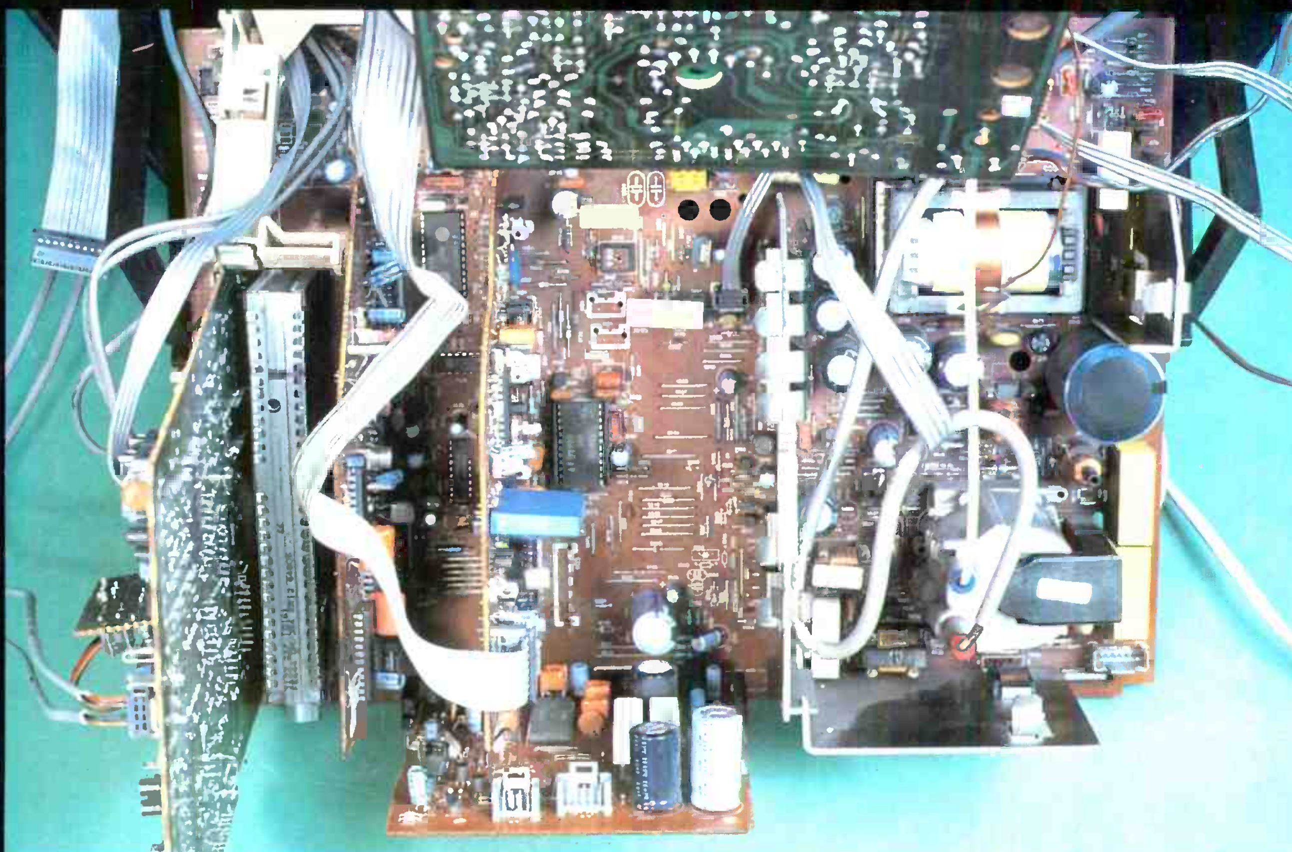
OCTOBER 1993 £2.20

TELEVISION

SOUTHLAND NEWSAGENCY

SERVICING·VIDEO·SATELLITE·DEVELOPMENTS

FREE TV/VIDEO SPARES GUIDE



Servicing the Philips 3A Chassis

Sync and TB Generator Circuits

Fault Notes from Toshiba · DX-TV

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VCR Clinic · TV Fault Finding

