM software. There are S, composite and r.f. outputs. Price in Japan is around £360: no UK launch details have been announced.

Philips has introduced a professional CD recorder, Model CDD521, that can record all types of compact discs at double speed. Price is around £3,300.

Nimbus has developed a CD-ROM encryption system known as CD-secure: the data is encrypted during the mastering stage and can be read only with a computer that's equipped with special software.

GEC Spares

SEME has been appointed official stockist of spares for GEC television and video equipment. Enquiries should be sent to SEME Ltd., Units 2E and 2F, Saxby Industrial Estate, Melton Mowbray, Leics LE13 1BS (telephone 066 465 392, fax 066 463 976).

Transmission Notes

ZDF, the German broadcaster which is leading the work on PAL Plus, has told the broadcast and telecommunications standards body ETSI that it plans to add a 14:9 aspect ratio option. This would enable compatible TV sets to recognise transmissions using either the 4:3, 14:9 or 16:9 picture format. It's thus possible that all three may come into general use in Europe.

Existing broadcasters in the USA are to be allocated an extra channel each by the FCC, free of any charge, to encourage them to transmit HDTV services. The broadcasters would be required to give up one of the two channels once HDTV has become established, which the FCC predicts will be some time in the next decade.

New DX-TV Converters

Two new DX-TV converters have been introduced by HS Publications, 7 Epping Close, Derby DE3 4HR (0332 381 699). The first is a new version of the popular D100 De Luxe with an automatic band scanning facility to enable the DXer to preview the most productive v.h.f. or u.h.f. channels when an opening is imminent. The new unit has variable and switchable vision i.f. bandwidths for weak signal enhancement plus multi-system sound which is heard via an f.m. radio – an optional a.m. to f.m. adaptor is available for monitoring French TV a.m. sound. The D100 with bandscan costs £99·99 while the a.m.-f.m. adaptor costs £19·95. Both prices include UK postage and packing.

The second is a low-cost, simple-to-use DX-TV tuning system that has been designed as a superior alternative to a v.h.f.-u.h.f converter. Known as the D400 it also has variable vision i.f. bandwidth (6-3MHz approximately) and covers the most productive DXing channels, i.e. NZ1-R4 in Bands 1/2, M4-E12 in Band 3 and E21 to approximately E50 at u.h.f. Operation is from 13-28V d.c. or 220-240V a.c. using the adaptor supplied. Price is £49·95 UK post free.

Technical Information

Infotech, 76 Church Street, Larkhall, Lanarkshire ML9 1HE (0698 884 585) has published a new (third) edition of its *Electronic Data Reference Manual* at £5·95. The book lists models (audio, TV and video) for which data is available from Infotech, with many equivalents. Infotech will send a copy for only £1·50 to anyone who returns an earlier edition.

Video/TV News

Ferguson has now released its 1,250-line, widescreen TV set, Model B86W. Selling at around £3,500, the set has an impressive specification including multistandard (PAL/SECAM/NTSC) capability, a built-in satellite tuner and D2-MAC receiver, a 99-programme tuner, the facility for five external AV programmes, Nicam sound, a five-band graphic equaliser, a two 70W five-speaker audio system with surround sound and a 36in. Black Matrix tube with anti-glare coating. Whatever their standard the incoming signals are converted to 1,250 lines: 4:3 images can be zoomed up to occupy the entire screen width. The handset works with an interactive menu control system to simplify operation. 28 and 32in. models will follow.

Panasonic has launched two new TV sets, Models TX21MIT and TC21MIR, which have the "top dome" sound system – there's a speaker grille directly above the screen. Other features include a built-in calendar and calculator and a mood light function that can be used to illuminate the room in any one of seven colours. The TX21MIT has an S terminal and Fastext decoder. Prices are £399·95 and £349·99 respectively.

Recent Hitachi video releases include the VT-F860 Nicam VCR with hi-fi and theatre sound at £479·99, and the VM-SP1 Video 8 camcorder which has a weatherproof body, ×64 digital zoom and a digital signal processor for improved picture quality at £999·99.

JVC is marketing the Video Plus+ programming system in Japan: the RM-VP1 handset costs around £45. Panasonic has launched a video printer in the UK, Model NV-MP1, at £1,199·95. It's S-VHS compatible and can record images from a camcorder, VCR or TV set. Features include multi-image printing in which the printed page is divided into 4, 9, 16 or 26 frames, strobe printing, digital enlargement and picture-in-picture.

Canon has launched a new still video camera, Model RC560, whose features include multi-image display; in-camera editing to rearrange, erase or edit pictures; and a 28mm wide-angle lens. Price is around £1,800. Another Canon release is a budget camcorder, Model E230, whose features include a ×10 zoom, video light and built-in titler at £599·99.

TV Fault Finding

Reports from Philip Blundell, AMIEIE, Eugene Trundle, Brian Storm, L.V. Cooper, Stephen Leatherbarrow, Steve Cannon, Liz Hopkins, Michael Dranfield and John Edwards

Grundig M63-370 (CUC3600 Chassis)

How's this for an odd symptom? When the set was first switched on in the morning the SECAM light came on and the picture had a broad white vertical bar in the centre of the screen. The power supply was producing the normal 152V output but the BU508A line output transistor was overheating. A scope check on the BU508A's base drive waveform showed that it was being driven at twice the correct frequency. The TDA8140 chip was faulty. **P.B.**

Philips CTX Chassis

Thanks to Michael Dranfield for his tip (October 1991 issue) on coloured patterning with this chassis. The set with which I had the fault was a Pye 42KT2142/05T: it had very severe colour patterning. The faulty coil is shown as 5153 on the circuit diagram but was 5150 in my set. I was able to rob a coil from a scrap KT3 two-chip decoder panel – Toko type 91792. **P.B.**

Philips NC3 Chassis

I've had another of these portables that was stuck in standby because someone had fitted the wrong type of Preh on-off switch. These sets need low-voltage contacts that make when the set is on, not the momentary-make type. The part no. is 4822 276 12503. **P.B.**

Ferguson TX10 Chassis

For low width check whether the width control RV851 has fallen in value. **P.B.**

Hitachi CPT2176 (G6P Chassis)

The problem with this set was intermittent failure to come to life when it was switched on: the power LED was off and there was a gentle squeal from the power supply. The cause of the problem was dry-joints on the line driver transformer. Not on the operational pins but on the lugs that secure the transformer's metal frame to the PCB lands – they are used as an earthing link between two sections of the circuit. We've also encountered this with other makes like Tatung, Finlux and ITT. **E.T.**

Osaki P60G

An obscure set perhaps, but it uses the TDA3562A colour decoder chip whose reliability is not of the best. If you replace it was an ordinary stock TDA3562A, as we did, various problems arise: a delay of thirty seconds in the appearance of the picture; no picture at all; or a blue hue with a generally poor grey scale. To avoid these problems order and fit a "Telefunken specification" chip, type TDA3562A-TFK, which is stocked by the large component wholesalers. **E.T.**

Panasonic TX2472 (Alpha 1 Chassis)

Everything seemed to work perfectly until an attempt was made to change channel or alter the volume, whereupon the set would initially ignore the command then, nine times out of ten, it would obey the command after a few minutes' delay. Attention was first paid to the two micro control chips IC1203 and IC171, but nothing seemed to be amiss here. On an impulse I removed the teletext PCB and linked across pins 4 and 6 of plug E10 to restore picture synchronisation. After this the set behaved faultlessly. The teletext PCB has three more micro chips that work in conjunction with IC1203 and IC171. When we checked around them we found that crystal X3505 was dry-jointed. Resoldering this item solved the problem. **B.S.**

Panasonic Alpha 1 Chassis

Lack of colour at the top of the screen when playing back prerecorded video tapes has been the complaint we've had with several of these sets. The cure is to change C604 from 0·047μF to 0·33μF. **B.S.**

Fisher CFB1410P

The trouble with this set was no colour. We tried fitting a new colour decoder chip but this made no difference. More detailed checks showed that D430 was going leaky, changing the bias on Q430. As a result the phase of the pulses fed to pin 8 of IC201 was inverted. **L.V.C.**

Toshiba C1695

Over the entire length of the tuning potentiometer's range this set would tune in only stations at the bottom end of the band. The cause of the problem was that CA23 on the front panel was dry-jointed. **L.V.C.**

Nikkai TLG99

This colour portable had two faults. It arrived in the workshop dead, but prior to that it had had an intermittent low-gain problem. As it has remote control, standby switching is incorporated. This is done by altering the voltage applied to pin 2 of the STK5412 power supply chip IC104. The switch-on signal comes from the front panel via the three transistors Q116/7/8. D.C. continuity checks showed that the print between the collector of Q117 and R106 was open-circuit. The cause of the low-gain problem was an a.g.c. fault. This was again due to open-circuit print – between pin 4 of the tuner and pin 5 of the TDA4501 chip IC101. The damage had been done by insertion into the board of TP1 (the a.g.c. voltage test point), the print being a little thin here. **S.L.**

Finlandia Nicam CTV

The first of these sets to enter our workshop threatened to empty it due to the ear-splitting whistle/howl that accompanied the blank screen. We soon discovered that there was a short-circuit across the 15V supply. The cause of this was one of the TDA2040 audio output chips, IC2040. When this had been put right we had to fathom out how to operate the set. Why is it that these days I have to spend so much time figuring out which button to press without erasing all previously stored information while simultaneously trying to remember which sequence stored the information in the first place?! Why use all these symbols: what's wrong with words? **S.L.**

Philips 2A Chassis

This set was brought in to have the back-up battery replaced, which is now a very common requirement. After doing this the tuning system behaved erratically. The set would search all right, but all was not well when a station was found. The tuning system stopped its search as it should, but would then alternate on either side of the correct tuning point, drifting in and out of tune continuously. Tuning is carried out by the SAB3037 CITAC chip. Its supplies and the 4MHz clock signal at pin 21 were fine and as the tuning system stopped its search on finding a station we concluded that the channel identification input signal was o.k. On finding a signal the SAB3037 chip is supposed to carry out fine tuning by doing an a.f.c. test. This can be monitored at pin 7. The fault lay here. It seemed that the test was being carried out but the chip ignored the outcome. Fitting a new chip and tuning in restored normal operation. **S.L.**

Decca/Tatung 160 Series Chassis

This colour portable was dead. The h.t. was present and correct but there was no 11·5V supply to the signal circuits. This supply is provided by a very simple regulator consisting of transistor Q501 and a zener diode. Q501 was without base bias because R508 (10kΩ) was open-circuit. **S.L.**

Ferguson TX9 Chassis

This fault is more annoying than anything else, but it may save much cussing and destruction of TDA1170S field timebase chips to make a note of it. If the flyback boost voltage capacitor C208 (100μF) goes open-circuit every TDA1170S fitted will be instantaneously destroyed. **S.L.**

Ferguson TX100 Chassis

A recent case of a dead set was caused by C115 in the power supply being short-circuit. In this condition the outputs from the chopper circuit are at only ten per cent of the normal level.

No sound with a remote control plus teletext set led us to pin 10 of the SAA5012 chip on the remote control panel. The response here to remote commands was normal but was not reaching the audio circuit because D123 was open-circuit. **S.L.**

Cathay CTV3000

The problem with this portable was line drift when warm. We found that the area around the TA7698A chip was very sensitive to heat. The cause of the trouble was C232, which is connected to pin 33. **S.L.**

Philips K35 Chassis

This set bounced on us with an intermittent tripping fault. During its first visit we'd attended to all the dry-joints around the line output transformer and the power supply. The receiver had then been carefully set up and given a soak test for several days before being returned. On its return to us slight EW bowing was noted. A meter check at the emitter of the BD234 EW driver transistor TS490 produced a very low reading (should be 10V). Working back we found that the voltages around TS485 were also wrong. The cause of the problem was TS494, which had a 1kΩ collector-to-emitter leak. Replacement of this transistor enabled us to set up the receiver again and stopped the intermittent tripping. **S.L.**

Hitachi CPT1446

I haven't seen this one since the days before 625 lines came to the UK. When the set was first switched on the picture was perfectly clear, with good colour, but after a short time the colour would disappear from the centre of the screen, leaving a circular hole of monochrome picture that moved around rather like a jellyfish. It transpired that the phosphor was peeling away inside the tube. As it wasn't torn there was no obvious marking on the tube when the set was switched off. **L.H.**

Hitachi CPT1646

This set was dead with number one and the standby LEDs alight in the display. If the programme up or down button was pressed the number changed but the standby LEDs remained lit. It seemed that the microcomputer control chip thought that the set was in standby and on at the same time: very strange! We followed the standby line from the chip. This brought us to the BC548B standby switching transistor Q1455, where the voltages showed that something was definitely amiss. The transistor was open-circuit base-to-emitter. A replacement restored normal operation. **S.C.**

Sony KVD2512 – Nicam

The more things that get crammed into TV sets the more there is to go wrong. Nicam is the latest addition, and we've had a few faults relating to Nicam on sets from various manufacturers. When receiving a Nicam broadcast this set would intermittently revert to mono, analogue sound with the Nicam lights extinguished. Now for the sound to revert to analogue mono the input to the Nicam circuit must be of pretty dire quality, but the picture and the analogue sound seemed to be perfect. A scope check on the input to the Nicam panel was carried out: not much could be seen as it's a 6MHz i.f. signal, but the signal amplitude at the 6MHz trap did seem quite low. A further scope check showed that there was ample output from the i.f. module. The only item in between these points is the Nicam buffer transistor Q181. When a replacement (type JC501 or 2SC2785) was fitted Nicam sound boomed through. **S.C.**

Panasonic TX24A1 (Alpha 2 Chassis)

The problem with this set was that the on-screen display wasn't line locked. If the volume or any other function was adjusted the relevant bar came up on the screen but it was as though the line hold control was misadjusted: the picture in the background was fine however. We were all of the opinion that the cause of the fault was on the teletext panel. Sure enough when text was selected with the handset the decoder had real trouble processing the information. The page header kept corrupting, the selected page would only very rarely update and most of the display was garbage. Curiously if mix was selected the text line hold also went out, with the background picture very much line locked.

We replaced the SAA5231 VIP chip IC3501 and checked the supplies and the 6MHz clock, all to no avail. A check on the video input to the chip showed that this was perfect. I was sure that the cause of the fault was somewhere around this chip, probably something to do with the data slicing or sync separator sections. So the capacitors connected to the relevant pins were replaced. This eventually paid off: the culprit was C3511 (220pF) which is connected to pin 24, the pulse generator pin. Since then we've heard from Panasonic that this is a known fault with Alpha 1 and 2 series receivers. **S.C.**

Sony KV2256 (RX Chassis)

There were six wide bands across the entire screen: the effect from left to right was light grey, black, white, black, white, black. These bands were of approximately equal width. The sound was normal but no picture content was visible. As the electrolytic capacitors give trouble in this chassis we checked all those on the power supply panel. The culprit turned out to be C655 (220μF, 25V) in the 5V supply that feeds the microcomputer chip. **J.E.**

Matsui 1580

This set was dead with fuse F851 shattered. We found that the BU508A chopper transistor Q801 was short-circuit. It's driven by a TDA4601 chip and checks here showed that R808 (270kΩ) which is connected to pin 4 was open-circuit. **J.E.**

Akashi 1450

We'd never heard of this colour portable before and didn't recognise it when the back was removed. The complaint was that the set was dead with the standby indicator on. Fortunately the PCB is well laid out, so it didn't take us long to discover that there was no a.c. feed to the power supply as R801 (1·5Ω, 5W) was open-circuit. There didn't appear to be any shorts so we replaced the resistor and switched on. Thankfully the set now worked all right. **J.E.**

Philips NC3 Chassis

The customer complained that the stations drifted off tune every few seconds. We found that the cause was the 13-position rotary channel selector switch S300. A spray with switch cleaner immediately put matters right and improved the feel of the switch. **J.E.**

Bush 2020

The problem with this set was no colour. Checks showed that normal chroma was present at the input to the TDA3562A colour decoder chip (pin 4) but there was no output at pin 28, which feeds the delay line circuit. A new chip put matters right. Another common cause of no colour with these sets is R251 (18kΩ) going open-circuit. This removes the bias from the chip's colour control pin 5. **J.E.**

Sanyo CBP2145

When this set was switched on from cold it would emit a loud arcing noise with flashing lines across the picture, almost as though the focus spark gap was arcing. The fault would clear after ten minutes or so, making fault finding difficult. To cut a long story short, after using three-quarters of a can of freezer we found that the culprit was C364 (100μF, 16V) which smooths the 12V supply. When we had removed this capacitor we plugged it into the bench digital capacitance meter and then heated and cooled it to see what was happening. The more it was cooled the further its value dropped towards zero. **M.Dr.**

Grundig GSC100 Chassis

The symptoms were e.h.t. but no picture, no sound, no channel LED alight and R607 springing open after a few minutes. The cause of the trouble was the SKE2G l.t. rectifier Di511. If in doubt replace this diode. It works very hard and can become intermittent. **M.Dr.**

Hitachi CPT2656

Every one of these sets that has come in for repair has had exactly the same fault: dead with the supply line voltages very low and a slight chirp from the power supply at switch off. The cause has every time been slight reverse leakage in the BY228 diode D508 in the line output stage. We use a DG3P diode as a replacement. **M.Dr.**

Fidelity ZX2000 Chassis

This set had a horizontal shift fault: the picture had moved over, leaving one third of the screen blank. Adjusting the horizontal shift preset control restored a normal display but it seemed best to look for the cause of the shift. The shift control itself had fallen in value from 220kΩ to only 163kΩ. **M.Dr.**

Nikkai BG001-N

If you get one of these 14in. portables in for repair the chances are that the fault will be in the power supply. We find that the most common fault is a defective mains rectifier thyristor. You may find it short-circuit with a blown fuse, or the power supply may be hunting or drawing excessive current. Under these latter conditions the set may work all right from a soft start when powered via a variac, but the variac will buzz very loudly. Then, on connecting the set directly to the mains, the fuse will blow at switch on. The thyristor (Q811) is type SF8J41 and is marked with the number F8J. No other type seems to be suitable and the correct one from Nikkai costs around £9. You'll sometimes find that in addition to Q811 being faulty both R832 (1Ω, 1W) and R831 (330Ω) are open-circuit. **M.Dr.**

Decca 130 Chassis

This set was stuck on channel one. The cause of the fault was traced to R003 (10kΩ, 1W) being open-circuit – it feeds the 33V supply to the tuning PCB. The cause was given away by the fact that channel one couldn't be tuned in. **M.Dr.**

Murphy CTV3500

The power supply in this 14in. colour portable was tripping. Disconnecting the line output stage made no difference but disconnecting the 12V supply from the chopper transformer stopped the tripping. As no fault could be found here we used a regulated power supply to provide the 12V feed. The result – still tripping! Attention was next turned to the 2SA794 standby switching transistor Q118. When its collector was disconnected the set worked, but Q118 was found to be o.k. We checked back through two other transistors and found that there was no standby power supply voltage. The standby power supply is extremely simple, just a mains transformer that feeds a half-wave rectifier diode with a reservoir capacitor and 15Ω surge limiting resistor (though the service manual gave the value of this resistor as 22Ω). Both the mains transformer and the resistor were open-circuit. After fitting replacements the set worked fine and no reason for the failure could be found. **M.Dr.**

CD Player Casebook

Reports from Mike Leach, Brian Storm and P.J. Roberts

Akai CDM300

This machine looked very Akai from the outside but when it was opened I saw a Philips laser assembly and chips. It didn't use a Philips PCB however: this item was obviously all Akai designed. Anyway, the complaint was that after a short while the sound would deteriorate, slowly becoming very distorted. The customer said that it sounded like white noise. On test the machine worked all right for at least an hour. I was able to instigate the fault by using the trusty hairdryer. It was brought on when a short burst of heat was directed at a TDA1541 DAC chip. Fitting a replacement produced good results even when the player was thoroughly warm. **M.L.**

Dennon DCD960

Skipping and jumping was the reported fault with this fairly new machine. We found that it played all right for the first twenty minutes. When a fresh disc was inserted it read the TOC, played the first minute of the track then started to skip very badly. After that it wouldn't read any other discs. When a disc was inserted all that would happen would be that the disc rotated and the laser would chirp. It would carry on like this indefinitely. I dived in suspecting, too soon, a faulty laser – I tried one from a similar machine without looking to see what was really happening. The fault remained the same of course.