A REED BUSINESS PUBLICATION

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October 1993

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On sale September 15th

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2N6403	160p
3N143	65p
DIODES	
Rectifier Diodes	
BY127	8p
BY133	8p
BY164	40p
BY179	35p
BY184	32p
BY196	20p
BY206	11p
BY207	11p
BY210	22p
BY225	120p
BY227	19p
BY228	28p
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BY298	23p
BY299	22p
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BYX55/600	25p
BYX70/500	32p
OA47	10p
OA90	10p
OA91	10p
OA200	10p
OA202	10p
IN.914	2p
IN.4001	3p
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IN.4007	4p
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IN.5400	9p
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IN.5408	12p
RGP15	15p
RGP30	16p
SKE4F2/06	60p
SKE4F2/08	80p
SKE4F2/10	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	5p
1.3W	
BZX61 RANGE	
2V7 to 39V	9p
CRYSTALS	
Freq in MHz	
1.0	260p
2.4576	180p
3.276	115p
4.0	110p
4.194	130p
4.43	95p
5.0	130p
6.0	115p
10.0	140p
11.0	250p
12.0	120p
14.756	200p
15.0	160p
18.0	130p
18.432	130p
24.0	250p
48.0	160p
VOLTAGE REGULATORS	
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7806	25p
7808	25p
7812	25p
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7824	25p
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7908	30p
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LM317K	200p
LM317T	100p
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EL34	300p
EL95	85p
EL500	100p

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PL519	430p
PY81	100p
PY88	100p
PY500A	190p
LED's	
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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	
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AN210	165p
AN214Q	170p
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CX175	325p
CX186	750p
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CX804A	775p
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CX867	575p
CX868	525p
CX877	300p
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LINEAR ICs – Cont.	
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2SC3890	150p
2SC3895	400p
2SC3897	650p
2SC3907	420p
2SC3909	450p
2SC3927	560p
2SC3946	120p
2SC3950	120p
2SC3953	120p
2SC3954	150p
2SC3973	275p
2SC3975	275p
2SC3987	220p
2SC3996	1200p
2SC4006	100p
2SC4020	280p
2SC4023	325p
2SC4056	350p
2SC4106	200p
2SC4123	450p
2SC4124	250p
2SC4169	60p
2SC4236	550p
2SC4237	750p
2SC4242	200p
2SC4262	50p
2SC4301	550p
2SD198	140p
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2SD200	210p
2SD201	260p
2SD257	195p
2SD313	40p
2SD315	75p
2SD325	30p
2SD330	110p
2SD348	460p
2SD357	40p
2SD358	40p
2SD371	240p
2SD380	650p
2SD381	80p
2SD388	170p
2SD389	90p
2SD400	14p
2SD401	50p
2SD402	120p
2SD415	120p
2SD424	400p
2SD426	150p
2SD427	350p
2SD438	45p
2SD467	15p
2SD468	25p
2SD471	75p
2SD525	50p
2SD526	70p
2SD545	60p
2SD549	120p
2SD551	400p
2SD555	500p
2SD560	150p
2SD571	80p
2SD575	530p
2SD600	30p
2SD601	40p
2SD602	60p
2SD612	50p
2SD613	70p
2SD636	10p
2SD637	40p
2SD638	60p
2SD639	60p
2SD640	350p
2SD642	50p
2SD655	60p
2SD661	60p
2SD666	70p
2SD667	70p
2SD668	120p
2SD669	40p
2SD673	350p
2SD676	250p
2SD716	80p
2SD717	180p
2SD718	100p
2SD722	240p
2SD725	270p
2SD734	60p
2SD-741	120p
2SD-743	130p
2SD-756	100p
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2SD-762	140p
2SD-763	140p
2SD-768	180p
2SD-772	200p
2SD-773	40p
2SD-774	60p
2SD-777	400p
2SD-784	650p

2SD-786	100p
2SD-787	80p
2SD-788	100p
2SD-789	80p
2SD-792	400p
2SD-794	100p
2SD-795A	140p
2SD-811	450p
2SD-819	400p
2SD-820	450p
2SD-821	550p
2SD-822	400p
2SD-826	100p
2SD-836	60p
2SD-836A	60p
2SD-837	80p
2SD-838	400p
2SD-841	160p
2SD-844	200p
2SD-845	250p
2SD-850	260p
2SD-856	48p
2SD-858	250p
2SD-863	60p
2SD-864	200p
2SD-866	120p
2SD-866A	140p
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2SD-879	60p
2SD-880	40p
2SD-882	80p
2SD-892A	100p
2SD-894	120p
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2SD-921	320p
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2SD-947	100p
2SD-950	300p
2SD-951	350p
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2SD-965	100p
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2SD-973	60p
2SD-973A	70p
2SD-985	120p
2SD-986	120p
2SD-1012	60p
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2SD-1024	130p
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2SD-1031	130p
2SD-1037	750p
2SD-1046	200p
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2SD-1160	150p
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2SD-1168	425p
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2SD-1391	450p
2SD-1392	150p
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2SD-1397	175p
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2SD-1399	300p

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2SD-1402	280p
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2SD-1913	50p
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2SD-1961	50p
2SD-1978	50p
2SD-1984	150p
2SD-2012	50p
2SD-2046	50p
2SJ-48	425p
2SJ-49	425p
2SJ-50	425p
2SJ-56	700p
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2SJ-75	280p
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2SJ-77	350p
2SJ-79	225p
2SJ-103	75p
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2SJ-162	680p
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2SK-56	100p
2SK-68	100p
2SK-73	75p
2SK-106	40p
2SK-107	40p
2SK-109	120p
2SK-118	50p
2SK-125	100p
2SK-133	650p
2SK-134	415p
2SK-135	415p
2SK-147	160p
2SK-150	150p
2SK-162	115p
2SK-163	40p
2SK-168	40p
2SK-176	800p
2SK-192	45p
2SK-196	150p
2SK-197	140p

2SK-214	170p
2SK-216	200p
2SK-217	35p
2SK-218	400p
2SK-240	140p
2SK-270	50p
2SK-294	350p
2SK-310	200p
2SK-312	750p
2SK-315	70p
2SK-320	120p
2SK-322	140p
2SK-323	130p
2SK-358	300p
2SK-370	40p
2SK-371	40p
2SK-386	600p
2SK-388	850p
2SK-405	450p
2SK-413	500p
2SK-414	500p
2SK-415	500p
2SK-429	180p
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2SK-872	950p
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2SK-51	100p
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2SK-73	60p
2SK-74	50p
2SK-77	50p
2SK-81	50p
2SK-86	160p
2SK-87	45p
2SK-88	70p
2SK-121	150p
2SK-128	175p
2SK-165	225p
2SK-166	300p

COMPUTER IC's	
2114	150p
2532	200p
2716	100p
2732	200p
2732A	220p
2764	150p
27C64	200p
27128	150p
27256-25	150p
27512	300p
4116	40p
4164-15	80p
4164-12	90p
4164-10	100p
41256-15	80p
41256-12	100p
41256-10	110p
41464-12	150p
41464-10	200p
6116	80p
6264-15	160p
6264-12	200p
6264-10	210p
62256-12	300p
6502	300p
6502A	360p
65C02	930p
6522	280p
6551	380p
6800	210p
6802	220p
6803	500p
6808	500p
6809	500p
6810	150p
6818	380p
6840	290p
6845	200p
6850	90p
8080A	380p
8085A	300p
8086	500p
8088	480p
8156	300p
81LS96	130p
81LS97	130p
81LS98	130p
8224	240p
8226	240p
8243	250p
8250	750p
8251	200p
8253	180p
8255	160p
8256	700p
8257	220p
8271	3400p
8279	270p
8283	400p
8284	440p
8287	280p
8288	650p

8748	700p
8755	800p
Z80ACPU	100p
Z80BCPU	160p
Z80ADMA	200p
Z80APIO	150p
Z80BPIO	150p
Z80ACTC	140p
Z80BCTC	200p
Z80ASIO	210p
Z80ASIO-1	210p
Z80ASIO-2	210p
Z80ADART	260p
74S289	180p
74S387	200p
75107	65p
75110	75p
75113	100p
75122	110p
75150	95p
75154	100p
75162	700p
75182	95p
75183	95p
75188	55p
75189	55p
75195	185p
75451	40p
75454	65p
75492	55p
8T26	95p
8T28	110p

SIMMS	
256K×9-80	1000p
256K×9-70	1100p
1MB×9-80	3000p
1MB×9-70	3200p

SIPS	
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256K×9-70	1200p
1MB×9-80	3100p
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OPTO COUPLERS	
4N25	50p
4N26	50p
4N27	50p
4N28	50p
4N29	90p
4N30	90p
4N31	90p
4N32	100p
4N33	100p
4N36	58p
4N37	58p
4N38	68p

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W005 1A/50V	16p
W01 1A/100V	18p
W02 1A/200V	19p
W04 1A/400V	21p
W06 1A/600V	23p
W08 1A/800V	28p
BR81D 2A/100V	33p
BR82D 2A/200V	33p
BR84D 2A/400V	37p
BR86D 2A/600V	43p
BR88D 2A/800V	43p
BR32 3A/200V	43p
BR34 3A/400V	43p
BR36 3A/600V	44p
BR62 6A/200V	80p
BR64 6A/400V	72p
BR251 25A/100V	150p
BR252 25A/200V	165p
BR254 25A/400V	185p
BR256 25A/600V	200p
BR258 25A/800V	240p
BR351 35A/100V	185p
BR352 35A/200V	200p
BR354 35A/400V	220p
BR356 35A/600V	230p
BR358 35A/800V	260p
BY164 1.5A/100V	40p
BY179 1.5A/800V	40p