When the fault was present you could see, with the door open, that the laser didn't return to the centre of the disc to read the TOC. After much hassle I discovered that the cause of the trouble was the helical gear that drives the laser assembly. This gear receives its drive from beneath the chassis, protruding through the chassis to drive the laser unit. After removing the gear then cleaning and regreasing it the player worked perfectly. **M.L.**

Technics SLP222A

The disc would spin then the machine would lapse into a sullen state, clunking and doing nothing else. Watching the eye waveform appear and disappear wasn't much help, so a new Philips laser assembly (part no. 4822 691 30209) was fitted. It was completely dead. The next one I fitted read the disc but failed to play past track two on any disc. The third replacement set up and played beautifully. Just as well as the spares storage drawer was now empty! **B.S.**

Technics SLP222AK

Intermittent skipping was the complaint with this unit. Sure enough on test it played all right for a short time then developed a slight hiccup every few minutes. Unusually, the symptom was more in evidence at the start of the disc. In my experience a tendency to skip at the start of a disc is generally an indication of trouble with the turntable motor.

This model uses a Philips radial laser unit (type CDM4) which is quick and easy to change – the motor and the radial pickup are incorporated in one block. When a replacement had been fitted the fault was still present and we found that there was no interruption to the motor drive voltage when the hiccups occurred. So attention was turned to the clamp bearing. We had no further trouble after replacing the small plastic end bearing, part no. 4822 4669 2257. **B.S.**

Akai CDM512

The customer brought in this player and explained that though he had bought it about a year ago he'd never tried to use it until now. Unfortunately it didn't work. On examining the unit we found that everything seemed to be o.k. physically but, as the customer said, it didn't function – it wouldn't even read the TOC. A look at the manual revealed that the player has a test mode. Good! There are some mistakes in the manual however, so I suggest that you follow the test-mode instructions below:

To engage the test mode, start with the player switched off. Short-circuit J304 (marked test), turn on the power, count to three then remove the short-circuit across J304. The display should now show "0 TEST". In this condition the laser and all the servos are off.

Press play/pause to engage test mode one. The display should show "1 TEST". The laser should be lit and all the servos off.

Press play/pause a second time to engage test mode two. The display should show "2 TEST". The laser should be lit, the focus servo should be on and the spindle and tracking motors off.

Press play/pause again for test mode 3. The display should show "3 TEST". The spindle servo should now be operative, with only the tracking servo off.

A fourth press on play/pause should bring up "4 TEST" on the display, with all the servos on and locked and sound available at the audio output sockets.

A further press on play/pause should reset to test mode zero.

I engaged the test mode and ran through the above sequence. This proved that the player could focus on the disc. But in mode three the disc ran away, so it seemed that there was something wrong with the spindle servo operation. I decided to check whether there was any r.f. output (eye pattern) from pin 4 of IC001. When the scope's probe was connected to this point only a very low-amplitude, noisy signal was displayed. From this I deduced that the preamplifier marked HF inside IC001 was faulty – since focus was found the pickup and the two input preamplifiers at pins 5 and 6 of IC001 were o.k. So a new CXA20109 chip was fitted (part no. EI-3961233). The focus, tracking offset and E-F balance adjustments were then carried out. After doing all this the player worked, playing the test disc with no difficulty. **P.J.R.**

Test Report: Tandy Micronta 22-167 DMM

David Botto

Tandy's new Model 22-167 Micronta autoranging digital multimeter incorporates a high-speed sampling bar-graph and has the look of an expensive instrument you'd expect to cost far more. Its tough plastic case is housed in a shock-retardant grey moulded rubbery holster that protects the meter against knocks and general hard use. That it does this well was proved by the fact that the test DMM sent to me had burst from its packaging and had been repacked by the Post Office. Despite this hard treatment the instrument arrived undamaged and in good working order.

The 22-167 weighs 250g including its two 1·5V AA (or equivalent) batteries – 400g with the holster. Without the holster its grey plastic case measures approximately 160 × 75 x 42mm. A slot at the rear of the holster enables the meter to be hung upright for viewing at eye level. There's also a convenient tilt stand that makes the display easy to read when the meter is standing on the bench. The holster also prevents the meter from sliding about in use and makes it less likely that the instrument will slip over the edge of the bench.

Readouts

There's a 3·75-digit readout (3,200 count). This is fast becoming the norm with DMMs and is far better than the older 3·5-digit readout (1,999 count) that was so common. For example, 2·151V measured with a 3·5-digit display reads off as 2·15V. With the Micronta 22-167 you get an accurate 2·151V readout. This additional accuracy is a real boon with modern solid-state equipment.

Each display digit is 0·5in. high and is of a nice black that's easy to view without straining your eyes. The 33-dot, fast-response bar-graph display, which is fine for nulling and peaking measurements, has nicely numbered bold segments that are easy to read. Updating is carried out twelve times a second. The fast bar-graph response makes this DMM first rate for diode and transistor checks.

Ranges

A seven-position rotary switch with a good positive feel selects the ranges. The switch positions are clearly marked in amber lettering for the voltage and resistance ranges and in silver-white lettering for the diode test, audible continuity and current ranges. Table 1 lists the range specification. Except for the power on switch which is red the button selector controls are grey. When you press one of these buttons to select a function the meter emits a cheerful beep, giving positive confirmation that the function has been selected.

The new autoranging Tandy Micronta 22-167 digital multimeter in its matching shock-retardant rubbery holster that provides protection, enables the meter to be hung and includes a tilt stand.

The meter is fully autoranging, with a range-lock button if you want to stay in a single range and a data hold button. Another button switches between diode and audible checks, and between alternating and direct current. In any mode over range is indicated by a large O.L. in the display. There's a full set of annunciators to indicate the mode and range selected. The exception here is with the current ranges, where the decimal point, d.c. positive and negative and a.c. modes are shown but not the range selected.

Power Consumption

Battery power consumption averages only 5mW. So the batteries should give good service, especially when long-life types are used. The automatic power-off circuit operates when no measurements have been made during a period of ten minutes. This power-off feature, now found on many DMMs, is fast becoming essential for the service engineer who works in a busy workshop where telephones and other distractions are facts of life.

A picture of a battery appears when the battery voltage falls, telling you that it's time to fit a replacement. Only one screw has to be removed: the complete back then comes away. This reveals the meter's internal construction. It's neatly laid out and well made.

Meter Protection

Overload and transient protection help to guard the meter on most ranges. The d.c. voltage ranges are protected to a maximum of 1kV d.c. and the a.c. voltage ranges up to 750V a.c. A fast-blow fuse (Tandy catalogue no. 270-1241) rated at 0·5A, 250V provides protection on the current ranges. Tandy say that for continued protection against fire only this special fuse should be used. A spare is supplied, clipped inside the meter. The manual states that care is required with the 1kV d.c., 750V a.c. and 10A a.c./d.c. ranges as exceeding the maximum limits on these ranges can damage the meter and prevent an over-range indication. The resistance ranges are protected against excess voltage – 450V a.c. for one minute.

Safety

The three test sockets are recessed for safety and cannot be touched. Despite this it seems to me that it's possible with this type of socket for an odd piece of wire, solder or a component lead to touch the metal of an unused socket, a point I've made before. It would have been nicer to have had plastic insulated recessed sockets. An excellent safety feature however is that the sockets are all clearly labelled with internationally recognised safety and warning symbols. Following what now seems to be standard practice with modern DMMs, a separate socket is provided for the 10A a.c./d.c. ranges.

The two test prods are fitted with right-angled safety plugs at the socket end and finger guards at the test end. They are rated at 1·2kV. When using this or any other DMM bear in mind that any voltage exceeding 25V is potentially dangerous. The rubber holster provides additional safety when the 22-167 is hand held whilst taking a measurement.

On the Bench

I found the Micronta 22-167 easy and convenient to use. When checking d.c. voltages in the autorange mode the O.L. symbol appears briefly at the moment when the meter changes range automatically. When measuring a 9V d.c. source for example the O.L. symbol appears briefly just before the display indicates 9V. I soon got used to this however and didn't find it distracting.

The autoranging is reasonably fast. Just the same when carrying out measurements on the 30V range – the one most frequently used by TV/video/computer service engineers – I found it best to lock to the 30V range.

The acid test of a DMM is whether the stated accuracy ratings are confirmed. With this in mind I made a number of accuracy checks using precision voltage sources and comparison checks with known accurate precision DMMs. The claimed accuracy of the d.c. readings on the 300mV to 3V ranges is ±0·5 per cent. When a close-tolerance 5V d.c. test source was measured the reading was 5·01V, which I thought was pretty good. Further checks proved the accuracy on all the a.c. and d.c. voltage ranges to be well within the claimed accuracy. See Table 2.

The a.c. ranges are average responding, which means that they respond to the average a.c. value (0·637 times the peak value), though they are scaled to read the r.m.s. value of a sinewave.

I was particularly impressed with the autoranging ohms ranges which read pretty well spot on. These ranges were checked with a number of known accurate precision resistors. It's especially handy for the TV/video/computer engineer to be able to measure resistance values from 0·1Ω to 30MΩ without having to touch the meter's settings. When the ohms ranges are selected the O.L. symbol appears together with the MΩ symbol. The instruction book says that with resistors of over 1MΩ the meter may take a few seconds to stabilise. The meter I tested had a fast response – less than one second – on all the resistance ranges however and I found that I didn't need to use the range-hold facility.

The open-circuit voltage across the test prods on the ohms range is 1·233V. It drops to about 0·4V when connected to a semiconductor junction. I was able to make in-circuit checks on PCBs without encountering any problems. Continuity measurements can be made using the internal piezoelectric buzzer – this is useful when you are trying to locate a break in a printed circuit track.

The data-hold function is handy when you need to carry out measurements in awkward places. With the common test prod clipped to chassis and the meter held in one hand it's easy to freeze the display by pressing the Data-H button. You can then read the measured value at your convenience.

Table 2: Voltage test results.

Voltage source	*Micronta 22-167 reading*
1mV	1·1mV
2mV	2·1mV
2·5mV	2·6mV
10mV	10·06mV
1V	1·001V
3V	3·004V
4V	4·01V
5V	5·01V
6V	6·01V
8V	8·00V
10V	10·02V
12V	12·01V
15V	15·02V
20V	20·23V
24V	24·00V
30V	30·15V
32V	32·20V
2·58V at 1Hz	2·57V
16·76V at 50Hz	16·75V
33V at 50Hz	33·5V

The sample voltage values chosen present the stiffest test to a DMM.

Table 1: Brief electrical specification.

300mV-3V d.c. ranges: ±0·5 per cent of reading and ±0·2 per cent of full scale. ±1 in last digit.

30, 300 and 1,000V d.c. ranges: ±1 per cent of reading and ±0·2 per cent of full scale. ±1 in last digit.

3, 30, 300 and 750V a.c. ranges: ±1·2 per cent of reading and ±0·5 per cent of full scale. ±1 in last digit.

300μA, 30mA d.c.: ±1 per cent of reading and ±0·5 per cent of full scale. ±1 in last digit.

3,000μA, 300mA d.c.: ±1·5 per cent of reading and ±0·2 per cent of full scale. ±1 in last digit.

10A d.c.: ±2 per cent of reading and ±0·2 per cent of full scale. ±1 in last digit.

300, 3,000μA, 30, 300mA a.c.: ±2 per cent of reading and ±0·5 per cent of full scale. ±1 in last digit. Maximum measurement 300mA.

10A a.c.: ±2·5 per cent of reading and ±0·5 per cent of full scale. ±1 in last digit.

300Ω, 3, 30, 300kΩ: ±1 per cent of reading and ±0·2 per cent of full scale. ±1 in last digit.

3MΩ: ±2 per cent of reading and ±0·2 per cent of full scale. ±1 in last digit.

30MΩ: ±3·5 per cent of reading and ±0·5 of full scale. ±1 in last digit.

Range: Full auto or manual range control for voltage measurements; semi-auto or manual range control for current measurements; automatic polarity.

Input impedance: 10MΩ on the a.c./d.c. voltage ranges – over 100MΩ on the 300mV d.c. range.

Operating temperature: 0-50°C.

Conclusion

In conclusion I rather liked the Micronta 22-167 DMM. A fully autoranging digital multimeter with the performance that this one provides must be good value for money at less than £50. The price complete with test prods and an easy to understand operator's manual is £49·95 including VAT – batteries are extra. Insulated slip-on alligator clips to fit the test prods are available at 99p a pair including VAT (Tandy part no. 270-354).

My thanks to Mr. Brant and Dianne Webber of Intertand UK Ltd., Tandy Centre, Leamore Lane, Walsall WS2 7PS for arranging the loan of the sample instrument.

Master-slave Switch-mode Power Supplies

Ray Porter, M.Sc., C.Eng., MIEE

Previous articles in *Television* have described the use of switch-mode power supplies in TV receivers and have covered particular applications and trends. One system that hasn't been covered to date is known as the master-slave circuit, because the timebase generator chip contains the pulse-width modulator and acts as the master, mains isolated from the chopper drive chip which operates as a slave to the pulse-width modulator. This article describes the principles and fault diagnosis techniques. We'll take as our example the ITT Monoprint B chassis, which was used in several ITT models manufactured during 1986-7. The relevant i.c.s in this chassis are the TDA8371 sync/timebase generator chip IC601 and the TEA2165 chopper drive chip IC701, though the principles are the same with several i.c. sets made by Philips and SGS-Thomson.

Circuit Operation

Fig.1 shows in much simplified form the master-slave switch-mode power supply circuit used in this chassis. The chopper transformer TR701 provides mains isolation. It operates at line frequency and, when working normally, provides the drive for the line output transistor.

Several supplies are generated by this transformer. The main one is the 115V supply which is fed to the line output stage and is sampled by the pulse-width modulator circuit in IC601. The pulse-width modulator controls the average level of the energy that's stored in TR701 and then delivered to its secondary circuits as the chopper transistor T701 is switched on and off. This switching varies in accordance with the error between the portion of the 115V supply at pin 22 of IC601 and the reference voltage at pin 23.

The chopper driver chip IC701 has built-in under and over voltage and excess current protection systems. These remove the drive to the base of T701 when the chip's supply goes outside its correct limits or the current demand on T701 is excessive.

In the standby mode transistor T602 is switched on and the reference voltage at pin 23 of IC601 falls to zero. As a result the voltage on the 115V line falls to 35V, IC701 providing an output in the form of bursts of pulses. Most of the set's functions are then disabled because of lack of the supply voltages. The remote control system still functions however, ready to bring the set back into full operation by removing the drive to D611/T602. This restores the reference voltage at pin 23 of IC601. The pulse-width modulator then takes over the drive to T701 and the supplies all increase.

In normal operation the line oscillator controls the timing of the drive to T701 so that beats, and thus interference, between the line timebase and power supply switching are avoided. Good saturation of T701 when it switches on, and thus low dissipation, is ensured by the collector current imaging waveform fed to pin 2 of IC701.

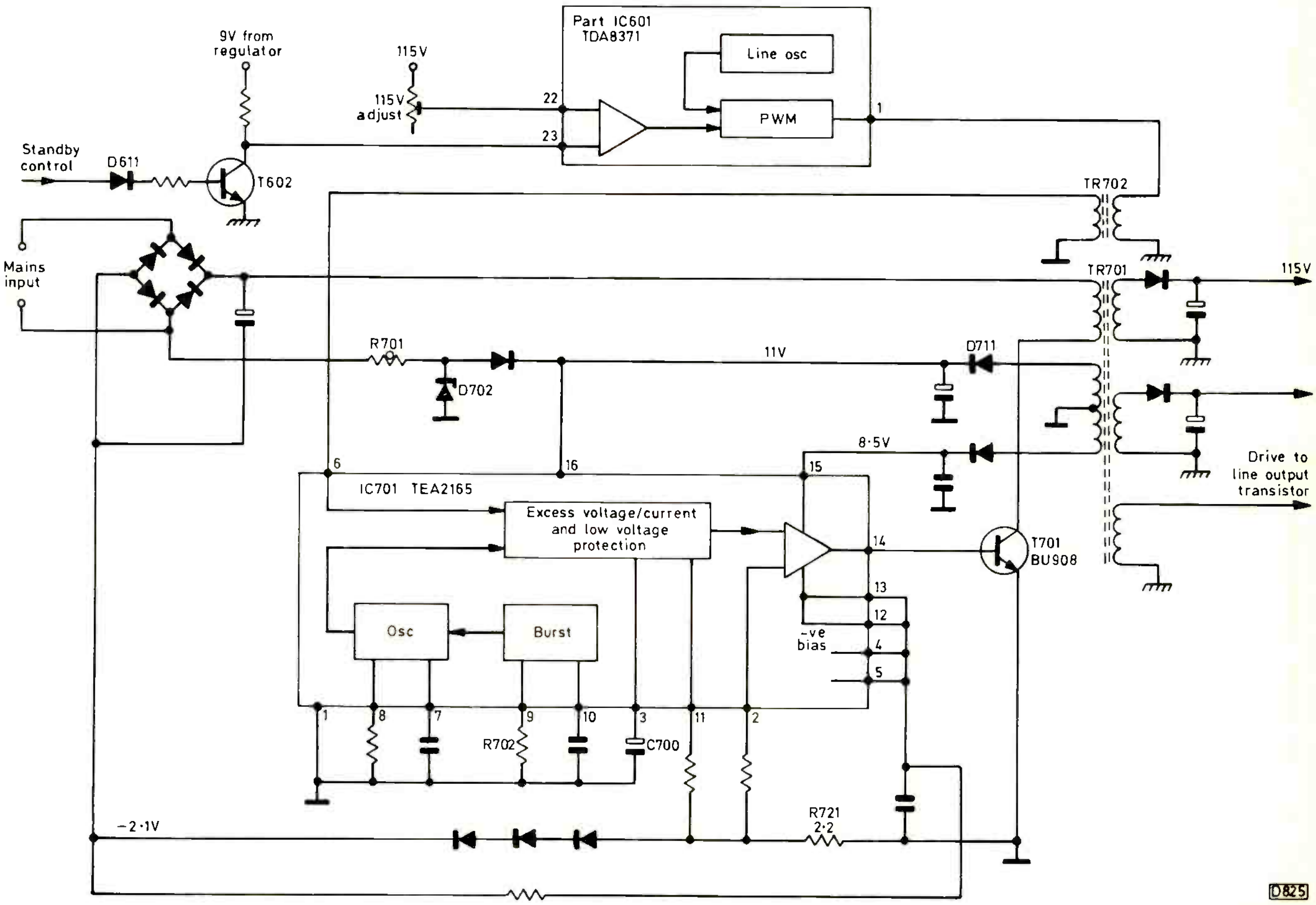


Fig. 1: Simplified circuit of the master-slave switch-mode power supply used in the ITT Monoprint B chassis.

This results in T701's base drive being increased when its collector current is in the region where the transistor's gain starts to fall off.

When the mains switch is closed the voltage developed across zener diode D702 supplies IC701. A soft-start action controlled by R702 and IC701 then occurs so that the supplies rise slowly until the microcomputer control chip brings the set out of the standby mode. Full voltages are then established. During the start-up period the resistance of posistor R701 increases and the supply to IC701 is supplemented by the action of D711/TR701.

In the standby mode the voltage at the anode of D611 rises to about 4V. T602 switches on and as we've seen the voltage to which the level of the 115V supply is referred falls to zero. The pulse-width modulator's output falls to minimum and the 115V supply drops to 35V. When the user selects a channel number the power supply returns to the fully-regulated condition.

Safety Systems

IC701 has several monitoring circuits built into it. These remove the drive output at pin 14 when safe limits are exceeded. The under and over voltage systems shut down the power supply then allow it to start up again. The monitoring system for current overloads checks on both a pulse-by-pulse basis and on an average assessment of current demand. C700 is charged by an 80μA source within IC701 and, so long as an excess-current situation has not been detected by IC701, is similarly discharged. In the overload condition C700 charges to 3V at which point IC701 shuts down. C700 then remains charged until the mains supply is switched off. This is the average-current monitoring. T701's collector current is monitored at pin 11 of IC701. When the voltage here exceeds 0·8V IC701 shuts down, this feature providing the pulse-by-pulse overload protection.

Fault Finding

If the set is apparently dead, check the voltage on the 115V line. If there's no voltage here check at C700. More than 3V here indicates that a current overload or an incorrect supply voltage to IC701 has been detected. Check that IC701's supply voltage is satisfactory during start-up – poor decoupling capacitors can result in transient supply excursions that trip the i.c. into its off state. Check for shorts across the various supplies obtained from TR701. If nothing amiss is found, disconnect pin 4 of the line output transformer and instead connect a 60W bulb across the 115V line as a dummy load. If there's a fault associated with the line output transformer the voltage on the 115V line will now be 85V.

C700 may also become charged if IC701's supply voltage dips because of poor smoothing capacitors. Those in the positive supply to the chip and the negative-bias network should be checked by substitution. If none of these actions restores drive from IC701, disconnect it from T701, use a 9V battery if necessary to provide it with a supply and use a scope to monitor its output. Look for bursts of 14·6kHz pulses at pin 14, spaced a few hundred milliseconds apart.

If the voltage on the 115V line is 35V the set may be stuck in standby. Check whether the voltage at the anode of D611 is 4V: if the 7V reference voltage at pin 23 of IC601 is also absent investigate why the microcomputer control chip is demanding the standby mode.

If you find that the chopper transistor T701 is faulty IC701 should also be replaced as it should have protected T701 against damaging overloads.

Telephone Test Set

Ian Rees

My workshop is six miles from any main town and to make ends meet I have to service anything that runs on electricity, be it brown, white or grey. I turn away nothing, from agricultural to nautical equipment. This leads to many problems – but the variety of work means that I'm never bored.

When a particular type of equipment starts to come in fairly regularly I find it best to knock up some simple test sets to help with future repairs. So it was when telephone equipment started to come in: cordless telephones, ordinary telephones and answerphones all now arrive in a steady trickle and there's also the occasional modem and fax machine. Repairing such items is no great problem, but a source of signal apart from the BT line, both for monitoring and calling, is needed to speed up service.

The test set described in this article is able to ring both two- and three-wire equipment and check the audio and dialling circuits, including the old bell-type phones that seem to have come back into favour.

Principle of Operation

Fig. 1 shows the basic arrangement used in the test set. Many modern telephones operate with just two wires that are connected to pins 2 and 5 of the modern BT plug. The ringing tone, which consists of the line switching between positive and negative supplies at around 60V, is simulated by switch S1. As well as some surge suppression the master BT socket contains a 1·8μF capacitor and a 470Ω resistor that are connected in series across pins 2 and 5. These components are duplicated, as shown, in the test set. Their junction is connected to pin 3, which on some phones is used as the ringing line for the bell etc. When the handset is lifted the impedance of the line falls, pulling down the voltage between pins 5 and 2 to some 8V depending on the equipment. This is shown by the light. A microphone can be switched in via amplifier one and monitored by the equipment being tested. Alternatively the equipment's microphone can be checked by amplifier two, whose output is fed to a deaf-aid type earpiece, avoiding acoustic feedback. Dialling can be checked by watching the light flicker and listening to the clicks in the earpiece.

Circuit Description

The full circuit is shown in Fig. 2. I built the test set mostly from odds and ends that happened to be around.

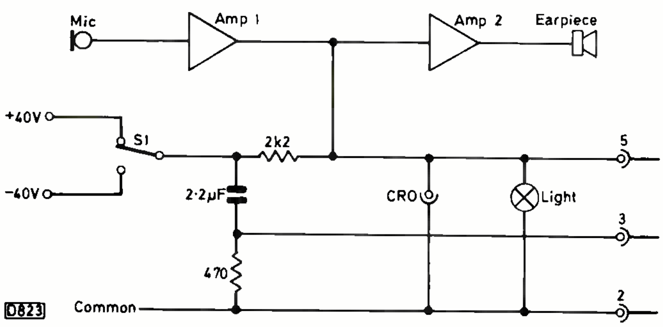


Fig. 1: Simplified circuit showing the way in which the telephone test set works.

Nothing exotic is used and most of the parts are non-critical.

The ringing voltage is supplied via the contacts of relay RLA. Tr1 switches the supply when S2 is closed. If you want to slow the ringing rate, increase the value of C3. The small 12V relay used must have contacts that break before they make. C7 and R4 duplicate the components in the master BT socket and supply ringing pulses to pin 3.

The two amplifiers are as simple as they come and are switched into use by S1. Tr2 and Tr3 amplify the signal from the line, via C8: the output can be monitored using a standard low-impedance earpiece plugged into the 3·5mm jack. The output from a small electret type microphone is amplified by Tr4 and Tr5 and fed on to the line so that it can be heard via the equipment being tested. The circuit is quite sensitive and the microphone can be several feet away.

A socket, labelled CRO, is provided for connection of an oscilloscope. This can be very useful at times when tracing the source of distortion etc.

Use

The test set is simple to use and requires no setting up.

When a telephone is plugged into the test set's BT socket, the LED should shine brightly with the phone rest

Components List

R1	2·2k	C1	470μF, 25V electrolytic
R2	100Ω	C2	1,000μF, 50V electrolytic
R3	47k	C3	1μF, 100V
R4	470Ω	C4	1,000μF, 50V electrolytic
R5	220k	C5	0·1μF, 100V mylar
R6	10k	C6	220μF, 16V electrolytic
R7	390k	C7	2·2μF, 100V
R8	2·2k	C8	0·1μF, 100V mylar
R9	10k	C9	4·7μF, 10V electrolytic
R10	220k	C10	0·047μF, 100V mylar
R11	2·2k	C11	4·7μF, 10V electrolytic

All 0·25W, 5 per cent

D1	BY127
D2	1N4148
D3-6	BY127
D7	1N4148
Tr1	BC107
Tr2	BD131
Tr3-5	BC107
LED	Standard red LED
IC1	7812 12V regulator
MIC	Electret microphone
T1	25-0-25V and 0-16V a.c. 1A mains transformer
F1-2	1A anti-surge fuses
RLA	12V one-pole changeover relay with break before make contacts
BT	Standard 4-pin BT socket
S1	1-pole changeover toggle switch
S2	1-pole on/off toggle switch
JK	3·5mm jack socket
CRO	BNC socket
	8Ω earpiece

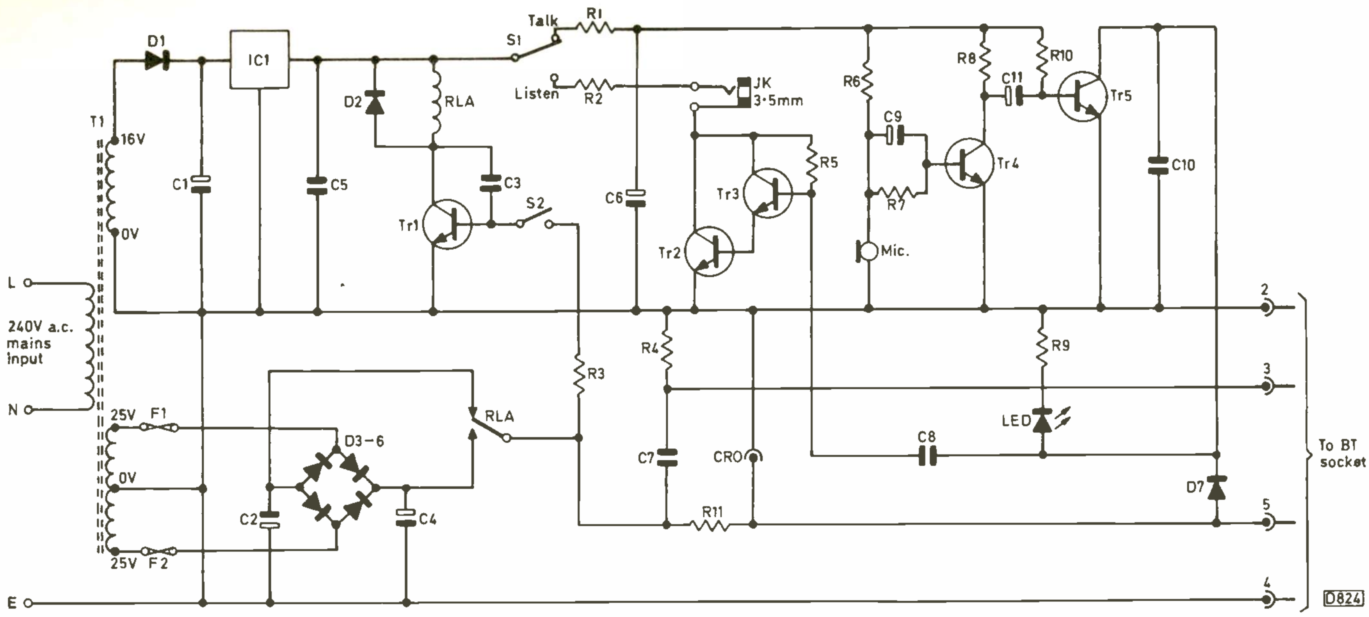


Fig. 2: Full circuit of the telephone test set.

on. If S2 is then closed the phone should ring or beep etc. When the phone's handset is lifted, the LED's brightness should drop and a burr should be heard in the phone's earpiece, similar to the dialling tone. Open switch S2 and with S1 in the talk position anything spoken should be heard loudly in the phone's earpiece (you may have to move back a little to avoid feedback). With S1 in the listen position and the test earpiece to your ear, anything spoken into the phone's mouthpiece should be heard clearly.

Test the dialling by watching that the light flashes each time a pulse is sent to the phone. Count the pulses. They can also be heard in the earpiece. Memory can be checked to see if stored numbers are correct.

Answerphones can be set to pick up after a certain number of rings: this can be simulated by flashing S2. Where remote answering is a feature this can be tested by applying the tone to the electret microphone.

The CRO BNC socket for scope connection can also be used with a suitable BNC T connector to inject tones when repairing faxes and modems.

ECONOMIC DEVICES 32 TEMPLE STREET, WOLVERHAMPTON, WV2 4AN

SPECIAL OFFERS

AVAILABLE UNTIL 31-5-92 OR WHILE STOCKS LAST

BU508AF	£1.06	TDA4505E	£3.99	TDA2600	£3.05	1038 (3V32 Take Up Idler)	£1.08
BUT11AF	£0.75	TDA4601	£1.32	BU508A	£0.75	VCR Fault Finding Guide	£6.99
TDA2579	£2.70	TDA3561A	£3.21	BU326A	£0.87	1620-IC Protector Kit	£14.95
TDA3562A	£2.31	STK5481	£4.37	1036 (3V29 Reel Idler)	£2.04	LT1215 – ITT LOP Transformer (Pt. No. 4515-03-25)	£15.75