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TIC206D 4A/400V	60p
TIC225D 6A/400V	69p
TIC226D 8A/400V	68p
TIC236D 12A/400V	85p
TIC246D 16A/400V	105p
TIC253D 20A/400V	190p
TIC263D 25A/400V	205p
T2800D 8A/400V	52p

THYRISTORS	
2N5061 0.8A/60V	20p
C106D 4A/400V	28p
TIC116C 8A/300V	59p
TIC116D 8A/400V	70p
TIC116M 8A/600V	79p
TIC126D 12A/400V	75p
TIC 126M 12A/600V	90p
BR103	37p
BR303	85p
BT106	180p
BT116	80p
BT119	100p
TIC44	22p
T7088	200p
T7089	200p
T7127	200p
T5/80H	230p
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SG264	550p
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VXL5/V20H £13.00
VXL6 £18.00
VXL7 £22.00
VXL8/VXL9/VXL10/VXL11/VTV100 £18.50

HITACHI
VT11/VT14/16/30/33/34/330/340/503/640/5030 £12.00
VT7/VT17/VT18/VT19 £23.50
VT35/VT38/VT39 £24.00
VT100/110/111/112/113/115/118/120/125/128/220/225/VT400/405/410/413/414/415/418/510/518/520/525/526/VTM625/626 £16.00
VT3000 £10.00
VT4000/4200/5000/5500 £12.00
VT77/680/3000/6500/7000/8000/8030/8040/8100/8300/VT8500/8700/9000/9300/9500/9700/9900 £12.00
VT8/VT9/VT56/VT57 £34.00
VT65 £26.00
VT130/VT135/VT138/VT145/VT250/VT255/VT258/VT420/425/426/428/430/435/438/535/536/VTL301/VTM630/635/636 £21.00
VT52/61E/VT62E/VT63/VT64/VT640 £15.00
VT150 (4 HEAD) £27.00
VT530 £25.00

ITT
VR3605/3905/3935/3943/3954/3985/3993 £6.50
VR3833/VR3913/VR3914/VR3963/VR3975/VR3912 £6.50
VR3986 £20.00
VP3826/VR3906/3916/3926/3946/VR3948/6348 £15.75
VR3927 £17.00
VR3976 £24.50
VR3977 £31.00
VR3994 £23.00
VR3995/3997 £31.50
VR3917 £16.00

JVC 3HSS
HR2200/HR3300/HR3320/HR3330/HR3350/HR3360/HR3660/HR3750/HR3860/HR4100 £6.50
3292/8903/8900/8901/8902/8903/8606/8922/8923/3V01/3V06/3V22 £6.50
HR3660/HR7600/HR7610/HR7650/HR7700/HRD110/HRD111/HRD120/HRD121/HRD220/HRD225/HRS100 £6.50

FERGUSON 3HSS PIN
8904/8924/8941/8943/8944/3V16/3V23/3V24/3V31/3V35/3V36/3V38/3V39/3V49 £6.50
HRD140/HRD141/HRD143/HRD150/HRD157/HRD158/HRD160/HRD5101/HRS10 £15.50

FERGUSON
8944/8943/3V42/3V44/3V45/3V46/3V47/3V52/3V54/3V55/3V56/3V57 £15.50
8956/8951/3V64/FB10/FV11/3V65/FV20/FV21/FV22/FV26 £17.00
3V48 £24.50
3V43/3V53 £31.50
8930/8940/3V29/3V30 £7.50
8945 £24.00
3V00 £10.00
FV31 £22.00
FV37 £38.00

JVC
HRD170/171/210/211 £17.00
HRD565/566 £24.50
HRD725/HRD755 £31.50
BR7000E/BR7000S £30.00
HR7200/7300/7350/2650 £7.20
HRD455 £20.00
HRD520 £22.00
HRD300/HRD400/HRD600 £29.00
HR4100 £10.00
HRD750 £33.00
HRD250/257 £27.00

JVC & FERGUSON
3V32/8942/HR7655 £23.00
HRD180/230/3V59/FV12L/FV20B/FV22/26/30/32/33 £30.50
HRD370/3V58/FV13H/HRD430/HRD470 £27.00
HRD530/700/FV14T £33.50
GRC1/GRC2/3V41 £30.00