1580H	3.72	2SC2482	0.25	AN245	5.78	BC237B	0.04	BD707	0.49	BU536	1.53	HM6231	12.30	MCR1065	1.56	STA441C	2.39	TA7241	2.23	TDA1512	2.48	TEA1002	5.14
1585R	3.72	2SC2565	3.67	AN318	7.42	BC238B	0.05	BD710	0.80	BU608	1.54	HM6232	5.77	MDA2062	2.14	STA471C	2.23	TA7243P	2.71	TDA1515A	1.93	TEA1009	1.48
17089	3.28	2SC2570	0.46	AN3821K	12.70	BC239	0.03	BD809	0.52	BU705	1.56	HM6251	5.69	MJ2955	0.94	STK0029	5.71	TA7250	3.28	TDA1518Q	3.05	TEA1014	1.49
17127	1.88	2SC2570A	0.28	AN3991K	3.26	BC251	0.31	BD810	0.45	BU806	0.79	HM7103	2.97	MJ802	3.06	STK0039	5.21	TA7267P	1.96	TDA1522	1.24	TEA1039	1.60
1N4002	0.06	2SC2632	0.28	AN5111	3.56	BC252	0.69	BD839	0.49	BU806A	0.78	KA2101	0.58	MJE13005	0.79	STK0040	7.18	TA7270	1.50	TDA1670A	2.02	TEA2018A	1.46
1N4004	0.06	2SC2655	0.29	AN5265	1.30	BC252B	0.16	BD901	0.45	BU807	0.48	KBL08	0.45	MJE2955	0.66	STK0059	9.46	TA7271P	1.90	TDA1701	4.71	TEA2164	3.67
1N4005	0.05	2SC2671	0.65	AN5435	1.24	BC300	0.38	BD902	0.58	BU826A	2.31	L200CV	1.35	MJE3055	0.49	STK025	9.37	TA7273	3.22	TDA1770	2.49	TEA2165	3.69
1N4006	0.05	2SC2688	0.29	AN5512	1.82	BC301	0.23	BDV65B	1.12	BU908	1.13	LA1201	0.54	MJE340	0.38	STK043	10.72	TA7274P	2.15	TDA1870	2.45	TIC106D	0.54
1N4007	0.05	2SC2785	0.16	AN5521	1.60	BC303	0.26	BDW83	1.15	BUT11	0.71	LA1230	1.28	ML237B	1.95	STK2129	9.82	TA7280	2.11	TDA1904	1.17	TIC106M	0.67
1N4448	0.05	2SC2791	4.25	AN5612	2.26	BC307	0.05	BDW84C	0.94	BUT11A	1.01	LA1357N	2.77	ML923	4.95	STK3042	4.82	TA7281	2.29	TDA1905	0.91	TIC45	0.55
1N5402	0.05	2SC3153	2.21	AN5900	1.23	BC307A	0.05	BDW93C	1.06	BUT12A	1.07	LA1385	1.40	MN1405VKF	11.41	STK4131	7.56	TA7299	2.34	TDA1908	4.83	TIL100	0.50
1N5404	0.07	2SC3156	3.61	AN6310	4.55	BC308A	0.11	BDX32	1.65	BUT56A	0.87	LA3161	0.37	MN1435VX	12.75	STK4141	8.00	TA7313AP	0.60	TDA1908A	0.99	TIP110	0.28
1N5408	0.10	2SC3182	1.73	AN6326	3.50	BC308C	0.05	BDY20	2.06	BUW11A	0.84	LA4112	0.94	MN1435VXB	9.98	STK4142	7.97	TA7325P	1.63	TDA1940	3.89	TIP112	0.33
1N914	0.03	2SC3225	0.33	AN6341	2.23	BC327	0.05	BF115	0.39	BUW41B	0.81	LA4140	0.35	MN6168	4.13	STK4162M	9.22	TA7343AP	0.69	TDA1950	2.34	TIP120	0.55
1S1555	0.21	2SC3715	3.79	AN6552	0.61	BC327B	0.17	BF123	0.17	BUW84	0.68	LA4182	0.75	MN650	2.27	STK4171	10.56	TA7361P	2.11	TDA2002	0.82	TIP121	0.40
1S2076	0.28	2SC388A	0.66	AN6610	0.74	BC328	0.06	BF127	0.13	BUX84	0.33	LA4192	1.10	MPSA42	0.22	STK4181II	12.47	TA75358P	0.66	TDA2003V	0.63	TIP126	0.51
2N2219A	0.26	2SC458	0.08	AN7110	0.99	BC337L	0.21	BF179	0.30	BUX85	0.74	LA4220	1.25	MPSA56	0.11	STK433	6.19	TA7607AP	1.89	TDA2004	1.24	TIP132	0.41
2N2222	0.16	2SC536	0.05	AN7156	2.45	BC338	0.05	BF184	0.40	BUZ71	0.50	LA4261	1.60	MPSU10	2.54	STK4332	5.38	TA7609	1.90	TDA2005	1.24	TIP137	0.96
2N2905	0.20	2SC867A	5.52	AN7161	2.48	BC368	0.08	BF185	0.39	BY127	0.05	LA4270	2.04	MPSU60	2.21	STK4352	1.65	TA7628P	1.45	TDA2006	1.02	TIP29	0.40
2N3054	0.85	2SC945	0.08	AN7171K	3.74	BC369	0.21	BF194	0.14	BY133	0.06	LA4282	2.06	MR818	0.33	STK437	7.96	TA7630	0.95	TDA2009	2.23	TIP2955	0.79
2N3055	0.57	2SD1051	0.46	AU107	7.72	BC372	0.43	BF195	0.07	BY164	0.49	LA4400	2.95	MR854	0.13	STK4392	5.78	TA7640AP	1.04	TDA2020	2.29	TIP29C	0.29
2N3442	1.12	2SD1138	0.71	AU113	12.99	BC546A	0.05	BF196	0.14	BY176	0.93	LA4422	1.07	MR856	0.14	STK441	9.73	TA7676P	4.13	TDA2161	2.88	TIP29D	0.75
2N3773	1.03	2SD1207	0.21	BA145	0.10	BC546B	0.05	BF197	0.24	BY179	0.77	LA4440	1.52	NE545B	3.10	STK459	7.73	TA7680AP	4.39	TDA2170	1.61	TIP29E	0.39
2N3819	0.41	2SD1265	0.71	BA157	0.10	BC547	0.10	BF198	0.08	BY184	0.29	LA4445	0.94	NE555	0.21	STK461	8.99	TA7681AP	5.09	TDA2270	1.98	TIP3055	0.69
2N3904	0.10	2SD1273	0.79	BA158	0.07	BC547B	0.10	BF199	0.03	BY199	0.18	LA4460	1.30	NE555N	0.23	STK5211	12.63	TA7698AP	5.61	TDA2522	14.78	TIP30A	0.24
2N4444	2.60	2SD1275	0.66	BA159	0.07	BC549	0.05	BF200	0.37	BY206	0.12	LA4461	1.25	NE556	0.41	STK5315	6.30	TA7705P	1.38	TDA2524	0.41	TIP30C	0.16
2SA1015	0.08	2SD1308	0.69	BA317	0.05	BC556	0.05	BF245	0.50	BY207	0.17	LA4500	1.63	NE646N	1.68	STK5322	6.58	TA7769P	1.39	TDA2525	3.54	TIP31	0.25
2SA1020Y	0.30	2SD1397	1.44	BA5102A	1.23	BC556B	0.05	BF245A	0.18	BY210-400	0.18	LA4505	1.73	OA47	0.24	STK5325	4.85	TA8210H	4.93	TDA2530	0.41	TIP31A	0.31
2SA1095	5.71	2SD1398	1.63	BA536	1.52	BC557	0.05	BF245B	0.37	BY224-600	4.95	LA4508	2.05	OA90	0.09	STK5326	10.31	TA8215	3.99	TDA2532	0.41	TIP31C	0.28
2SA1102	1.73	2SD1427	2.81	BA6109	1.38	BC557B	0.05	BF255	0.10	BY226	0.15	LA4520	1.04	OA91	0.14	STK5331	3.51	TA8691N	5.74	TDA2540	0.36	TIP32A	0.35
2SA1175	0.49	2SD1432	4.74	BA6209	1.27	BC558	0.05	BF256	0.23	BY227	0.12	LA4700	3.42	PH425	0.66	STK5332	2.38	TAA550	0.30	TDA2541	1.46	TIP32C	0.36
2SA1186	3.42	2SD1453	1.49	BA6210	1.48	BC558A	0.05	BF257	0.34	BY228	0.36	LA5112	3.30	PT8504	5.65	STK5333	2.88	TAA700	2.37	TDA2560	2.47	TIP33	0.63
2SA1208	0.25	2SD1497-02	6.85	BA6222	1.16	BC558A	0.05	BF258	0.02	BY229	1.64	LA5512	0.46	R2540	1.00	STK5372	3.71	TAG626	1.34	TDA2576A	5.77	TIP33A	0.89
2SA473	0.49	2SD1497-06	6.85	BA656N	0.81	BC560C	0.20	BF259	0.30	BY229-600	1.18	LA7042	2.48	R2540X	1.86	STK5421	2.52	TBA120	0.51	TDA2577	2.68	TIP33C	0.95
2SA562	0.16	2SD1541	3.30	BAS11	0.28	BC637	0.14	BF324	0.10	BY229-800	0.88	LA7223	2.46	R2M	0.66	STK5422	5.28	TBA120AS	0.85	TDA2577A	2.76	TIP34	1.15
2SA634	0.52	2SD1577	3.25	BAV18	0.07	BC639	0.17	BF337	0.36	BY255	0.12	LA7520	2.00	R4050	1.85	STK5466	5.36	TBA120SB	0.26	TDA2578A	2.95	TIP34C	0.86
2SA673	0.08	2SD1876	4.47	BAV21	0.11	BC640	0.05	BF338	0.38	BY298	0.12	LA7800	1.24	R4051	2.22	STK5471	4.64	TBA120T	0.57	TDA2581	2.14	TIP41A	0.29
2SA684	0.33	2SD1877	1.90	BAW62	0.03	BC879	0.37	BF355	0.46	BY299	0.12	LA7801	1.24	RB156	1.55	STK5476	4.85	TBA120U	0.46	TDA2581Q	1.65	TIP41B	0.30
2SA733	1.36	2SD234	0.91	BAX14	0.27	BC880	0.36	BF362	0.99	BY476A	0.66	LA7820	1.52	RGP10	0.27	STK5482	4.08	TBA1440	1.47	TDA2582	2.60	TIP41C	0.26
2SA769	1.07	2SD313	0.41	BB105B	0.16	BD131	0.26	BF392	0.15	BY713	0.74	LA7830	0.99	RGP15	0.41	STK6962	2.22	TBA2800	0.66	TDA2590	2.50	TIP42A	0.29
2SA940	0.76	2SD325D	0.50	BC107	0.13	BD132	0.20	BF422	0.13	BYD33G	0.34	LC7120	2.72	RGP30M	0.29	STK7216	5.20	TBA395	0.66	TDA2591	1.15	TIP42C	0.35
2SA952	0.13	2SD350A	3.71	BC107B	0.19	BD135	0.21	BF423	0.09	BYV95C	1.13	LM1303N	0.85	RM11C	0.29	STK7226	7.94	TBA396	0.41	TDA2593	0.75	TIP47	0.49
2SA966Y	0.28	2SD401	0.94	BC108	0.14	BD136	0.19	BF450	0.18	BYV96D	0.05	LM1877	1.40	S2000AF	1.15	STK7308	4.70	TBA520	1.20	TDA2594	2.14	TIPL791A	1.14
2SA970	0.13	2SD468C	0.41	BC108B	0.37	BD137	0.43	BF458	0.30	BYW19	0.87	LM1881N	6.80	S2055AF	2.14	STK7348	4.49	TBA530	2.45	TDA2595	2.06	TIS91	1.02
2SA984	0.20	2SD476	0.94	BC108C	0.13	BD139	0.28	BF459	0.28	BYW56	0.16	LM317T	0.46	S2530A	2.20	STK7356	5.42	TBA540	1.72	TDA2611A	0.60	TIS43	0.64
2SB1010	0.33	2SD613	0.61	BC109	0.11	BD140	0.23	BF469	0.33	BYX55-600	0.20	LM324N	0.29	SAA1004	1.10	STK7358	5.30	TBA540Q	1.15	TDA2611AQ	1.30	TL011CP	1.32
SB546	0.51	2SD621	5.37	BC117	0.13	BD150	1.10	BF472	0.21	BZV85C68	0.41	LM339N	0.14	SAA1174	3.95	STR1096	3.94	TBA560C	0.66	TDA2640	3.71	TL071CP	0.36
2SB616	3.00	2SD636	0.13	BC139	0.31	BD189	0.39	BF479	0.63	CA1310E	0.75	LM358	0.21	SAA1250	1.45	STR40090	6.63	TBA651	0.98	TDA2652	9.53	TL494	1.12
2SB643S	0.20	2SD637	0.12	BC140	0.20	BD190	0.29	BF480	0.62	CA3094	2.97	LM358N	0.21	SAA1251	3.20	STR4211	4.20	TBA750Q	4.95	TDA2653	0.00	TMP47C432AP	17.50
2SB688	1.24	2SD667	0.25	BC141	0.25	BD201	0.38	BF597	0.15	CD4001	0.13	LM380N	0.79	SAA1293	8.59	STR440	6.19	TBA800	0.49	TDA2653A	2.64	TMP47C434N-3555	11.74
2SB772Q	0.41	2SD716	1.07	BC142	0.26	BD225	0.48	BF758	0.31	CD4016	0.13	LM386	0.45	SAA1351	7.99	STR441	5.77	TBA810P	1.61	TDA2655B	4.25	UC3844	4.62
2SB774	0.44	2SD718	1.14	BC147	0.04	BD232	0.39	BF759	0.33	CD4017	0.16	LM8560B	3.50	SAA3027P	6.19	STR451	5.78	TBA810S	0.41	TDA2680	4.95	UPA81C	0.69
2SB819	0.46	2SD725	3.34	BC147A	0.05	BD233	0.26	BF762	0.33	CD4021	0.41	M104	6.07	SAA5000A	2.48	STR50020	7.55	TBA810SH	1.60	TDA2841	2.97	UPC1181H	0.95
2SB861	0.79	2SD734	0.23	BC148	0.05	BD234	0.43	BF869	0.24	CD4052	0.21	M192B1	2.47	SAA5010	3.02	STR50103	5.77	TBA820	0.53	TDA3100	2.68	UPC1182H	2.19
2SC1061	0.36	2SD762	0.62	BC148A	0.05	BD237	0.29	BF870	0.30	CD4053	0.19	M21C	1.20	SAA5012	3.21	STR5412	5.78	TBA820M	0.41	TDA3190	0.82	UPC1185H	4.13
2SC1096	0.48	2SD774	0.23	BC148B	0.03	BD238	0.10	BF960	0.26	CD4069	0.17	M293	14.63	SAA5050	4.54	STR58041	5.78	TBA910	1.12	TDA3190P	1.07	UPC1188	2.08
2SC1114	1.12	2SD787E	0.25	BC149	0.03	BD239	0.28	BF966	0.56	CD4070	0.13	M490	14.92	SAB3013	2.67	STR6020	5.77	TBA920	0.49	TDA3300B	5.96	UPC1225H	2.47
2SC1116	3.02	2SD837	1.00	BC149C	0.03	BD241	0.39	BF970	0.68	CD4528	0.37	M491	7.70	SAB3021	10.19	STR6020 Kit	5.77	TBA950	1.63	TDA3330	4.47	UPC1228HA	0.54
2SC1162	0.30	2SD841	1.24	BC154	0.14	BD243	0.42	BFR91	0.58	CNX62A	0.84	M494	8.57	SAB3035	6.16	T6041V	0.92	TBA970	4.00	TDA3505	3.04	UPC1230	2.14
2SC1213	0.13	2SD856	0.47	BC157	0.12	BD243A	0.41	BFW92A	0.84	CR3CM	2.40	M50115AP	2.43	SAF1032P	4.27	T6064V	2.55	TCA270S	1.00	TDA3541	0.92	UPC1230H	2.15
2SC124	0.42	2SD869	2.48	BC159	0.05	BD243C	0.36	BFX29	0.33	CRO2AM	1.78	M51102L	1.72	SAF1039	2.29	T6076V	2.77	TCA440	1.89	TDA3560	5.83	UPC1238	1.39
2SC1318	0.08	2SD870	2.45	BC160	0.40	BD244A	0.33	BFX85	0.31	CV12E	2.44	M51231P	1.40	SDA2112	12.96	T9013V	4.87	TCA800	1.60	TDA3561	5.75	UPC1278H	2.06
2SC1364	0.28	2SD880	0.33	BC161	0.26	BD244C	0.41	BFY50	0.30	CX109	6.84	M51393AP	4.50	SG264A	9.37	T9034V	1.40	TCA800Q	1.60	TDA3565	0.66	UPC1318	2.48
2SC1384	0.84	2SD882	0.29	BC167	0.40	BD245C	0.68	BFY51	0.33	DTA124EF	0.12	M51521L	0.54	SG613	13.50	T9035V	1.38	TCA910	1.17	TDA3566	3.75	UPC1335V	2.72
2SC1398	0.41	2SD898B	2.39	BC171	0.07	BD246C	0.69	BR100	0.23	DTA144EF	0.41	M5218L	0.36	SG6533	16.46	T9038V	5.91	TCA940	3.30	TDA3571B	2.99	UPC1351C	1.65
2SC1413A	1.96	2SD973	0.36	BC171B	0.13	BD278A	0.70	BR103	1.03	ER1400	2.08	M5231L	0.53	SGS1F344	5.04	T9053V	1.15	TD3F800R	4.12	TDA3576	11.55	UPC1353	1.30
2SC1509	0.37	74LS00	0.20	BC172	0.05	BD317	1.40	BR303	1.20	HA11235	1.73	M53216P	1.28	SKE2G202	0.63	T9064	0.82	TD3F900H	6.37	TDA3590	1.61	UPC1362C	2.34
2SC1573Q	0.25	7805-T022	0.23	BC172C	0.09	BD318	1.12	BRX44	0.99	HA11244	3.71	M54532	1.24	SKE2G204	7.27	T9065V	3.86	TDA1003A	1.34	TDA3640	5.77	UPC1363	1.02
2SC1740	0.11	7808	0.29	BC177	0.13	BD379	0.54	BRY56	0.41	HA1124A	0.70	M54543L	1.21	SKE4F106	0.30	TA7122BP	0.61	TDA1004A	3.30	TDA3650	8.64	UPC1365C	1.65
2SC1741	0.16	7812-T022	0.26	BC178	0.10	BD410	0.33	BSS38	0.17	HA11423	3.87	M54544L	3.40	SKE4F210	0.89	TA7137P	1.10	TDA1006A	7.00	TDA3651A	1.81	UPC1366	1.49
2SC1815	0.13	7815	0.24	BC182	0.05	BD433	0.26	BSX20	1.12	HA11440	2.55	M54548L	2.45	SKE4G104	0.51	TA7146P	5.87	TDA1010	1.04	TDA3651AQ	1.98	UPC1378H	1.07
2SC1826	0.69	7818	0.39	BC182A	0.12	BD434	0.28	BT106	1.16	HA1166X	6.73	M54648L	5.04	SKE5F310	1.63	TA7152P	3.48	TDA1011	0.96	TDA3653AQ	2.14	UPC1391H	0.50
2SC1827	0.74	7912	0.33	BC182L	0.05	BD436	0.31	BT139600	1.10	HA11703	3.37	M54898AP	14.69	SL1430	1.36	TA7176P	1.75	TDA1011A	1.28	TDA3653B	1.10	UPC1394	1.23
2SC1923	0.13	AA119	0.34	BC182LB	0.05	BD437	0.30	BT151800	1.11	HA11713	1.31	M58485P	5.78	SL1431	1.65	TA7193AP	3.20	TDA1013A	1.51	TDA3654	1.48	UPC1420CA	5.13
2SC1942	1.98	AC176K	0.29	BC183	0.05	BD438	0.16	BU205	1.03	HA11741	6.86	MB3712	0.99	SL1432	0.63	TA7193P	5.05	TDA1015	0.96	TDA3810	2.47	UPC1458C	0.66
2SC1959	0.10	AC187	0.15	BC183L	0.08	BD441	0.69	BU208	1.14	HA13001	1.30	MB3730	1.77	SL471	1.65	TA7205	1.06	TDA1020	1.50	TDA4420	1.23	UPC1488H	0.99
2SC1969	1.80	AC187K	0.31	BC184	0.04	BD442	0.40	BU208A	0.90	HA13108	2.67	MB3731	1.98	SL490	1.16	TA7205P	1.00	TDA1035T	2.19	TDA4427	2.65	UPC2002	1.09
2SC2001	0.13	AC188	0.29	BC184L	0.03	BD510	1.30	BU208D	1.39	HA13118	2.06	MB3732	2.16	SN29764AN	1.77	TA7207P	1.63	TDA1037	2.68	TDA4442	3.19	UPC324C	0.37
2SC2073	0.49	AC188K	0.65	BC184LC	0.09	BD519	0.78	BU406	0.43	HA13403	3.96	MC13002	3.71	SN29770BN	8.60	TA7210P	1.45	TDA1044	1.51	TDA4500	2.97	UPC4558C	0.41
2SC2078	0.58	AD149	0.50	BC204	0.35	BD529	0.93	BU406D	1.24	HA1374A	2.89	MC13002P	3.53	SN74141N	0.17	TA7217AP	1.40	TDA1059B	0.44	TDA4501	5.20	UPC574	0.99
2SC2141	1.23	AD161	0.99	BC207B	0.22	BD530	1.01	BU407	0.51	HA1377	1.51	MC1310P	0.82	SN7474N	0.44	TA7222	1.24	TDA1060	2.39	TDA4503	2.39	UPC580C	2.47
2SC2166	0.92	AD162	0.92	BC212B	0.05	BD535	0.38	BU426A	0.60	HA1388	1.87	MC1327P	0.41	SN76013ND	7.75	TA7222AP	1.23	TDA1082	2.47	TDA4600	1.43	UPD1937C	2.81
2SC2168	0.87	AF124	0.74	BC212L	0.05	BD536	0.46	BU426E	2.06	HA1389	2.44	MC1330A1P	1.22	SN76227N	1.03	TA7227P	1.90	TDA1083	1.15	TDA46002	1.92	X0035TA	7.27
2SC2271	0.21	AF127	0.58	BC214	0.05	BD537	0.40	BU500	1.06	HA1392	1.84	MC1350P	1.76	SN76666N	1.20	TA7230P	1.30	TDA1151	0.49	TDA46002D	2.88	X0065CE	6.35
2SC2314	0.45	AF139	0.28	BC214L	0.08	BD538	0.37	BU508D	1.24	HA1397	2.56	MC1358P	1.23	SN76705AN	2.97	TA7233P	1.72	TDA1170	0.96	TDA4600F	1.65	X0109CE	13.61
2SC2320	0.18	AF279	0.33	BC237	0.05	BD677	0.29	BU508V	1.65	HA1398	2.56	MC1377P	4.08	SR2M	0.66	TA7240AP	2.15	TDA1170S	0.85	TDA4601D	2.34	X2402	4.93
2SC2335	0.49	AL102	2.48	BC237A	0.07	BD679	0.43	BU526	1.36	HA1452	0.85	MC14493P	3.64	STA401	2.23	TA7240P	2.15	TDA1180	1.24	TDA4610	4.95		
																		TDA1270	1.50	TDA4950	1.57		
																		TDA1412	0.74	TDA7240	2.29		
																		TDA1420	1.52	TDA8140	2.31		
																		TDA1470	3.41	TDA8180	5.19		
																		TDA1506	4.45	TDA8190	2.78		
																		TDA1510	2.06	TDA9403	1.50		
																				TDA9503	1.56		

IF YOU DON'T SEE IT LISTED ASK FOR QUOTE. GIVE MAKE. MODEL. LOCATION. REMEMBER TO ADD £1.00 POST & HANDLING U.K. MAINLAND ONLY. HANDLING CHARGE TO ALL EXPORT ORDERS AT COST. ADD 17½% VAT TO TOTAL

VCR Clinic

Reports from Philip Blundell, AMIEIE, Brian Storm, Alfred Damp, John Edwards, Eugene Trundle, Nick Beer, Ian Bowden and Graham Richards

Grundig VS340

This machine had a capstan servo fault. In play the capstan would stop, then go too fast, then stop and so on. Checks showed that the capstan tacho signal at pin 2 of IC700 was erratic while there was no input at pins 17 and 18 of this chip. The wire to the tacho coil was dry-jointed where it connects to the threading motor's PCB. **P.B.**

Mitsubishi HS349

This machine kept stopping in play. The reel tacho signal at the collector of Q5A0 was intermittent because the reel sensor PCB's earthing screws were making poor contact. **P.B.**

Grundig VCRs with Panasonic G Deck

If you encounter one of these machines with the timing gears out of alignment, check socket P1503 for dry-joints – it's on the right-hand side of the cassette carriage. **P.B.**

Philips DMP2 and DMP3 Decks

Further to Nick Beer's note (February Clinic, page 272) on the VR6180, a number of changes were made to later versions of these decks, which have the capstan tacho head on the outside of the flywheel. The following parts were changed: top plate item 255, part no. 4822 466 82467; scanner ring item 227, part no. 4822 532 11776; erase head item 247, part no. 4822 249 40252; capstan item 262, part no. 4822 535 92909; tacho head and PCB, part no. 4822 214 32587; threading motor item 252, part no. 4822 361 21242; crank item 259, part no. 4822 528 20593; control lever item 272, part no. 4822 403 53744; in addition a washer and spring were added under item 256, washer part no. 4822 532 11775, spring part no. 4822 492 52095. **P.B.**

Grundig VS700

The complaint was that this machine wouldn't play. When a cassette was inserted the counter was displayed after ATTS, not the time used on the tape, while if any deck function was tried it would operate for only a second after which stop was selected. Checks showed that the reel tacho signals were present at the optocouplers but were missing at pin 32 of the SDA2087 chip. The TDA8118 chip was faulty with pin 14 short-circuit to chassis. **P.B.**

Panasonic NV-G45

Erratic capstan was the complaint with this machine. So it proved to be on test, speeding up and slowing down at random. On this machine (G deck) the capstan also drives the mechanism operation, so you have to be careful with capstan speed faults because you can damage the mechanism. The fault would show up when any point in the capstan circuit was touched, but it seemed logical to start by checking the capstan FG waveforms. Sure enough we found that the FG waveforms fluctuated up and down wildly at the capstan FG amplifier IC2104. The key seemed to lie with R2184 at the input to the FG amplifier, as there was no waveform amplitude variation at one end of this component and a very erratic variation at the other end. We removed this surface-mounted resistor and tacked a conventional 1kΩ resistor in its place. The capstan circuit then operated perfectly in all modes. **B.S.**

National NV-H75

This foreign machine had a dead power supply. Power was restored when the 2SC1384 crowbar transistor Q1006 on the secondary side of the switch-mode power supply was replaced. It was leaky. The machine then seemed to work – until the deck solenoid was engaged. The power supply then current limited sharply. Investigation in the primary side feedback circuit brought us to a rather sorry looking capacitor, C1042 (10μF, 25V). It was brown and discoloured. Fitting a replacement restored normal power. **B.S.**

Hinari VXL6

This machine would stop intermittently and the counter was very erratic in the play mode. We also noticed that the counter continued to count even in the stop mode. Replacing the take-up reel sensor cured the fault. **A.D.**

Mitsubishi HS330

The problem here was no playback colour. We scoped the video output when a known good tape was tried. This showed that the colour burst was present, so the next step was to check the alignment of the colour playback circuit. The voltage-controlled crystal oscillator was found to be running at 4·4328MHz instead of 4·4336MHz. Adjusting this as laid down in the manual restored the playback colour. **A.D.**

JVC HRD520

If you get one of these machines with what appears to be a loading-mechanism or mode-switch fault, e.g. the pinch roller drive peg hits the end of its cam, check that the slit washer (item 40 in the mechanical parts list) is present and correct. If it falls off, the sliding plate assembly's teeth can jump across those of the control cam. **E.T.**

Sony SLV615

This machine wouldn't carry out any reverse functions (rewind, review, reverse slo-mo): within a few seconds of one of these being selected the deck would shut down. The obvious suspect was the right-hand end sensor, but both this and the nearby operational-amplifier buffer chip proved to be innocent. The 100-pin flatpack syscon/servo chip was the cause of the trouble. **E.T.**

Sanyo VHR4350 (P88 Mechanism)

This machine would intermittently fail to rewind or fast wind the tape because it tried to drive the reels via the clutch instead of directly. The mechanism is in the same position for stop, fast forward and rewind: when the fault was present we saw that the cam slide assembly at the rear right-hand side of the deck had jumped out of cam groove

3. The cure for this problem is to replace the cam slide assembly with a modified one, available under the same part number (613 022 0059), which comes with fitting instructions. Also replace the loading belt.

An occasional problem with this deck is tape snagging when the cassette is ejected. Cure it by cleaning the periphery of the capstan flywheel and the brake pad that bears on it. **E.T.**

Akai VS967

This machine worked perfectly in every respect apart from the fact that the fluorescent display panel wasn't lit up. Very low heater drive was the cause of this, and replacement of C446/7 in the voltage-doubler circuit on the main PCB provided a complete cure. The faulty capacitors measured o.k. when removed from the machine... This and several contemporary models can suffer from premature display panel wear unless the circuit in the area of C446/7 is modified – details are available from Akai in modification sheet AV10015. **E.T.**

Philips VR6290

This machine half accepted a tape then the carriage made a squealing noise and ejected it. Inspection of the carriage's operation with the top cover removed showed that the carriage attempted to go in all the way but the cassette flap didn't open and thus fouled on the left-hand guide roller. The cause of this was that the tape flap opener spring had become displaced. Simply relocating the spring into the opener cured the problem. **J.E.**

Panasonic NV7200

No tape functions and won't eject said the job card. There was a tape in the machine but there was no response from the function selectors and their indicators though the power-on LED and the channel indicator were as normal. Our past experience has often been that this problem is caused by either dirty contacts or a broken cassette-in leaf switch. Not this time however. With a cassette in there should be 12V at each tag of the switch (contacts closed). There was no voltage at either tag, so we had a 12V feed problem. When we traced back to pin 2 of plug/socket P6014 on the system control panel we found that the 12V supply was missing here as well. L6001 was open-circuit. **J.E.**

Toshiba V57/Ferguson 3V35/JVC HRD120

"Went haywire, then o.k. except that it wouldn't eject, now no functions" read the report. This is becoming a common fault. CP1 (ICP-F15) goes open-circuit due to failure of the M54544L cassette motor driver chip. Another reason for this can be a defective motor. The same two possibilities apply with the loading motor and its drive chip, which are also fed via the same ICP. When CP1 goes open-circuit the 13V supply to both circuits is removed. **N.B.**

Panasonic NV7200

This machine had been serviced by one of our apprentices – he'd fitted the parts in the VUD kit, changed the heads and one or two other items, but there was now no drive. The absence of a familiar sound when ejecting was noted: the solenoids weren't being energised, so the brakes were on. R6083 (2·2Ω fusible) which feeds the unregulated 20V supply to the solenoid drive circuits was open-circuit because the 2SA768 transistor Q6027 was short-circuit – it had run hot and melted its solder. The reason for this failure was the presence of an extraneous conductor that had fallen on to the syscon board from the mechanism – a circlip that was missing from the brake band under the back-tension post. **N.B.**

Grundig VS310

The display said F1. This was because there was no loading motor movement – it wasn't being driven as R2155, the PTC thermistor in series with the output to the motor from pin 3 of IC2150, was dry-jointed at one end. **N.B.**

Toshiba V109

This full-lace machine was accused of damaging tapes, as a result of which the heads were now clogged. After cleaning these we found that the cause of the problem was very slightly weak reel drive due to a worn drive clutch. It's a delight to change this item from underneath. **N.B.**

Sanyo VHR2300/Granada VHSDS2

The complaint was that the sound had been poor and had subsequently disappeared. On inspection we noticed that the 820Ω resistor R10 looked a little discoloured. A check then showed that it was open-circuit. Fitting a replacement restored the sound, but it was poor. This was due to a contaminated audio-control head. After cleaning the tape path we had perfect operation. **G.R.**

Sharp VC780HM

This machine would eject any cassette that was inserted. We soon found that it could be fooled into accepting a cassette if it was switched off immediately after inserting the cassette then switched on again. Checks at pins 47 and 14 of the IX0234GE system control chip showed that they changed state before the cassette was ejected. The reason for this became clear when we checked at pins 17 and 18: there were no end or start sensor pulses. When attention was turned to the sensors themselves we found that two tiny black squares of tape had been applied. Where had they come from? **G.R.**

Panasonic NV-G25

The fault report said that the playback picture was noisy: it was also worse with its own recordings. On test we found that the noise on the screen had a definite pattern and wasn't random. As a start we checked the earth continuity between the video head preamplifier unit and the main PCB and other possible earth paths. All measured o.k. but the strange thing was that the noise was made worse when an extra lead was connected from the head preamplifier to the main PCB. A scope was next used to check the noise on the various supply lines – the main connector from the switch-mode power supply seemed a convenient place to do this. Apart from the −19V supply at pin 10 of P1001 the supplies had very little noise. At pin 10 however there were noise spikes of around 1V amplitude. When the power supply can was removed the cause of the trouble was obvious: smoothing capacitor C1022 had split its top and was open-circuit. A new capacitor greatly reduced the spikes and cured the problem. **I.B.**

Satellite Notebook

Nick Beer

Some years ago, well before the advent of Astra and the recent growth in the sales of small, cheap fixed-satellite TV systems, I was involved with a 1·5m offset motorised system produced by Skyscan of Maidenhead who I believe are no longer active in this field. The kit was reasonable for its time, and I found the installations very interesting because of the relatively wide range of channels available via the Eutelsat I and Intelsat V satellites. Until recently I'd not worked for some years with motorised systems, then....