LOGIK
VR960 £16.00
VR950 £16.00

LOEWE
OC410/420/440 £24.00
OC50/OC55/OC60/OC65 £15.00

LUXOR
9225 £21.50

MATSUI
VX500E/VX600A/VX800A/VX810A/VX880A/VX770B/VX773B £13.50
VCRL3/VX730 £15.00
VX735/VX755 £16.00
VX735A/VX755A/VX765/VX850 £17.50

MITSUBISHI
HS303/HS304/HS320/HS700 £16.00
HS306/HS316/HS710 £18.00
HS307 £27.00
HS319 £26.00
HS330 £26.00
HS400 £29.00
HS349 £28.00
HS411 £29.00
HSE30 £24.00
HS338 £24.00
HSE11 £23.00
HS300/HS301/HS302/HS310 £17.00
HS200 £6.50
HS337/HS347 £17.00

NATIONAL PANASONIC 4HSS-3HSSN
NV3000/NV300/NV7200/NV333/NV7500/NV7800/NV7850/NV322/NV332/NV340/NV390/NV2000/NV2010/NV7000/NV8170/NV8200/NV8400/NV8600/NV8610/NV8620 £6.25

NATIONAL
NV777/NV330 £17.00
NV430/AG1000 £11.00
NV280/NV460/470/480 £16.50
NV730/NV770 (4 HEAD) £18.50
NV336 £18.50
NV180/NVD48 £23.00
NV370/NV380/NV100/NV630 £8.50
NV788 £36.00
NV810/NV830 £27.00

NATIONAL Cont.
NV850/NV950 £30.00
NV870/NV890/NV970 £36.00
NVG33/NVG46/NVL23/NVL25/NVL28 £24.00
NVG30/NVG31/NVG40/NVG130
NVJ30/NVL20 £18.00
NVG10/NVG11/NVG12/NVG14/NVG16/NVG120/NV250/NV280/NV450/NV465 £16.50
NVG18 £22.00
NVG20/NVG21/NVG22/NVG25/NVG28/NVG200/NVD48 £22.00
NVG50/NVG300 £30.00
NVG45/NVG46 £30.00
NVH70 £50.00
NV688 £25.50
NV600 £23.00
AG-6800/6810 £39.00
AG-6100/6200/6300 £32.00
NVH65 £50.00
NVG7/NVG9/NV230 £18.00
NV780 £36.00
NVG15/NVG400 £48.00
NVM7/NVMC20/NVF70 £52.00

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 (for model DX3000) £45.00
N895 £31.50

NORDMENDE
460/9-460/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
VH1/VH2A £7.00

PHILIPS
VR6460/VR6520/64VR60/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

SAISHO
VR100/VR605/VR705/VR805/VR905/VR1000/VR1100/VR1200/VR1600 £12.50
VR3300X/VR3600X/VR3650/VR3800 £14.00
VR3200/VR3500 £15.00
VR2000/VR3300/VR3600 £15.00

SALORA
6500/6600 £21.50
SV7300/8200/8300/9200 £19.50
SV7400/8400 £23.00
SV8100 £13.50

SAMSUNG
SVX301/VB900/VB910/VVT510/VT320/VT5600/VX510/VX511/VX520/VX616/VX626/VX627/VX717/SV716/717/SVX303/305/VB510/520/610/616/617/619/620/626/627/629/710/971/V1520/616/621/626/906/710/VX617/619/629/710/712/VX720/730/970/971/972 £19.00
VB770/V1730/770/VK8220/VX750/770/8225 £21.00

SANYO
VTC5000/VTC5400/VTC6000/VTC6500/VPR5000/VTC1500/VTCM10/VTCM11/VTCM20/VTCM21/VTCM25/VTC2000/VTC5100/VTC5150/VTC5300/VTC5400/VTC5350/VTC5370/VTCNX10/VTCNX15/VTCNX20/VTCNX30/VPR5800 £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/VHR3310/VHRD500 £18.00
VHR1100/VHR1200 £18.00
VHR1500/VHR2500 £28.00
VHR2700 £24.50

SHARP
VC300/VC393/VC496 £3.00
VC488 £48.00
VC779 £20.00
VC789/VC790 £32.00
VC300/VC381/VC383/VC386/VC387/VC388/VC482/VC483/VC486/VC3300/VC8381/VC9100/VC9300/VC9500/VC9700/VC9400/VC9600/VC200 220/384/385/471/477/481 £13.00
VC582/VC583/VC651/VC681/VC750/VC780/VC781/VC683/VC684/402/500/571/673/581/584/585/600/682/685/693/VC700/772/7810/782/7822/783/8461 £13.00
VC6000/VC6200/VC6300/VC7300/VC7700/VC7750/VC8000/VC8300 £20.00
VC793 £36.00
VC473/785/788 £25.00
VC699/VCA501/VCA602 £29.00