Motorised Systems

The Bang and Olufsen product development manager came to see us and asked whether we could put together a package that would enable them to offer a motorised satellite TV system alongside the fixed, Fuba manufactured Astra systems they were marketing. He was quite confident that they could sell a more elaborate and expensive system, and I must admit that his enthusiasm for the project was contagious.

I investigated the possibilities and came up with a Channel Master kit that's of US origin. It came to my attention as a result of a mailshot from Longreach Marketing of Bath. The price, though this was not the prime consideration, is exceptional – more on this in a minute. A system was obtained on a trial basis. It seemed to be well built, and installation and alignment were straightforward. The dish is a moulded, non-metallic one: a 1·2m offset type with a triple arm mounting for the head end that consists of an LNB, an electromagnetic polariser (manufactured by Racal) and a large feedhorn assembly. This head ensemble is encased in a plastic hood that tidies everything up, providing one of the neater approaches to this part of an installation. We specified one or two improvements to the system – an 18in instead of a 12in arm and an LNB with a noise figure of 0·9dB instead of 1·1dB.

From a consumer point of view to run a motorised system with the current B and O range couldn't be simpler. The Beosat LM satellite receiver fits neatly inside the TV set, installation taking only a few minutes. It's a great improvement on the earlier Beosat LX. The Posit LM positioner unit also fits inside the main set. All the sockets are grouped together at the back. Connections are made via DIN leads to the positioner, polariser, LNB, decoders etc. When the customer changes channel, the dish moves to the required position if a change is necessary. Each of the 99 locations has its own frequency, audio subcarrier, dish position and polariser skew adjustments. There's an on-screen display that shows all 99 locations and their names. Vision can be muted automatically on a location used for a radio channel.

I decided that this kit would provide us with a package that could be sold at around £1,400 retail excluding installation. We don't carry out our own Astra installations though we do handle any servicing required. We did however want to undertake the motorised installations as this is a more specialised job and they would be exclusively for B and O customers. It's also far easier to justify a sensible installation charge at this end of the market. The next step, so that there wouldn't be any misunderstandings, was to draw up guidelines and conditions as to what we would and wouldn't do as part of an installation and what reception we could guarantee.

We don't build the concrete base or do the wiring – we have a builder and an electrician on call for this work. This is handy as a satellite installation often coincides with a Link installation.

Problems

We have had one or two problems in implementing this system however, though our display system, the original test rig, has been working without any trouble since it was first installed.

When we installed the first system we found that a number of bits were missing from the kit – the actuator mounting bracket and bolts for the polar mount for example, while instead of a Channel Master arm we'd been supplied with an Echostar version which, while still being an 18in arm, is much smaller. Aside from the missing bits, which we had to pinch from our display system because Longreach took a time to get them, the installation worked – for a week. The customer then complained that she had lost signals. When I checked I found that the dish positions were off on every location – by a greater amount at each extremity of the dish's movement. I had a strong suspicion that the customer had been fiddling, but there was fairly obviously a fault. After resetting all the positions I asked her to try again, and was soon back. Maybe the positioner was miscounting the tacho pulses fed back from the arm? A scope check showed that the pulses were of fairly low amplitude and noisy. Much cleaner pulses were obtained when I fitted the genuine Channel Master arm from our display system, and after resetting everything again no further problems occurred. It was obvious from all this that the Echostar arm that had been supplied instead of the Channel Master one was not a suitable alternative when interfaced with the B and O kit.

We've more recently been obtaining equipment from Eurosat Distribution, who have a number of branches across the country. We now obtain our Pace IRDs from the Exeter branch. The first Channel Master kit I ordered from this company was of original source throughout, apart from the LNB, and was slightly cheaper. The LNB was a Sharp one with a noise figure of 0·8dB. The Exeter branch has proved to be helpful and knowledgeable and, particularly important, has always had what we want in stock.

One problem we found was that when the hefty positioner was used with the B and O Posit LM unit the dish would in cold weather move slightly then stop. B and O is aware of this. The load of course increases in cold weather, and with certain arms the positioner is not able to deliver enough current. There's a modification which adds another transformer to the circuit. This overcomes the problem and speeds up movement of the dish. We now carry out this modification before installation to prevent problems and enhance the performance.

We've found that the B and O equipment works very well and when interfaced with the Channel Master kit provides a superb motorised package.

There are one or two software modifications I'd like to see in the Beosat LM receiver. First the ability to dump a dish position to a number of locations to save having to set it up every time. Secondly not having to rename locations when you restore data after sweep tuning. And finally an expansion of the location total to about 150 would make life easier and make better provision for the future – it's amazing how soon you fill up 99 locations with all the radio stations that are currently available in addition to the TV channels.

Servicing Tips

We have a couple of servicing tips to pass on this month. With the Ferguson SRA1S receiver patterning on the high-power transmissions of Sky One, News and Movies has been traced to C65 being faulty. We found that the reason for a dead (squealing) Ferguson SRV1 receiver was that the chopper transistor was short-circuit: it's also worth checking whether D5 is open-circuit.

Correction

Finally a correction is required to the March issue Notebook. This is due to an editorial misunderstanding. The gold spot LNB introduced by Ferguson is intended to help when the field strength is low. There's a premium to pay, but the LNB is helpful when used with the poorer SRD4 receiver. The cure to the basic problem mentioned, LNBs producing a low output after some time, is simply to replace the faulty LNB.

Long-distance Television

Roger Bunney

February was another fairly active month for DX-TV reception. There was considerable propagation via the F2 layer during the month, but DXers in the south did better than those in the north. A dash of Sporadic E reception and some tropospheric propagation made for an interesting month.

Simon Hamer received IRIB (Iran) and Dubai on ch. E2 during most days in February, sometimes at very high levels. On the few mornings that I was able to monitor Band 1 ch. E2 was jammed with signals – on the days when New Zealand and Australian TV were seen I was of course at work! The F2 log is as follows:

1/2/92	Iran E2.
2/2/92	NTA (Nigeria) ch. E3 via TE.
5/2/92	Dubai, Iran E2; TSS (Russia/CIS) R1.
6,7/2/92	Dubai E2.
8/2/92	Australia A0 (ABMN-0 and RTQ-0); New Zealand ch. 1, three channels with offsets measured by scanner, weak video seen; RTM (Malaya) E2; Thailand E2; China C1, 2; TSS R1; Iran, Dubai E2.
11/2/92	Australia A0 (ABMN-0, RTQ-0); unidentified FubK test card at 1017 (not Iran).
12/2/92	Iran and Dubai E2; unidentified signals as follows: Arabic E3, A2 and E2 FubK pattern.
13/2/92	CIS R1; Dubai, Iran E2.
14/2/92	CIS R1.
15-20, 22-24/2/92	CIS R1; Iran, Dubai E2.
29/2/92	Dubai E2 with teletext programme guide.

The SpE log is as follows:

15/2/92	TVE (Spain) E2, 3; TSS R1.
16/2/92	TSS R1.
20/2/92	RUV (Iceland) E4.
29/2/92	TVE E3.

Several DXers logged an aurora on the 25th though there were no reports of TV reception.

There were several minor tropospheric openings. On the 5th TVE was received from ch. E3 through Band 3 to u.h.f., also German signals in Band 3 and at u.h.f., mainly along the south coast. During the 5th to the 9th there were further periods of cross-channel reception from as far as Spain. Mark Baldwin received Band 3/u.h.f. signals in Northampton, possibly partly due to ducting. There were signals from Germany and the Benelux countries across the UK on the 8th and 9th. More lively tropospheric conditions were present on the 24-25th, with Band 3/u.h.f. signals from France, Spain, Germany and the Benelux countries and, on the 25th, Sweden and Denmark.

Our thanks to David Glenday (Arbroath), Simon Hamer (Powys), Tim Anderson (St. Leonards), Roger Fussell (Torpoint), Peter Schubert (Rainham) and Mark Baldwin (Northampton) for sending in reception reports.

Ryn Muntjewerff (Holland) reports that there's a second ch. E2 outlet operational in Thailand, relaying Bangkok ch. E9, power unknown. It seems that the ch. E2 PM5534 test pattern seen by Robert Copeman and Anthony Mann in Australia via F2 on February 5th originated from SVT-1 (Sweden)!

Tim Anderson asks whether any overseas readers can assist with the following queries. (1) Where does the ch. E2 ±2kHz FubK test pattern come from? – it's not from Iran. (2) Likewise the 48·24 and 48·26MHz Arabic signals with no VITS, which are again neither Dubai nor the two Iranian transmitters. (3) Any thoughts on the long-standing mystery of the ch. R1 525-line signals seen in Australia from the north? Tim wonders whether left-over NTSC equipment from US army activities in Vietnam could be the origin, especially as this country is listed as using both 525-line NTSC and 625-line SECAM.

News Items

Poland: The Lublin ch. R2 transmitter now radiates a local TV service instead of TVP-2. Oddly, TVP carries BBC World Service TV teletext – World News and Markets are on pages 103 and 104 respectively. Our thanks to Andy Emmerson for this information.

Hungary: As with Czechoslovakia a change from SECAM to PAL is envisaged – experimental PAL transmissions are expected to start this summer. Conversion to PAL would be expensive nationally as most receivers in use are single-standard SECAM ones. A further problem is MTV's financial difficulties: there have been severe staff cutbacks and programme hour reductions. Nine high-power transmitters are currently on order to improve coverage in five border regions. The authorities are giving consideration to the commercial possibilities of cross-border transmissions, which would have to use PAL.

Cyprus: In the January column I referred to the use of both PAL and SECAM. This has brought a response from Costas Mouhtaris, Chairman of the Union of TV Technicians in Cyprus. He writes as follows: "Cyprus is one country, with 37 per cent of the island under Turkish occupation since 1974. There are three relays that are not licensed by either the EC or the Cyprus government in the occupied territory. Otherwise there are three main transmitters in Cyprus. CBC-1 ch. E6 and CBC-2 ch. E31 both use the PAL B/G standard. The Greek ET-1 ch. E28 service uses SECAM." Our thanks for this information.

CIS (formerly the USSR): The former Gostelradio is now known as the Russian State Television and Radio

Company. It operates as Ostankino, which is the name of the Moscow TV centre. During the current year Ostankino is to receive a state budget. It will subsequently be privatised and operate as a commercial enterprise. The CT-1 network is to be used as a CIS platform, with each of the independent states having air time. Use of the four main channels is expected to be as follows: 1 CIS, 2 Russia, 3 Moscow, 4 educational. The Ostankino TV centre is to continue as the main source of transmissions in all time zones.

Transmitter Update

The Swedish third programme (TV4) is now being distributed terrestrially. High-power transmitters currently in operation for the service are as follows: Goteborg ch. E46, Horby E50, Karlstad E46, Malmo E47, Norrkoping E54, Stokholm E42, Sundsvall E50, Uppsala E52, Vasteraas E51, Orebro E58. The following transmitters are due to come into service by the end of June: Bollnas E49, Borlange E60, Boraas E55, Gavle E30, Helsingborg E41, Karlshamn E44, Skovde E47, Vannas E50, Alvsbyen E52.

The Norddeutscher Rundfunk is now using the following formerly East German transmitters: Helpterberg E37 (250kW H), Marlow E8 (100kW H), Schwerin E11 (100kW H) for the NDR-1 service; Helpterberg E22 (300kW H), Marlow E24 (500kW V) and Schwerin E29 (500kW H) for the NORD-3 service. Our thanks to the BDXC for the above information.

A correction is required to the Australian ch. 0 transmitter references in the January column (F2 reception report). Robert Copeman points out that DTQ-0 should have read RTQ-0 (Toowomba), which was formerly DDQ-0, Queensland (vision carrier 46·171MHz, transmitter power 150kW e.r.p.). The ABMN-0 Wagga Wagga, NSW transmitter remains in operation as before (vision carrier 46·24MHz, 100kW e.r.p.).

Interference

Six News has drawn attention to two sources of strong Band 1 interference. The Panasonic NV-L20HQ radiates at 50·112MHz: a high-pass filter in the aerial lead, adjacent to the VCR, solves the problem. Use of a toroid would reduce the radiation. The Binatone 01/3150 telephone answering machine radiates at 50·115MHz. There is at present no solution to this one. Has anyone any ideas? It appears that the microcomputer clock or dividers are the source of the radiation.

Satellite News

The footprints of the Eutelsat II F4, 5 and 6 satellites are being modified to give greater coverage of the CIS. Eutelsat is also investigating the possibility of co-locating two craft with up to forty TV transponders at a single orbital position.

Canal Plus will use SECAM for its transmissions via the new Telecom 2A satellite, with Nagravision scrambling. The latter is similar to the Canal Plus Espana/Premiere scrambling, which requires a smart card for reception. Seven transponders on the new satellite are being leased by Canal Plus for its own service plus Canal Jimmy/Canal J, TV Sport, Cine Cinema, Cine-Cinefil, MCM Euromusique and Planete. Anyone thinking of acquiring a pirate Canal Plus decoder might find it best to postpone such a move. Filmnet is ready to use D2 MAC with Eurocrypt.

There are strong suggestions that by early autumn Thames TV will be providing a subscription-based commercial TV service via Astra 1B, in direct competition with BSkyB. Other projected satellite TV services for the UK include the Eurosoccer Channel and two channels, Indra Dhnush Television and TV Asia, aimed at viewers of Asian origin. The African Caribbean cable channel is also considering satellite TV distribution.

CNN parent company Turner Broadcasting is to offer a 24-hour cartoon channel across the USA from October 1st. The company recently bought the Hanna Barbera cartoon library (Tom and Jerry, the Flintstones, Yogi Bear etc.). If all goes well a pan-European service will be launched.

British Aerospace's Sportscast subscription service via Eutelsat II F3 at 16°E is to use Videocrypt scrambling, mainly on grounds of security and cost: the decoders are plentiful and cheap whereas B-MAC encoded distribution is costly and the decoders are more complex.

Swift Television Publications (17 Pittsfield, Cricklade, Swindon SN6 6AN, phone/fax 0793 750 620) has released on a 3·5in disc that runs on IBM type PCs compatible with MS DOS 3·0 or higher a new satellite program for those in the installation trade, research workers and the (very) dedicated satellite enthusiast. The "Satmaster", written by D.J. Stephenson, provides information on orbital positions, interference protection, establishing the correct azimuth and elevation settings for any satellite at any part of the world and much else. It works out reception characteristics, given information on the satellite, the receiving site and the equipment to be used (i.e. dish size, LNB noise figure etc.), also polarisation offsets for any satellite above your horizon. The various graphs and calculation results can be displayed on a VDU screen or printed out. Use of the program enables all manner of tedious and difficult calculations to be sorted out with ease. It includes a 20,000-word technical guide. The UK price is £33 including UK postage: add £2 for Continental Europe and £4 for other parts of the world.

Equipment for DXing

Last month we discussed tuning to receive Sporadic E signals in Band 1. It's not unfortunately possible to predict when an SpE opening will occur. Many TV-DXers develop a feel for when conditions are right however. I've found for example that a hot, sultry, overcast day with a feel of thunder during June or July is a likely time: not always, but often. Such propagation occurs when patches in the E layer, either localised or widespread, become sufficiently densely ionised to be able to reflect incident v.h.f. signals, usually in Band 1 but sometimes into Band 2 and very occasionally reaching into Band 3. In a similar manner to the medium-wave band signal reflection that occurs after dark, E-layer signals received may have come from distances between 400 miles and 1,500 miles in a single hop. Multiple-hop propagation greatly increases the distance. At times when multiple-hop reflections occur it's possible to receive in the UK Band 1 signals from the Middle East, Africa and, occasionally, the eastern seaboard states of Canada. An SpE opening can occur at any time during May through to late August. Due to the transmitters closing down, night-time reception is infrequent.

As signal strengths can be very strong even a simple aerial can provide dramatic reception during a good opening. Thus SpE DXing is a hobby that can be enjoyed using minimal equipment – and certainly without the need to erect a 60ft mast! A simple wideband dipole mounted on a short pole will suffice. Though some DXers use multi-element Yagi arrays, a simpler aerial system can be just as effective.

When I started DXing in 1962-3 I read an early Bernard Babani publication by a Mr. West who explained "how to TVDX" and the equipment to use/modify. I well remember the photographs of Mr. West's aerials: basic single dipoles and H-type arrays. The mass of reception photographs proved that such simple aerial systems, held aloft with one-inch steel conduit pipe, worked well.

In the UK SpE signals may arrive from any direction, including the west, i.e. from North America. A horizontally-mounted dipole responds to signals that arrive broadside to it. Thus a dipole mounted along an east-west axis will pick up signals across a broad range to the north and the south. Similarly a horizontal dipole mounted along a north-south axis will pick up signals from the west and east. Two such dipoles mounted horizontally at right angles on a common mast will thus provide omni-directional reception when a wideband combiner is used to combine the outputs. Alternatively a two-way switch can be used to select the outputs. The latter approach may be preferred in order to obtain directional discrimination. A vertically-mounted dipole is responsive to signals from all directions: since SpE signals undergo considerable polarisation shift this simpler approach may be preferred.

Gain and directivity can be achieved by adding a slightly longer element, called a reflector, behind the dipole. This reduces signal pick up from behind. A third, slightly shorter, element added in front of the dipole further increases the gain and directivity. This is called a director. The spacing between the three elements can be adjusted for optimum results. This is the Yagi-type array. You can use an aerial rotator with such an array or alternatively employ hand rotation. I feel that the simpler type of aerial is best for the newcomer however. As interest develops, so the aerial system can be improved.

For Band 1 coverage we need reception across the 48-70MHz spectrum. A standard half-wave dipole has a bandwidth of some 5MHz, falling off sharply at each side. The dipole's length determines its resonant frequency. For a wider bandwidth we could therefore arrange to have two dipoles cut for say 54 and 64MHz mounted close together, with selection of the outputs by switching. This is effective but very inconvenient. It's more efficient to use a wideband dipole that covers the whole 48-70MHz bandwidth – either a single vertical dipole or two such dipoles mounted horizontally at right angles to each other with switch selection as necessary. The aerials can be fitted to a pole or metal mast, preferably 18-20ft above ground to clear local obstructions. Run low-loss feeder(s) to the receiver and you're in business!

Fig. 1 shows various types of aerial for Band 1.

To calculate the length of a half-wave dipole use the formula 468/f, where f is the wavelength in MHz. The answer obtained is in feet. As an example, the channel E2 vision carrier frequency is 48·25MHz. 468/48·25 gives the result 9·69, i.e. 9ft 8·5in. This is the tip-to-tip length of a dipole cut to the ch. E2 vision carrier frequency.