SONY
DSR 19R (FOR SL-T 9ME) £39.00
DSR-21R (FOR SLC 8 C9) £30.00
DSR-35R (FOR C20/C30/C40/SLF1UB/SLF1E12 PIN SLC24PS/SLC33E/SLC44PS/SLF30PS/SLF60PS/SLK85/SLT20ME/SLT30ME £15.00
DSR 43R (FOR SLC7 RANGE/SL5000/SL5100/SL3000) 1 PIN SLC6E/SL36ES/SL37E £13.00
SL3000/8000/8080/SLC5E/SLT7ME £16.00
SLV201/202 £29.50
SLK95/SLT50ME £29.00

TOSHIBA
V63 £18.00
V9680 £42.00
V8600/V8700 £38.00
V21/V31/V33/V50/V51/V53/V9600 £14.50
V55/V57 £7.00
V71/V73/V74/V75/V81/V82/V83/V84/V85/V86/V87/V30/V77 £14.00
V93/V80 £20.00
V5470/V5480 £18.00

TRIUMPH
VR9500/VR9501/VR9525 £13.00

THOMSON
TX8000/V309/316/320/321/323/326/4100/4200/4300/VK305T/306T/309BL/3301/312T/410T/411T £6.50
TX8500/V318/342/343/351/352/353/4210/4230/4260 £15.75

VCR PINCHROLLERS

AKAI
VS9300, VS9500, VS9700, VS9800, BP7100, VP77 £2.50
VS1, VS2, VS3, VS4, VS5, VS6, VS9, VS10, VS8, VS15 £2.50
VS105, VS112, VS115, VS116, VS126, VS244, VS245, VS247, VS248, VS515, VS516, VS205 £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, VCR6000, VCR6100, VCR9000 £2.50
VCR5200 £2.50
VCR7000 £2.50
TVR1 £2.50

AIWA
AV66, AV77 £2.50
G700, G900 £2.50

ALBA
VCR300X, VCR4000 £2.50
VCR5000, VCR600 £2.50

AUTHENTIC
N850 £2.50

BLAUPUNKT
RVT100, 200, 202, 222, 224, 301, 306, 307, RTV309, 311, 312, 315, 316, 317, 319, 320, 328, RTV404, 414, 434, 444, 478, 707, RTX100 £2.50
RTV211, 214, 321, 322, 348, RTX250, 260 £2.50
RTV324, 325 £2.50
RTV330, 454, 520, 530, 535, 560, 660, 670, RTV720, 730, 740, 800, 810, 900, 910, 920 £2.50

DECCA
VR8300 £2.50
VRH8495DK (Pressure Roller Assembly) £6.25

FERGUSON
3V00, 3V16, 3V22, 3V23, 3V24, 3292, 8900, 8901, 8902, 8903, 8904, 8906, 8909, 8912, 8922, 8923, 8924, 8925, 8929 £2.50
3V29, 3V30, 3V31, 3V32, 8930, 8931, 8940, 8941, 8942 £2.50
3V35, 3V36, 3V38, 3V39, 3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V56, 3V57, 3V58, 3V59, 3V64, 3V65, FV10, FV11, FV12, FV14, 3V49, 8943, 8944, 8945, 8947, 8948, 8950, 8951, FV13H, FV20B, FV21R, FV22L, FV26D, FV30B, FV32L, FV33H, FC39S, VC141L £2.50

FISHER
FVHP420, FVHP520, FVHP530 £2.50
FVHP615, FVHP710, FVHP715, FVHP716, FVHP722, FVHP725, FVHP830, FVH618, FVH620, FCH622, FVH622, FVH771, FVH720, FVH721, FVH722, FVH725, FVH730, FVH840 £2.50
FVHP905, FVHP970, FVHP980, FVHP990, FVHP5000, FVHP5005, FVHP5050, FVHP5075, FVHP5100, FVHP905, FVHP906, FVHP908, FVHP910, FVHP911, FVHP915, FVHP916, FVHP918, FVHP975 £2.50
VBR330, VBS3500, VBS7000, VBS7500, VBS7600, VBS9000, VBS9900 £2.50