The vision carrier frequencies for the various Band 1 channels are as follows: E2 48·25MHz, E3 55·25MHz, E4 62·25MHz, IA 53·75MHz, IB (Italy) 62·25MHz, IB (Ireland) 53·75MHz, R1 49·75MHz, R2 59·25MHz, L2 55·75MHz, L3 60·5MHz, L4 63·75MHz, A2 55·25MHz, A3 61·25MHz, A4 67·25MHz.

Aerials and aerial insulators/components can be purchased from HS Publications, 7 Epping Close, Mackworth Estate, Derby DE3 4FS (send s.a.e. with enquiries). Aerial tubing can be purchased from local suppliers: it may be expensive (0·5in. diameter hard-drawn is best). The boom can be made of standard one-inch outside diameter aerial mast tubing, which should be

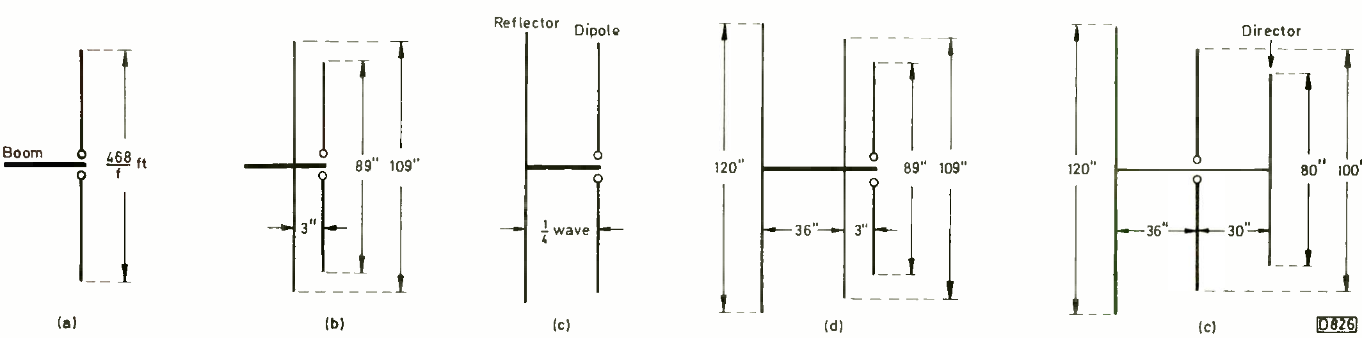


Fig. 1: Band 1 aerial designs. (a) Narrow-band dipole. Cut to the required channel frequency. (b) Wideband dipole. (c) Semi-wideband H array. Cut the reflector to ch. E3 and the dipole to ch. E2 or the reflector to ch. E4 and the dipole to ch. E3. (d) Wideband H array. (e) Wideband Yagi array. Boom 1in. tubing, elements 0·5in. tubing, feeder 75Ω coaxial cable.

available cheaply from aerial rigging firms. Many aerial riggers may have old v.h.f. aerial stocks – or even aerial systems that have been taken down from customers' premises. Aerial Techniques who advertise in this magazine can supply specialised TV-DXing aerials.

TEST CASE

353

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

Amongst all the charcoal-grey plastic cabinets ranged along the waiting-repair racks there was a brown one! Its cabinet really was made of chipboard and Fablon, a genuine bit of old English craftsmanship on the part of some factory machine now relegated to the scrap pile or maybe recycled into razor blades. Ah, the nostalgia for real chipboard!

This remarkable cabinet enclosed a Philips K30 chassis no less. It had gathered a great deal of dust during its ten years of service. Sherlock, who had been delegated to repair it, was a schoolboy when this set first saw the light of day. The job card told him that the picture was jittering so, after vacuuming out the dust, he switched the set on to assess the situation.

Since the tube was by now worn, the picture was somewhat weary. But this apart the set seemed to work well enough. Sherlock turned the brightness and contrast up a bit. The picture then began to jitter. Not up and down, nor side to side, but in a strange way with fragments of the image expanding and contracting over the edge of the screen, almost as if the picture was being zoomed in and out optically over a period of a fraction of a second. Sage plodded past the bench en route to the stores. "Dag's off" he said. Beg pardon?!

"Dag's off ground – that plays about with the e.h.t." Sage explained when quizzed on his return journey. To translate, what he was suggesting was that the tube's external conductive coating (Aquadag) was not connected to the set's chassis. But it was, as Sherlock quickly proved with his ohmmeter. Nevertheless the idea that the e.h.t. voltage was jittering seemed a credible one to Sherlock – the effect of low or poorly-regulated e.h.t. is to zoom the picture. So he hooked an e.h.t. meter to the tube bowl's cavity connector and sure enough the needle twitched as the picture jittered.

Now the e.h.t. voltage depends on the h.t. voltage, so this was where the next check was made. At HT2, which should be at 140V. One hundred and forty volts it was, with no detectable jitter even when the picture was playing its tricks. There was a variation of a volt or two between full and minimum brightness. The picture jitter/zoom occurred only at high brightness/contrast levels, but this was not reflected to any discernible degree in the h.t. voltage.

Attention was next turned to the line output stage, which has a diode-split line output transformer and a BU208A transistor. Sherlock connected his scope probe to the BU208A's collector and turned the Y gain setting fully anticlockwise. The pulses, of around 1kV peak amplitude, changed shape a bit as the brightness and contrast controls were turned up and down but showed little or nothing of the jitter that so badly affected the picture. Sherlock's course was now clear to him: the line output transformer, or at least its diode-split section, was in trouble and had to be changed. Was there a K30 line output transformer in the stores? There was indeed, complete with an invoice from Purley Way. Sherlock fitted it while Sage reminisced about Croydon Aerodrome, G11s and the girl at the reception desk in the days when his hair hadn't a streak of grey in it and he'd just been on a servicing course on the G8. What was that? A type of aeroplane? A specific size of intimate underwear? No, a TV chassis – one even older than the K30...

The new line output transformer made no difference to the symptom. This will come as no surprise to regular readers of the test-case column. Even though the e.h.t. was varying – or was it? – the transformer assembly was not responsible. Which somewhat cheaper component was causing the trouble? For the answer and another test case puzzler, see next month's issue.

ANSWER TO TEST CASE 352
– page 437 last month –

There was a shortage of workshop staff last month. And a shortage of inspiration. Dylan had run out of ideas for a somewhat ancient VHS machine with sound problems. He'd set up the relevant electronic circuits, changed the pinch roller and tilted the top (audio section) of the audio/control head stack until it was leaning across like the Tower of Pisa. But the sound from the tape was still low, hissy and fluctuating.

Finally, in an attempt to tie down the cause of the fault to a mechanical or an electrical problem, he connected the scope's probe direct to the audio head's output. Despite the scope's full gain setting there was no signal to be seen. Dylan tried the same test on a VCR with perfectly good sound playback and likewise got no response on his scope. Plainly the signal at this point is very small at the best of times! The machine was put on one side while a reel idler was fitted to the Hitachi one that had gobbled Jane Fonda's tape and Mr. Harper's picture tube was boosted.

The mystery was soon solved when Sage and the others returned to the workshop. The audio head assembly was badly worn: the erosion was plainly visible, rather like a water-worn pebble, when the head's front face was examined with the bench light at just the right angle. A replacement head restored good sound performance, though Dylan had to reset the recording and bias levels as well as align the new assembly in the tape path.

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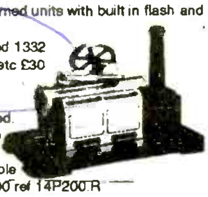

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TA7303	£1.10
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TA7325P	£1.50
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TDA1510	£3.20
TDA1510A	£3.20
TDA1512	£1.00
TDA1515A	£2.50
TDA1520	£3.95
TDA1670A	£3.00
TDA1701	£3.00
TDA1770A	£3.00
TDA1870A	£2.60
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TDA2532Q	£3.00
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TDA3562A	£5.00
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TDA3571BQ	£5.50
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TDA3651	£3.00
TDA3651AQ	£6.50
TDA3653	£4.00
TDA3654	£2.80
TDA3810	£2.90
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TDA4420	£2.45
TDA4422	£3.95
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TDA4501	£4.00
TDA4503	£4.50
TDA4505	£6.75
TDA4510	£4.40
TDA4600	£2.60
TDA4600-2	£2.60
TDA4601	£2.10
TDA4610	£4.50
TDA5101	£2.00
TDA7250	£5.50
TDA7607AP	£2.40
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UPC1263	£2.20
UPC1288V	£2.95
UPC1361C	£3.90
UPC1362C	£4.50
UPC1363	£1.90
UPC1365	£3.50
UPC1377C	£2.20
UPC1378H	£2.00
UPC1379	£2.20
UPC1382	£1.50
UPC1394	£1.70
UPC1420A	£7.00
UPC1458	£1.95
UPC1513HA	£2.00
UPC1520CA	£2.48
UPC339C	£0.70
UPD4011	£1.75
UPD4066	£1.95

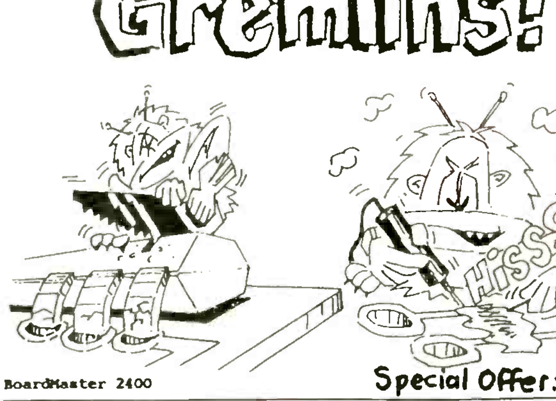
TRANSISTORS

2N3773	£1.90
2SA1095	£5.50
2SA1102	£1.90
2SA1112	£0.95
2SA1124	£0.35
2SA1220	£1.10
2SA1386	£4.70
2SA564	£0.40
2SA673	£0.20
2SA942	£0.35
2SA985	£0.95
2SB1016	£1.50
2SB772	£0.40
2SB775	£1.60
2SB819	£0.55
2SB965	£2.30
2SC1413A	£2.50
2SC1826	£1.80
2SC1942	£2.10
2SC1983	£1.30
2SC2003	£0.25
2SC2027	£4.50
2SC2230	£0.50
2SC2238	£0.75
2SC2331	£1.00
2SC2335	£1.50
2SC2531	£0.26
2SC2564	£3.04
2SC2570	£0.55
2SC2577	£1.50
2SC2592	£0.95
2SC2621	£1.25
2SC2631	£0.30
2SC2632	£0.30
2SC2655	£0.60
2SC2958	£2.50
2SC2979	£3.00
2SC3153	£3.40
2SC3402	£0.40
2SC3519	£4.60
2SC3678	£1.25
2SC3715	£4.80
2SC458	£0.20
2SC789	£2.50
2SD1047	£2.75
2SD1051	£0.85
2SD1128	£1.50
2SD1138	£0.85
2SD1159	£0.75
2SD1207	£0.75
2SD1273	£1.00
2SD1275	£1.30
2SD1288	£1.70
2SD138	£0.85
2SD1391	£4.20
SDC1397	£3.75
2SD1398	£2.25
2SD1426	£4.50
2SD1453	£1.60
2SD1455/2SD1730	£3.10
2SD1496	£4.00
2SD1497	£2.60
2SD1497-02	£5.95
2SD1497-06	£5.95
2SD1650	£3.50
2SD1877	£2.30
2SD639	£0.35
2SD667	£1.00
2SD725	£3.70
2SD787E	£0.30
2SD811	£2.95
2SD836	£1.10
2SD837	£0.80
2SD845	£2.70
2SD868	£3.50
2SD869	£3.00
2SD870	£3.50
2SD871	£4.50
2SD895	£2.00
2SD898	£2.75
2SD898B	£2.75
2SD900B	£4.00
BC107B	£0.10
BC108	£0.10
BC108B	£0.10
BC115	£0.16
BC118	£0.12
BC147A	£0.07
BC159	£0.09
BC171	£0.09
BC172	£0.09
BC172C	£0.07
BC182L	£0.09
BC183	£0.09

A. Z. ELECTRICS

SEE ADDRESS DETAILS ON NEXT PAGE

Gremlins!



BoardMaster 2400 — *Special Offer:* £1195

Finds device and PCB faults easily & quickly: Malfunctioning ICs, broken tracks, shorts, intermittent faults, conflicts, loose connections, stress related faults, temperature related faults, incorrect/illogical links. SAVE board configuration and IC test results automatically via NEW MasterLink PC connection system and COMPARE with faulty board signatures. Control the system remotely via your PC and easy to use menu driven interface. Functions as a standalone system or integrated with your PC. Completely portable

FINDS DEVICE & PCB FAULTS

and....tests TTL, CMOS, Memory, Interface ICs. Identifies & tests unmarked & housecoded ICs. Tests in-circuit - no need to desolder ICs. Tests devices up to 24 pins. Displays results on built-in LCD panel or external monitor/PC system (display of device with connections and status shown).

ChipMaster — *Special Offer:* £749

Very powerful out of circuit IC tester. Tests NAND gates to Z80s! Comprehensive test procedures. Built-in power supply for device under test. Detects intermittent & temperature related faults. Built in liquid crystal display. Can identify unknown or unmarked devices. Displays device number, description, function of pins and equivilents. 40 pin wide entry ZIF socket accommodates all DIL packages. Ideal for the identification & verification of prototyping and preused components for industry and in education.

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SATISFACTION GUARANTEED

Order with confidence. If you don't agree that A B I's equipment offers you the most cost effective fault diagnosis solution.....

WE'LL GIVE YOU ALL YOUR MONEY BACK.

Simply try the equipment for 7 days. If you're not completely satisfied, return the unit in original condition and packaging for a full no quibble and immediate refund.... Complete the form below and return to A B I (no stamp required) with a cheque or Access/Visa account number. Please allow 28 days for delivery.

NAME: ____________ POSITION: ____________

COMPANY: ____________

STREET: ____________

AREA: ____________

TOWN: ____________

COUNTY: ____________ POSTCODE: ____________

TELEPHONE: ____________ FAX: ____________

☐ PLEASE SUPPLY BOARDMASTER 2400 @ £1195 + VAT (£1404.13)

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☐ PLEASE SEND ME DETAILS OF OTHER A B I EQUIPMENT

I UNDERSTAND THAT IF I AM NOT 100% SATISFIED I MAY RETURN UNIT(S) IN GOOD CONDITION WITHIN 7 DAYS FOR A FULL REFUND

I enclose a cheque [ ] made payable to A B I Electronics Ltd OR please debit my Access/Visa card [ ]

Access/Visa a/c number: ____________

Expiry date: ____________

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Includes delivery by carrier to UK mainland address (other areas or overseas by quotation please telephone 0226 350145). Please cut out the coupon and return to the FREEPOST address below: ABI Electronics Ltd. Mason Way, Platts Common Ind. Pk. Barnsley, South Yorkshire, S74 9BR. Mark envelope FREEPOST. Alternatively, please tel: 0226 350145 or fax: 0226 350483

A.Z. ELECTRICS

Stock items despatched by return

Access & Visa Accepted

TDA8160 ORIGINAL £9.50

TRANSISTORS					
BC184	£0.09	BD244	£0.30	BU406	£0.90
BC212	£0.09	BD244C	£0.30	BU406D	£1.50
BC213	£0.09	BD278A	£0.80	BU407	£0.50
BC214A	£0.07	BD434	£0.80	BU426A	£1.00
BC214B	£0.07	BD508	£0.90	BU500	£1.00
BC214L	£0.09	BF195	£0.07	BU508A	£1.00
BC237	£0.07	BF196	£0.15	BU508AF	£1.70
BC238	£0.07	BF197	£0.15	BU508D	£1.00
BC307	£0.12	BF198	£0.07	BU806	£0.75
BC308B	£0.07	BF199	£0.14	BU807	£0.75
BC327-25	£0.07	BF244	£0.40	BUT11	£0.95
BC328-40	£0.05	BF259	£0.22	BUT11AF	£1.95
BC337	£0.07	BF422	£0.15	BUW84	£1.65
BC372	£0.95	BF458	£0.22	BUX84	£0.60
BC392	£1.50	BF459	£0.22	SD12659	£0.75
BC441	£0.25	BF469/BF471	£0.25	T9064V	£2.28
BC461	£0.25	BF471	£0.25	TIP110	£0.45
BC547	£0.07	BF472	£0.25	TIP112	£0.45
BC548	£0.07	BF870/BF472	£0.25	TIP29	£0.30
BC549	£0.07	BU108	£0.75	TIP30	£0.45
BC557	£0.30	BU126	£0.70	TIP31	£0.30
BC559B	£0.07	BU208	£1.00	TIP32	£0.30
BC639	£0.18	BU208A	£1.00	TIP41	£0.27
BC640	£0.30	BU208D	£1.15	TIP42C	£0.40
BD131	£0.50	BU208T	£1.00	TIP47	£0.98
BD132	£0.40	BU326A	£1.00	TIPL791A	£1.20
BD137	£0.35			ZTR604	£0.55
BD237	£0.22			ZTX650	£0.70
BD238	£0.22				
BD243B	£0.30				
BD243C	£0.40				

DIODES AND THYRISTORS					
BA157	£0.07	BY206 (BYB96R)	£0.55	DA91	£0.20
BR100	£0.20	BY210/800/BYV96	£0.55	OT112	£2.20
BR101	£1.40	BY227	£0.20	RGP15G	£0.45
BR103	£0.75	BY228	£0.50	RGP15J	£0.55
BR303	£1.50	BY229	£1.15	RGP15K	£0.35
BRY56	£0.75	BY299	£0.60	RGP30K	£0.70
BT116	£2.50	BY96D	£0.30	RHI	£1.30
BT128P	£4.50	BYV96D	£0.55	RM11C	£0.45
BT129P	£4.50	BYW56	£0.50	SG264	£8.50
BT151/800R	£1.75	BYW96E	£0.50	SG613	£12.00
BY126	£0.20	BYX10	£0.50	SKB02	£0.60
BY127	£0.08	BYX55/600	£0.55	SKB08	£1.20
BY133	£0.20	FB2506	£1.50	SKB2/02	£0.90
BY164	£0.90	IN4001	£0.06	SKB2/08	£1.10
BY164/SKB2/02	£0.90	IN4002	£0.06	SKE1/02	£0.60
BY179	£1.10	IN4004	£0.10	SKE1M15	£0.65
BY179/SK2/08	£1.10	IN4005	£0.10	SKE2G2/02	£0.75
BY184	£0.65	IN4006	£0.08	SKE2G3/04	£1.30
BY189	£2.00	IN4007	£0.08	SKE4F1/04	£0.45
BY190	£2.00	IN4148	£0.10	SKE4F1/06	£0.45
BY223	£2.00	IN5408	£0.25	SKE5F3/10	£2.20
		KBL08	£1.95	SR2M	£0.75
				T9053V	£1.40
				T9064V	£2.28

ASK FOR SEMICONDUCTORS NOT LISTED

VIDEO HEADS

AMSTRAD
3HSSR-VCR7000 (Saisho/Orion) £18.00
PSF1-VCR4500,5200,9000 .... £15.00
PSF2-VCR4600,4700 .... £15.00
PSF3-VCR6000 .... £21.50

FERGUSON
3HSSV-2 Head universal £7.50
3HSSVA-3V42,44,45,46 etc £20.00
3HSS4VB-3V32/HR7655 .... £25.00
3HSS4VC-3V48/HRD565 .... £26.00
3V48,58,59,65,FV10,11, 12,13,14,20,21,26
And most other Fergusons .... POA

HITACHI
3HSSHA-VT8000,9000 series £15.00
3HSSHB-VT11,33 etc £15.00
10082-VT120,220 .... £27.00
10081-VT130,135 .... £30.50

PANASONIC
3HSSN-2 Head universal £7.50
3HSSU1N-NV100,370,380/Philips VR6460 .. £11.00
3HSSU2N-NV230,470,480,G9,10, 11,15PX £21.00
3HSSU3N-NV430,460 .... £13.00
3HSS3N-NV777,330 .... £18.50
3HSS4NB-NV730 .... £19.00
3HSS4NA-NV366 .... £24.00
NVG30,33,40,45,46,130, & most other Panasonics .... POA

SANYO
3HSSSY-VHR1100,1110,1300 .... £18.00
3HSS3SY-VHR1500 .... £34.00

SHARP
3HSSSP-VC9300,9500,9700,381,481, 482,483,486 etc £15.50
3HSSSPB-VC581,583,651,670 etc £15.50
VC7000,8000 series (Brass) £42.00

OTHER MAKES
Alba 4000, Goldstar 8000, Sentra 8000, Solavox 1000 .... £21.00
Fisher FVHP510,520,530,615,710 etc £18.00
Fisher VBS7000,9000 etc £25.00
Hinari VXL2,4,3,20,25 .... £18.00
Hinari VXL5,6,20H £15.00
Mitsubishi HS306,710 .... £30.00
Orion VC150,180,VH1,2,3 etc £18.00
Saisho VR100,605,705,805,905 .... £18.00
Samsung Universal 2 Head £24.25
Toshiba V71,73,74,75,81,82,83,84,85,87 .... £20.00
Toshiba V93 .... £21.00

ASK FOR VIDEO HEADS NOT LISTED
The above heads are new.