FIDELITY
HQS200, VCR100, VCR600, VCR6100 £2.50
VTR1000 £2.50

FUJITSU
HS760, VX715, VX720D £2.50

FUNAI
VA, V2, VCR4000, VCR4500, VCR4530, VCR4600, VCR4800, VCR5200, VCR5400, VCR5840, VCR5843, VCR6000, VCR6600, VCR6800, VCR6803 £2.50
VIP1000, VIP1400, VIP3000 £2.50

GEC
V4004 £2.50

GRANADA
VHSAH1, VHSAH3, VHSVH4, VHSWH1, VHSXH1, VHSYH2 £2.50
VHSAN3, VHSBP1 £2.50
VHSAY3 £2.50
VHSBH1, VHSCH1, VHSFS1, VHSFS2, VHSEH2, VHSEH3 £2.50
VHSBY3, VHSCC1 £2.50
VHSDS2 £2.50
VHSDP1, VHSFP2 (Pressure Roller Assembly) £6.25
VHSEY1 £2.50
VHSFG2, VHSFG4 £2.50
VHSFJ4, VHSYJ2 £2.50
VHSF63 £2.50
VHSTJ1, VHSTJ2, VHSTJ3 £2.50
VHSWJ1, VHSWJ3, VHSXJ3 £2.50

GRUNDIG
BARCELONA, MADRID, MVS500, MVS550, MVS600, MVS620, 660, SE5110, SE5140, SE6100, SE6160, TVR4500, VS500, VS505, VS510, VS520, VS521, VS530, VS540, VS550, VS600, VS610, VS620, VS630, VS640, VS660, VS680, VS5180, VS5480 £2.50
MVS400, MVS440, VS400, VS410, VS440, VS460 £2.50
VS120 £2.50
VS510 £2.50

GOLDSTAR
GHV1221, GHV1232, GVH1240, GHV1241, GHV1242, GHV1243, GHV1244, GHV1245, GHV1246, GHV51, GHV8210, GHV8215, GHVP1240, GHPV1241, GHVP1247, GHVP1248, GHVP1290, GHVP1291, GHVP1296, GHPV1296, VCP1100, CHV51, GHV8000, GHV8200, VCP4000, VCP4130, VCP4200, VCP4300, VCP4301, VCP4305, VCP4306, VCP4310, VCP4311, VCP4315, VCP4316, VCP4320, VCP4321, VCP4325, VCP4326 £2.50

HINARI
V20H, VXL10, VXL11, VXL19, VXL5, VXL5, CXL7, VXL8, VXL9, VXL90 £2.50
VXL2, VXL3 £2.50
VXL4, VXL20, VXL35 £2.50

HITACHI
VT11, VT14, VT16, VT17, VT19, VT33, VT330, VT34, VT35, VT38, VT39, VT52, VT6500, VT680, VT6800, VT7, VT7000, VT8000, VT8500, VT9700, VT9900 £2.50
VT61, VT62, VT63, VT64, VT65, VT86, VT88, VT110, VT122, VT120, VT128, VT130, VT135, VT138, VT150, VT168, VT220, VM200, VM500, VM600, VT100, VT111, VT113, VT115, VT118, VT125, VT145, VT175, VT225, VT250, VT225, VT258, VT260, VT400, VT405, VT410, VT413, VT414, VT415, VT418, VT420, VT425, VT426, VT428, VT430, VT431, VT435, VT438, VT450, VT498, VT510, VT518, VT520, VT525, VT526, VT530, VT535, VT536, VT540, VT545, VT546, VT548, VT570, VT575, VT576, VT580, VT588, VT640, VT8, VT85, VT86, VT88, VTL30, VTM625, VTM626, VTM630, VTM636, VTM640, VTM645, VTM646, VTS80, VTS85 £2.50
VT3000, VT5000, VT8000, VT9300, VT9500 £2.50

ITT
VR3605, VR3905, VR3935, VR3985, VR3986, VR3993, VR3994, VP3826, VR3906, VR3916, VR3926, VR3946, VR3948, VR3976, VR3995, CR3997, VR6948 £2.50
VR3913, VR3914, VR3943, VR3954, VR3963, VR3984 £2.50
VR3907 £2.50
VR3912 £2.50
VR3917, VR3833 £2.50
VR3929, VR3968 (PRESSURE ROLLER ASSEMBLY) £6.25

JVC
HR2000, HR3300, HR3330, HR3360, HR3660, HR4100, HR7700, HR7200, HR7300, HR7350, HR7600, HR7610, HR7650, H7655 £2.50
HRD110, HRD111, HRD120, HRD121, HRD140, HRD150, HRD160, HRD225, HRD455, HRD565, HRD725, HRD157, HRD158, HRD170, HRD180, HRD210, HRD230, HRD250, HRD257, HRD300, HRD320, HRD370, HRD400, HRD430, HRD470, HRD530, HRD566, HRD700, HRD750, HRD755, HRD950, HRP50, HRS5000, HRS5500 £2.50