BELT KITS
Belt Kits for most models are stocked. Some examples are:

AKAI
VS1,2,5 .... 1.20
VS4,6.9,15 .... 1.10
Ask for models not listed.

AMSTRAD
TVR1,2,3, VCR4600, 4700,5200 .... 1.90
Ask for models not listed.

FERGUSON/JVC
3V00/3V16/3V22 etc 1.60
3V29/3V30 .... 1.20
3V35/36/38/39 .... 1.10
3V42/43/44/45/48/53/54/ 55/57 .... 1.00
Ask for models not listed. Loading belts on certain models also available.

FISHER
FVHP520/530 .... 1.00
FVHP615/620/622/710/711/ 715/716/720/721/725/830/ 840 .... 1.00
FVHP905/906/907/908/910/ 911/915/916 .... 1.20

GRUNDIG
VS400/410/440/450/ 460 .... 0.65
VS180/200/220/262/ 265/267 .... 2.20

VS310/315/320/380/ 385 .... 2.40
Ask for models not listed.

HITACHI
VT11/14/17/19/33/34/35/ 38/39/88 .... 1.30
VT8000/8500 .... 1.00
VT9300/9500/9700 .... 1.00
Ask for models not listed.

PANASONIC
NV230/250/280/370/380/ 430/450/460/465/485/630/ 810/830/850/870/890 .... 1.60
NV300/330/332/333/430/ 366 .... 1.60
NV7000/7200/2000/ 2010 .... 1.50
Ask for models not listed.

PHILIPS
VR6367/6467/6561/6751/ 6760/ 2.25
VR6460/6920/6520 .... 2.40
Ask for models not listed.

SANYO
VTC5000/5150/6500 .... 0.65
VHR1100/1300/1500 .... 1.00
Ask for models not listed.

SHARP
VCF3/VC402/500/571/581/ 582/583/584/585 .... 1.10
VC9300/9500/9700 .... 1.95
VC8000/8300 .... 1.95
Ask for models not listed.

Many other belt kits in stock. Examples are Alba, Funai, GEC, Goldstar, Granada, Grundig, Hinari, ITT, Mitsubishi, NEC, Orion, Saisho, Samsung, Schneider, Sony, Tensai etc.

NEW LINES

LOPT Hitachi CPT1476 .... £18.00
LOPT Hitachi CPT2276 etc £19.00
LOPT Matsui 1440 .... £18.00
Trip Grundig CUC2401 etc £17.00
OTHER GRUNDIG TRIPLERS IN STOCK

LINE OUTPUT TRANSFORMERS

Decca 100 .... 9.50
ITT CVC20 .... 12.50
ITT CVC25/30/32 .... 9.50
ITT Compact 80 Series 110 .... 16.75
ITT Compact 80 Series 90 .... 19.75
ITT CVC45 .... 18.00
ITT 1109F 14.00
ITT CVC1204 .... 11.50
ITT CVC800/1/3 .... 21.50
ITT CVC1100 .... 16.50
ITT CVC1150/1175 .... 20.00
ITT 6325 .... 18.50
ITT 3546 .... 18.50
ITT 1200/1 .... 20.00
Other ITT transformers available
Fidelity all models up to 20" ZX3000 .... 10.50
Fidelity Panel for ZX2000 .... 1.00
Fidelity 22" ZX3000 .... 18.50
Hinari CT4/5 & TVA1 .... 14.75
Philips KT3 .... 12.95
Rank Bush T20A 11.50
Thorn TX100 Green Spot 110 .... 16.75
Ferguson TX90 LOPT specify size/screen 17.75
Ferguson 3V35/36 Mains Transformer 23.00
Ferguson 3V44/44/45 Mains Transformer 18.85
Sony – Please state model for price
Universal Tripler 4.75
Universal Tripler with focus unit 9.50
Decca 120/130 series tripler 8.50
Thorn TX10 Focus Unit Kit 9.00
Hitachi and Matsui LOPTs in stock

VIDEO MOTORS

REEL MOTORS
Ferguson 3V29/30 .... £20.00
Ferguson 3V58,59,65,FV10,11,12,13, 14,20,21,22 .... £17.25
Ferguson FV260 .... £14.50
Hitachi 8000,8300,8500 .... £8.50
Sanyo VTC5000,5150,5400,5300,6500 .... £7.50
Sharp VC9300, 9500 etc, Original £15.00
Panasonic NV333,366 Original £13.20
All other Panasonics .... POA

CAPSTAN MOTORS
Ferguson 3V35,36 Original £22.50
Ferguson/JVC (Mechanical models) £20.00
Hitachi VT11 Original £30.00
Hitachi VT33 Original £32.00
Hitachi VT64 Original £19.75
Hitachi VT8000 series Original £34.50
Hitachi VT9000 series Original £34.50
Sharp VC7000 series Original £30.50

MODE CONTROL MOTORS
Ferguson 3V42,43,44,45,48,49,52,53 .... £6.00
Ferguson 3V58,59,65,FV10,11,12,13,14, 20,21,22,26 .... £4.50

Sharp Reel Motor Pulley only £1.20
Replacement of plastic pulley on a number of Sharp Reel Motors with the above metal pulley gives better rewind/FF performance.

IDLER ASSEMBLIES

FERGUSON
Take up Clutch (Mechanical models) £5.00
3V29/30 Take up Idler £2.00
3V29/30 Take up Clutch £2.85
3V29/30 Reel Idler £3.00
3V35 Reel Idler £3.00
3V35,36,38,39 Take up Clutch £2.85
3V58,59,64,65,FV10,11,12,13,14 Idler Arm .. £1.80
Clutch Assembly 3V44,45,48,49,52,53, 54,55 .... £14.00
Clutch Assembly 3V42,43 .... £14.00

FISHER
FVHP615,905,910, Idler Assembly Original £5.00
FVHP615 Gear Idler Assembly £4.35
FVHP905,910 Gear Idler Assembly £5.00
FVHP520,530 Idler £3.00
FVHP520,530 Pulley £0.70

HITACHI
VT11,33 etc. Original Idler Arm £2.50
VT11,33 etc. Idler Replacement £1.75
VT9300,9500 etc. Play Idler £3.65
VT9300,9500 etc. F/F Idler £2.95
VT9300,9500 etc. Idler £2.95
VT8000,8500 etc. F/F Rew Idler £2.95
VT800,8500 etc. Play Idler Assembly £3.00
VT8000,8500 etc. FF/Rew Pulley £0.70
VT11,33 etc. Clutch Assembly £8.00

PHILIPS
VR6460,6920 Idler Arm (Original) £3.00
DV464,6462,6463,650 etc. Idler Mod. Kit £4.50
VR6542,6843 Reel Idler £6.50
VR6542 Reel Drive Pulley £7.75
VR6843 Reel Drive Pulley £9.50

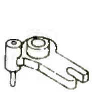
PANASONIC (All Original)
NV370 Idler Arm Unit VXP0521 Gen. £3.00
NV8600,8610 Play Idler VXP0243 .... £0.95
NV332,777,788 Idler Unit VXP0463 .... £3.00
NV600,688 Idler VXP0515 .... £3.00
NV333,366 Idler Arm 2 Unit VXL0997 .... £10.50
NV8400,8600,8610 etc. VXP0245 .... £0.95
NV333,366 etc. Idler VXP0401-NV700,7200, 7800 Idler VXP0344 .... £0.90
NV2000,3000 Play Idler VXP0331-
NV2000,3000 Idler Unit VXP0329 .... £1.10
Back Tension Bands .... From £1.50
All Panasonic Maintenance Kits .... POA
QUOTE PANASONIC PART No. FOR PARTS NOT LISTED

SANYO
Idler VHR1100,1300,1500 .... £5.50
Idler VHR2100,2300,2500,2700 .... £5.50
Reel Drive Pulley Unit VTC5000,5150,6500 .... £5.00
Idler Roller Assembly VTC5000,5150,6500 .... £2.25

SHARP
Idler VC9300,9500 etc. £1.75
Idler VC481,581 etc. £1.95
Idler (original) VC9300,481,581 etc. £3.50
Idler Assembly (original) VC651,681,685 .... £6.50
Idler Assembly (original) VC780,781,785,787, 793,VCT72 .... £6.50

AMSTRAD
4500,4600 MOD KIT INCLUDES PINCH ROLLER AND IDLER CLUTCH £5.00

Limiter Post Assembly £1.75
Makes & Models: Hinari VXL4, Matsui VX730,735,735A,755,770, 800A,810,820,880,990. Saisho VR1100,1200,1200HQ,1600,2500, 3200,3300,3300X,3500, 3600,3700



IDLERS FOR AKAI, SAMSUNG, MITSUBISHI, NEC, ETC. IN STOCK

REMOTE CONTROLS

Ferguson, Grundig, ITT, Philips, Pye, Sony, Hitachi, Matsui, Logik, Panasonic, Saisho, Salora, Samsung, Tashiko, Tatung, Toshiba. Various models TV & Video .... **From £14.50**

MANY HITACHI TV REMOTE CONTROLS NOW IN STOCK.

SONY REMOTE CONTROL RUBBER PADS.
STATE MODEL FOR PRICE.

New Additions
Universal Remote Control £25.00
Sony type RC670, RM670, RM673 ..... from £15.50
Sony type RC661, RM652, RM654, RM657, RM663, RM664, RM651 .... from £15.50
Panasonic Models TC2110, 2255, 2655, 2680, TX1752, 2251, 2656, 5500 .... from £14.50
Panasonic Models TC1632, 1642, 2232, TX2034, 2044, 2200, 2234, 2244, 2636, 3300 .. from £14.50

TV ON/OFF SWITCHES

ITT, Philips, Decca, Thorn, Fidelity, Grundig, Sony and Hitachi. State model for price.

PINCH ROLLERS

A range of Pinch Rollers is in stock, most of them @ **£2.80**. Makes include Akai, Amstrad, Ferguson, Fisher, Funai, GEC, Goldstar, Grundig, Hinari, Hitachi, ITT, JVC, Marantz, Mitsubishi, NEC, Nordmende, Orion, Panasonic, Philips, Samsung, Sanyo, Schneider, Sharp, Sony, Tensai, Thomson, Toshiba etc. Please state model and make.

Philips Pinch Roller for models VR6180, 6185, 6285, 6362, 6367, 6467, 6468, 6470, 6561, 6670, 6760, 6761, 6870 .... **£6.90**

OTHER SPARES

Universal Video Copying Kit £4.25
Universal Copying Kit (Scart) £5.20
Universal Camcorder Kit £6.90
Video Cassette Lamps from £0.50
CRT Anode Caps £0.60
Video Tape Splicing Kit £6.95
Hitachi TV Frame Module HM6251 .... £5.50
Hitachi TV Frame Module HM6232 .... £5.50
Cassette Housing Assembly Ferguson 3V35,36,38,39,42,43,44 .... £25.25
Cassette Loading Roller Assembly 3V23,3V31, 3V32 .... £3.50
Philips 1.2V Back up Battery £1.75
Philips 2.4V Back up Battery £2.80
5.5V Back Up Cap £1.85
Degaussing Positor Blue £3.00
Degaussing Positor White £1.30
Cassette Housing Assembly Hitachi VT11 .... £19.50
End Sensor for Hitachi VT63,64,65 (Pair) £2.75
Cassette LED Sensor for Panasonic etc £1.60
I.C. Circuit Protectors £0.60
Clear Service Cassette £5.90
Push Button Unit Thorn TX90 .... £12.75
Matsui/Saisho Limiter Post £1.75
Cassette Housing Modification Kit for Sharp VCA113HM Series. Includes cassette switch and star sensor PCB. Fault symptom No eject & intermittent load/unload £6.50
Video Idlers Spring Kit £5.95
Video Washer & E Clip Kit £5.50
Universal Video head Puller £16.00

MANY OTHER VIDEO AND TV SPARES IN STOCK

Back Tension Bands in Stock for Akai, Fisher, Hitachi, Ferguson, JVC, Mitsubishi, Panasonic, Sanyo and Sharp.

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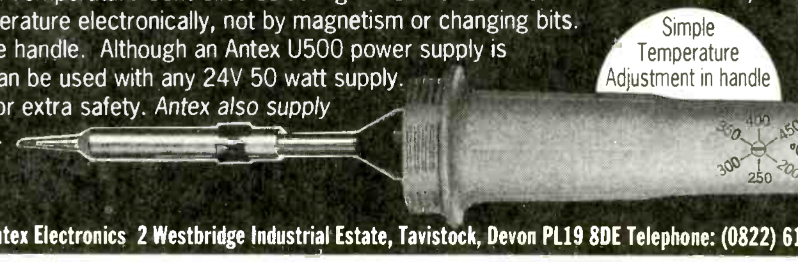

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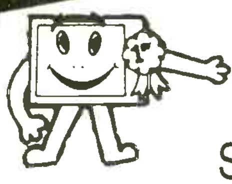

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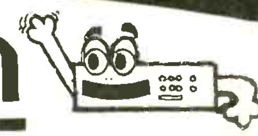

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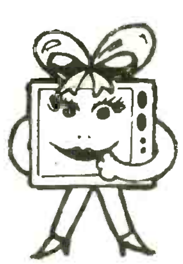

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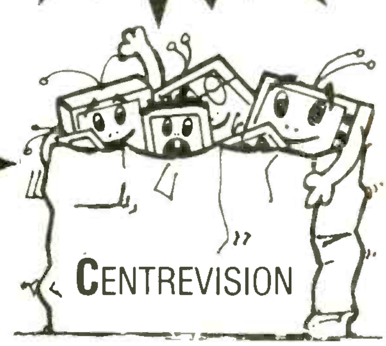

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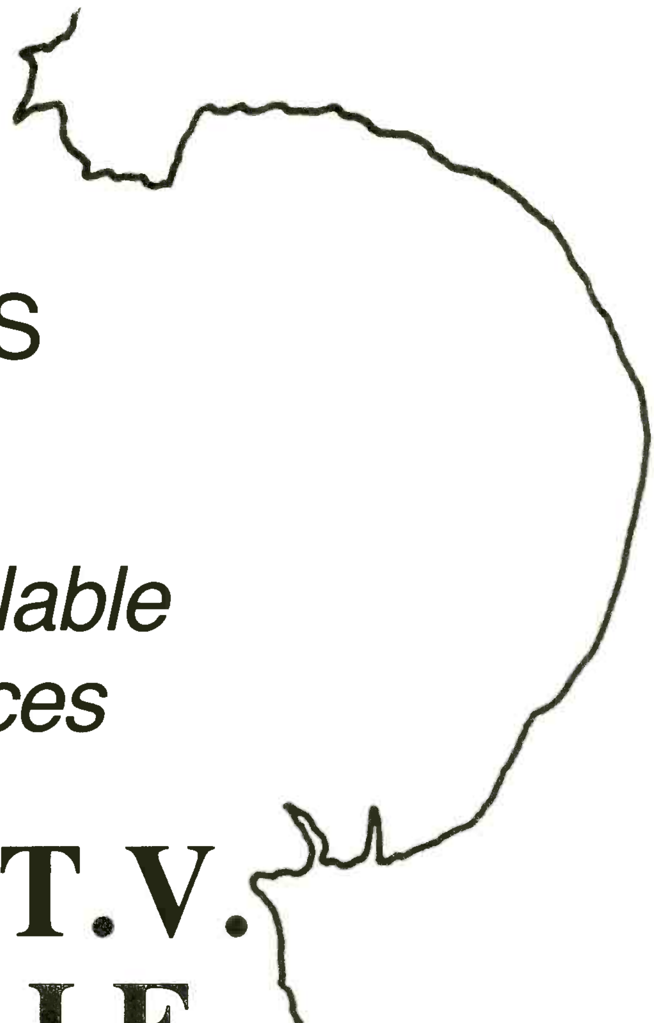

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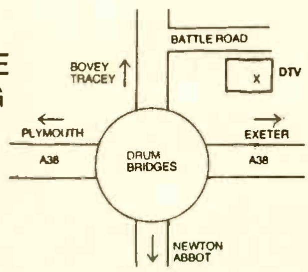

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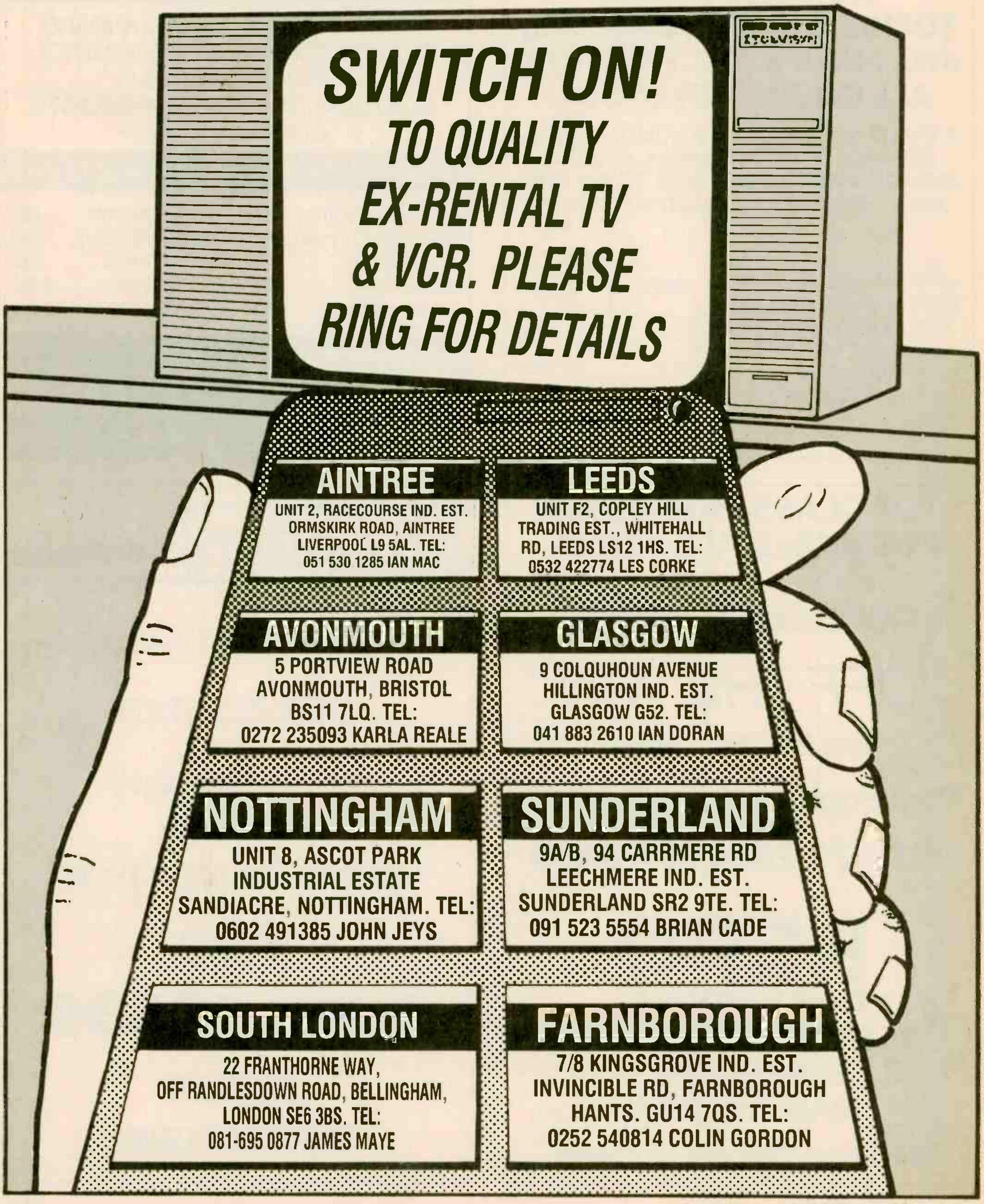
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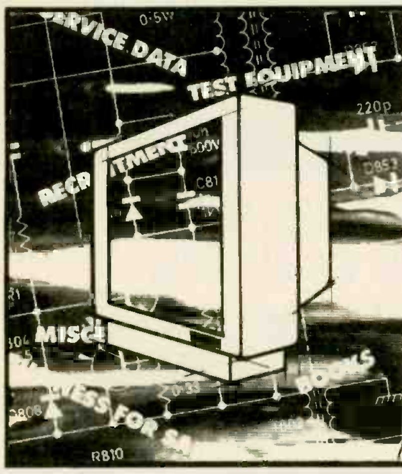

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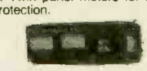

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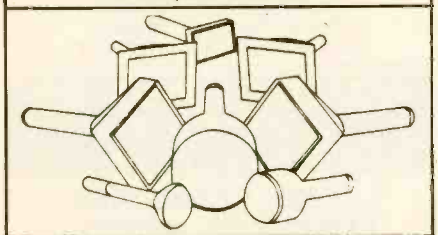

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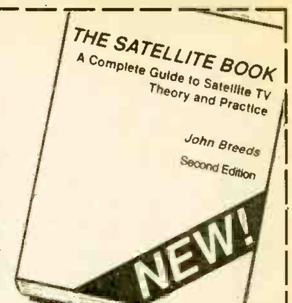

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- Diamond Colour Grid — £16.50
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- Yagi 20 A, B, CD OR WB — £19.56
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- Unix 92 B — £42.77
- Unix 92 CD — £39.25
- Unix 92 WB — £39.25
- BB Grid — £17.64
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- FM Omni — £7.35
- FM Dipole Heavy Duty — £3.32
- FM 2 Ele. Heavy Duty — £4.82
- FM 3 Ele. Heavy Duty — £7.56

THE TRIAX RANGE
- FM Omni — £6.58
- FM 2MT — £9.52
- FM 3MT — £10.84
- FM 4MT — £12.42
- FM 5MT — £14.30
- FM 5 Stereo — £16.08
- FM 8 Stereo — £26.63

Sat. Antenna

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all 22° off set reflectors complete with wall bracket
- 55cm Square Black Mesh >36dB — £28.13
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- 80cm Oval Light Solid 39dB — £40.13
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- 1 M. Oval Black Solid ®41dB — £0.00

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- 40mm LNB clamp (replacement) — £3.75
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- 45cm Flat plate antenna — £87.00

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FSS = 10.95 to 11.75 GHz
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K5 = 12.5 to 12.75 GHz Telecom

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- FSS 1.1dB — £60.00
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- K5 4 bolt fix Maspro 1.5dB — £35.00

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- Blue Cap, Cap Only — £2.50
- White LNB Cover — £2.50
- Black LNB Cover — £2.50
- Black Radome Cover — £2.50

LNB Feeds, Polorota

Feeds
- Horn offset C120 32mm collar — £12.00
- Horn offset WR75 32mm collar — £12.00
- Horn offset C120 40mm collar — £15.00
- O.M.T. V/H Microwave Splitter — £46.00

Feeds with combined Magnetic Polorota
- Horn offset C120 32mm collar — P.O.A.
- Horn offset WR75 32mm collar — P.O.A.
- Polyrod Lens offset WR75 23mm — £25.95
- Polyrod Lens Prime WR75 23mm — £25.95

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- Racal C120 — £29.95
- Racal WR75 — £29.95

Pulse to Magnetic Polorota Interface
- IRTE Interface P. to Mag — £19.95

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Antenna to Mast Clamps
- 15mm Aerial to 2" Mast Clamp — £0.30
- Universal Aerial Cross Clamp — £0.65
- Amstrad Dish to Mast Clamp — £2.75
- Lenson Heath Mast Adapter — £6.00

Mast to Mast Clamps
- Universal Mast Cross Clamp — £0.75
- Universal Mast to Mast Clamp — £1.60
- 2" x 15" Mast Coupler — P.O.A.

"V" Bolts & Mast Grippers
- 1.75" V Bolt & M8 Nut — £0.12
- 2.5" V Bolt & ⅜ Nut — £0.22
- 2.5" "V" Bolt & M6 Nut — £0.12
- Universal Mast Gripper — £0.38

Masting

Alloy Straight Masts
- 1' × 1" 18g (1.2mm) — £0.34
- 3' × 1" 18g (1.2mm) — £1.02
- 5' × 1" 18g (1.2mm) — £1.63
- 6' × 1" 18g (1.2mm) — £1.93
- 10' × 1.5" 16g (1.6mm) — £6.95
- 13' × 1.5" 16g (1.6mm) — £9.05
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- 20' × 2.0" 14g (2.0mm) — £26.00
- 20' × 2.0" 10g (3.0mm) — £40.00
- 20' × 2.0" 7g (4.0mm) — P.O.A.

Steel Straight Masts
Prime Steel to BS6323
Zinc Plated Inside & Out
- 13' × 1.5" 18g — £4.62
- 13' × 1.5" 16g — £6.09
- 20' × 2.0" 18g — P.O.A.
- 20' × 2.0" 16g — £12.74

Steel (Not Perfect) Seconds
Subject to availability
- 5' × 1.0" — P.O.A.
- 6' × 1.0" — P.O.A.
- 10' × 1.0" — P.O.A.
- 10' × 1.25" — P.O.A.
- 13' × 1.5" — P.O.A.
- 16' × 2.0" — P.O.A.
- 18' × 2.0" — P.O.A.
- 20' × 2.0" — P.O.A.

Alloy Shaped Masts
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- 3' × 1" 18g L-Cranked — P.O.A.
- 3' × 1" 18g S-Cranked — £1.22
- 5' × 1" 18g Cranked — £1.95
- 6' × 1" 18g Cranked — £2.28
- 6' × 1.25" 18g Cranked — £12.82

Bracketry

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Aluminium Painted
- 6" × 6" Welded Painted Ch — £0.98
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- Double Lash Pair Welded — £2.85

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- Standard Repair Kit — £1.28
- 5 Meter Wire Coil — £0.80
- 25 Kilo Lashing Wire — P.O.A.
- Metal Thimble — P.O.A.
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- Corner Plates Extra — £77.77
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- 2.5" V-Bolt & ⅜" Nut — £0.22

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- 24" T&K Welded Painted Wa — £5.35

FIXINGS

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Bolts have 13mm Hex Head & Nylon Plugs require a 10mm Bore Hole
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- Mungo 10×90mm Nylon P. & Bolt — £0.32
- Spit 10×60mm Nylon P. & Bolt — £0.19
- Hilti HRD-H 10/10S P. & Bolt — £0.32
- Mungo 10×50mm Ny.P. & Bolt per 100 — £13.00
- Spit 10×60mm Ny. P. & Bolt per 100 — £13.00

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- Spit 10×70mm Steel Exp. An — £0.32

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- 5mm Round Whitel Uni-Clip — £0.78
- 6mm Round Black Uni-Clip — £0.78
- 6mm Round White Uni-Clip — £0.78
- 7mm Round Black Uni-Clip — £0.78
- 7mm Round Brown Uni-Clip — £0.78
- 7mm Round White Uni-Clip — £0.78
- 9mm Round Black Uni-Clip — £0.95
- 9mm Round White Uni-Clip — £0.95
- 11mm Round Black Uni-Clip — £1.25
- 13×6mm for Sat1002 Bl. Clip — £2.25
- 26×7mm for K1015 Bl. Clip — £2.25

THE TOWER CLIP RANGE
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- 6+mm Round White Tower Clip — £0.78

Adhesive Tape (PVC
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COAXIAL CABLE 75 ohm

Attenuation figures are approx at 900MHz per 100 Meters

THE VOLEX RAYDEX RANGE
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- C55W1 21dB White 100m Drum — £11.95
- C56B1 17dB Black 100m Drum — £11.95
- C56W1 17dB White 100m Drum — £11.95
- SAT100B1 Black 100m Drum — £16.99
- SAT100W1 White 100m Drum — £16.99
- SAT1002 Coax + 2 Core Black — £35.00
- K1015 Coax + 7 core Black — £92.00
- CT100B1 19dB Bl. 100m Drum — £20.00
- CT100W1 19dB Wh. 100m Drum — £20.00
- CT125B1 15dB Bl. 100m Drum — £26.00
- CT125W1 15dB Wh. 100m Drum — £22.00
- C55B2 21dB Brown 250m Drum — £28.95
- C55W2 21dB White 250m Drum — £28.95
- C56B2 17dB Black 250m Drum — £28.95
- C56W2 17dB White 250m Drum — £28.95
- SAT100B2 Black 250m Drum — £41.95
- SAT100W2 White 250m Drum — £41.95
- CT100B2 19dB Bl. 250m Drum — £48.50
- CT100W2 19dB Wh. 250m Drum — £48.50
- CT125PE 15dB Bl. 250m Drum — P.O.A.
- CT167PE 11dB Bl. 250m Drum — £160.00
- CT233PE 9dB Bl. 250m Drum — P.O.A.

Under Ground & Heavy Industrial use
- CT100RBS 19dB 250m Drum — P.O.A.
- CT125RBS 15dB 250m Drum — P.O.A.
- CT167RBS 11dB 250m Drum — £230.00
- CT233RBS 9dB 250m Drum — P.O.A.
- CT100RBS 19dB 500m Drum — P.O.A.
- CT125RBS 15dB 500m Drum — P.O.A.
- CT167RBS 11dB 500m Drum — £460.00
- CT233RBS 9dB 500m Drum — P.O.A.

THE DS COAX RANGE
- DS75 26dB Black 250m Drum — £52.50
- DS100 19dB Black 250m Drum — £37.95
- DS165 11dB Black 250m Drum — £145.00

COAX.-CONNECTORS

PIB Connector Sealing Tape
- 19mm × 10m PIB Self Amalg. — £3.50
- 25mm × 10m PIB Self Amalg. — £4.25

Standard Coax Connectors
- Coax Plug Alloy British each — £0.20
- Coax Plug Alloy Screw on each — £0.30
- Coax Coupler British Wh. each — £0.20
- Coax Coupler British Bl. each — £0.20
- Coax Plug Alloy British per 100 — £12.95
- Coax Plug Alloy Screw on per 50 — £12.95
- Coax Coupler British Wh. per 50 — £5.95
- Coax Coupler British Bl. per 50 — £5.95
- F-Screw on CT100/RG6 each — £0.20
- F-Screw on C56 each — £0.20
- F-Crimp Bonded Ring CT125 each — £0.50
- F-Crimp Bonded Ring CT167 each — £1.00
- F-Crimp Loose Ring CT100 each — £0.20
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- F-Coupler Plug to Plug each — £0.50
- F-Push on Socket to Plug each — £0.50
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- F-Screw on C56 per 100 — £13.00
- F-Crimp Bonded Ring RG6 per 100 — £12.00f10
- F-Crimp Loose Ring RG59 per 100 — £6.00
- F-Crimp Loose Ring RG59 per 1000 — £50.00
- F-Coupler Socket to Socket per 100 — £14.00

WALL PLATES

Domestic Flush Sockets
- Single SCS (Standard Coax Socket — £0.75
- Double Two Coax Feed SCS — £0.95
- Double Two Coax Feed SCS/F — £0.95
- Double Diplexed TV/FM SCS — £2.60

Domestic Surface Mount Sockets
- Single SCS (Standard Coax Socket — £0.58
- Twin Single Coax Feed SCS — £0.90
- A-B Switch Coax SCS — £1.25
- Double Two Coax Feed SCS/F — £0.80

Teleste Domestic Flush Sockets
- 9003/00 Single SCS — £2.38
- 9115 Single F — £2.56
- 9117 Diplexed TV/Sat. SCS/F — £9.03

Teleste Flush Sockets
All Plates Isolated to BS415
- 9003/01 Single SCS — £2.38
- 9009 Diplexed TV/Fm SCS — £4.83
- 9044 Two Way Split SCS — £4.17
- 9122 Single F — £3.73
- 9117 Diplexed TV/Sat. SCS/F — £7.77

Teleste Trunking Socket
- 9110 Trunking Socket SCS Iso — £3.94

Wolsey Flush Sockets
All Plates SCS & Isolated to BS415
- P01U Single Iso — £2.65
- P02U Double Iso. TV/FM — £3.64
- P02UD Double Iso. UHF/VHF — £4.73
- P01U/11,15,20,26,32 or 38dB Tap — £4.15
- P02U/20,26 or 38dB Tap. Twin Iso — £5.53
- P01U/16dB Tap Terminated, Iso — £4.90
- P02U/16dB Tap Terminated, Iso — £5.53
- P02U/RSI Two Way Splitter, Iso — £3.80

AMPLIFIERS

Teleste Mast Head Amplifier 40-860Mhz
- 7274 Multi-4 Dist. Amp. Inc. Ps — £20.93
- 7273 Multi-3 Dist. Amp. Inc. Ps — £20.93
- 7271 UHF Pre-Amp. 15dB — £8.00
- 7066 UHF Pre-Amp. 26dB — £10.98
- 7080/10 UHF Cascade Ampl 26dB — £15.03
- 7065 40-860 Mhz Pre-Amp. 26dB — £14.76
- 7268/A UHF-A Pre-Amp. 29dB — £13.34
- 7268/B UHF-B Pre-Amp. 29dB — £13.34
- 7268/CD UHF-CD Pre-Amp. 29dB — £13.14
- 7261 Power Supply 12V DC 23mA — £7.85
- 7262 Power Supply 12V CD 80mA — £12.92

Wolsey Mast Amplifier 40-860Mhz
- Q140 UHF Pre-Amp. 14dB — £9.45
- Q150A UHF-A Pre-Amp. 15dB — £9.89
- Q150B UHF-B Pre-Amp. 15dB — £9.89
- Q150CD UHF-CD Pre-Amp. 15dB — £9.89
- Q260 UHF Pre-Amp. 26dB — £10.55
- Q261 UHF Cascade Amp. 26dB — £21.03
- Q300A UHF-A Pre-Amp. 29dB — £11.48
- Q300B UHF-B Pre-Amp. 29dB — £11.48
- Q300CD UHF-CD Pre-Amp. 29dB — £11.48
- P20 Power Supply 12V DC 22mA — £8.78
- P80 Power Supply 12V DC 80mA — £16.41

Teleste Multi-outlet Amplifier
Frequency 40-860MHz
- 1-Way 1 in : 1 out 7291 — £14.75
- 2-Way 1 in : 2 out 7292 — £15.81
- 3-Way 1 in : 3 out 7293 — £17.78
- 4-Way 2 in : 4 out 7294/00 — £24.00
- 6-Way 2 in : 6 out+1 7296/00 — £30.00
- 8-Way 2 in : 8 out+1 7298/00 — £36.00

Wolsey Multi-outlet Amplifier
- 1-Set UHF 1 in : 1 out 11dB — £9.95
- Booster 23 V/U 1 in : 2 out 23dB — P.O.A.
- 2-Set UHF 1 in : 2 out 7dB — £9.95
- 3-Set UHF 1 in : 3 out 12-9dB — £12.95
- 3-Set UHF/FM 2 in : 3 out 12-9dB — P.O.A.
- 4-Set UHF 1 in : 4 out 12-6dB — £16.95
- 4-Set UHF/FM 2 in : 4 out 12-6dB — P.O.A.

J. W. Hardy Multi-outlet Amplifier
- 4-Way UHF 3dB — £12.95
- 8-Way UHF 2dB — £18.95

VideoLab Multi-outlet Amplifiers
- 1-Way Lab Amp. 13dB — £6.95
- 1-Way Lab Amp. 6-18dB Variable — £7.95
- 2-Way Lab Amp. 2×10dB — £6.95
- 6-Way Lab Amp. 6×5dB+1×21dB — £16.95
- 8-Way Lab Amp. 8×6dB+1×21dB — £21.50

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- 28dB-45dBmV 40-860Mhz 1:1 7264 — £40.22
- 32dB-51dBmV 40-860Mhz 1:2 7281 — £61.00
- 32dB-51dBmV Diplex in V/U 7282 — £76.12
- 35dB-52dBmV Split Band V/U 7245 — £110.25
- 43dB-61dBmV Split Band V/U 7250 — P.O.A.
- 43dB-61dBmV UHF Only 7255 — P.O.A.
- 50dB-61dBmV Split Band V/U 7200 — £200.91
- 50dB-61dBmV UHF Only 7205 — £110.25
- 44dB-41dbmV .95-11.75GHz 5100 — £176.00

Wolsey MATV Amplifiers
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- 35dB-48dBmV VHF/UHF 1:2 Topaz — £75.37
- 35dB-48dBmV FM/UHF 2:1 Ruby FM — £82.94

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- VHF/UHF Split Band 1 in : 1 out 55V — £218.78
- 55V Line Powered Source — £181.50

ATTENUATORS 75ohm

- Atten. 3,6,9,12,18,24dB British — £1.24
- Atten. F-Type 3,6,10,20dB — £1.50
- Atten. F-Type 3,6,10,20dB DC pass — £2.10

FILTERS

Outdoor/Indoor Components
- UHF-2 way Split/Combin. DC pass — £9.30
- 40-860Mhz 2 way Split/Comb. DC pass — £5.60
- VHF/UHF Diplexer — £6.60
- UHF-Group A Pass Filter 9034-A — £12.20
- UHF-Group B Pass Filter 9034-B — £12.20
- UHF-Group CD Pass Filter 9034-CD — £12.20

Indoor Components
- UHF High Pass Filter — £2.27
- VHF-Band 2 Pass Filter — £14.00
- UHF-Band 4 Single Notch Filter — £8.95
- UHF-Band 5 Single Notch Filter — £8.95
- UHF-Band 4 Double Notch Filter — £18.50
- UHF-Band 5 Double Notch Filter — £18.50
- VHF-Band 2 Double Notch Filter — £18.50
- UHF-2 ch. Filter/Equaliser 1-2:1 — £38.85
- UHF-4 ch. Filter/Equaliser 1-4:1 — £65.00
- UHF-6 ch. Filter/Equaliser 1-6:1 — £92.00
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- 2.5A 19V 240 Mains MHP292 — £49.80
- 3.5A 19V 240 Mains MHP293 — £58.80
- Dual Power Lead ADC321 — £4.00
- Band-2 13dB-15dBmV MHU202 — £29.80
- Band-1 13dB-15dBmV 1-Ch. MHT10 — £129.80
- Band-3 13dB-15dBmV 1-Ch. MHT303 — £29.80
- UHF 13dB-15dBmV 1-Ch. MHT505 — £29.80
- UHF-TV Modulator MHM501 — £190.50
- VHF-TV Modulator MHM301 — £190.50
- UHF-TV Mod'tor Rad. Tuner MHR501 — £288.00
- VHF-TV Mod'tor Rad. Tuner MHR301 — £288.00
- VHF-TV Mod'tor Sat. Tuner MHS301 — £309.00
- UHF-TV Mod'tor Sat. Tuner MHS501 — £309.50
- Video Decoder Adaptor MHS001 — £10.10
- Audio Demods 6 Types MHD+++ — £17.90
- 47-860Mhz 27dB-48dBmV Amp MHA101 — £44.60
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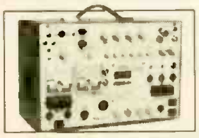

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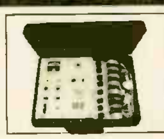

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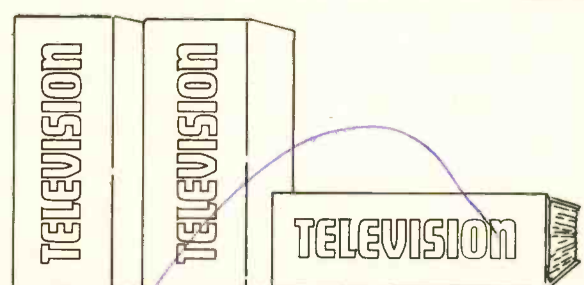

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BY 227	15p
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BYF 3214	40p
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Y 729	30p
Y 730	10p
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Y 860	30p
Y 933	5p
Y 969	50p
Y 997	30p
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R 1038	40p
R 1039	40p
R 2009	80p
R 20106	£1.00
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R 2210	60p
R 2257	60p
R 2265	50p
R 2305	50p
R 2306	30p
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TIP 30	25p
TIP 30A	25p
TIP 30B	25p
TIP 30C	25p
TIP 31	25p
TIP 32	25p
TIP 33B	50p
TIP 33C	70p
TIP 34A	50p
TIP 34B	60p
TIP 34C	70p
TIP 35B	50p
TIP 35C	70p
TIP 35D	80p
TIP 36	50p
TIP 36C	70p
TIP 41	15p
TIP 41B	40p
TIP41D	70p
TIP 42	10p
TIP 42/BRC 6109	10p
TIP 48	40p
TIP 49	30p
TIP 57	30p
TIP 100	30p
TIP 102	30p
TIP 110	20p
TIP 115	50p
TIP 117	50p
TIP 125	35p
TIP 126	40p
TIP 127	40p
TIP 130	30p
TIP 131	6p
TIP 136	30p
TIP 140	50p
TIP 142	80p
TIP 540	50p
TIP 2955	35p
TIP L761A-1000V/4Amp	75p
T6032	30p
T6036	40p
T6040	40p
T6047	40p
T6049	40p
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