MATSUI
VX850 £2.50

MITSUBISHI
HS200, HS300, HS301, HS302, HS303, HS304, HS310, HS320, HS700, HS330 £2.50
HS306, HS307, HS337, HS338, HS349, HS400, HS411, HS412, HS421, HS710, HS810, HS820, HS830, HSE10, HSE20, HSE30, HSE70 £2.50

NATIONAL
NV100, NV180, NV300, NV333, NV340, NV366, NV600, NV688, NV777, NV788, AG6010, AG6015, AG6100, AG6200, AG6400, AG6810, NV3321 £2.50
NV230, NV370, NV430, NV460, NV730, NV810, NV830, NV850, NV870, NV890, NV2000, NV2010, NV3000, NV7000, NV7200, NV7800, NV8600, NV8610, NV8620, NVG14, AG1000, AG1200, AG1500, AG2100, AG2100, AG2200, NV260, NV280, NV380, NV450, NV465, NV470, NV480, NV630, NV650, NV770, NV780, NV8050, NV8150, NV8200, NV8300, NV8400, NVG15, NVG30, NVG400, NVH70, NVG130 £2.50
NVG7, NVG19, NVG12, NVG18, NVG9, NVG10, NVG11, NVG120, NVG16 £2.50
NVG21, NVG25, NVH65, NVG33, NVG46, NVG50, NVG300, NVG65, NVF70, NVFS1, NVFS100, NVH75, NVJ30, NVL20, NVL23, NVL25, NVL28 £2.50
NVD40, NVD80, NVG21, NVG45 £2.50

NEC
N830, N831, N832, N833, N895 £2.50
PVC2300, PVC2400, PVC740, PVC744, PVC746, PVC760, PVC764, PVC766 £2.50

ORION
VH1, VH2 £2.50
VC150, VC180, VH1000, VH200, VH201, VH205, VH212, VH250, VH254, VH288, VH3, VH300, VH303, VH3030, VH312, VH33, VH3312, VH404, VH704, VH708, VH712, VH770, VH780, VR2948 £2.50
VH300, VH3050, VH2308, VH2400, VH2600, VH2700, VH4300, VLX20, VXL25, VXL30 Etc £2.50

PHILIPS
VR6460, VR6920 £2.50
VR2020, VR2021, VR2022, VR2023, VR2024 £3.20
VR6711 £2.50
VR6540 £2.50
DV8556, VR6485, VR6485, VR6589, VR6880, VR6948 £2.50
VR445, VR6442, VR6542, VR6843, VR6943 £2.50
DV464, VR2324, VR2300, VR2334, VR2340, VR2530, VR2414, VR2480, VR2486, VR2489, VR2430, VRS2498, VR6462, VR6463, VR6464, VR6560, VR6660, VR6860, VR6861, VR6862, VR6863 £2.50

Pressure Roller Assembly
DV186, DV190, DV286, SV486, DV471, DV582, DV511, DV761, VR6180, VR6182, VR6185, VR6285, VR6290, VP6291, VR6293, VR6362, VR6367, VR6390, VR6391, VR6393, VR6467, VR6468, VR6470, VR6561, VR6570, VR6581, BR6670, VR6676, VR6760, VR6761, VR6762, VR6870, VR6970, VR6971, VR8681, 62SB7, 68SB4, 71SB4, 72SB8, 92SB31 £6.25

SANYO
VHR1100, VHR1300, VHR1500, VHR2300, VHR1150, VHR1200, VHR2100, VHR2500, VHR2700 £2.50
VTC5000, VTC5150, VTC6500, VTC9300, VTCM10, VTCM20, VTC5150, VTC5350, VTC5400, VTC6000, VTC6500, VTC9100, VRP5800, VTCM11, VTCM21, VTCM31, VTCM50 £2.50
VHR3100, VHR3300, VHR3310, VHR3700, VHRD500, VHRD700 £2.50
VTC3000 £2.50

SHARP
VC381, VC386, VC2300, VC3300, VC7300, VC7700, VC8300, VC9100, VC9300, VC9500, VC9700, VC200, VC2300, VC3300, VC384, VC385, VC388, VC390, VC393, VC6000, VC6200, VC7750, VC800 £2.50

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VCR PINCHROLLERS Cont.

Sharp Cont.
VC387, VC481, VC483, VC486, VC496, VC581, VC582, VC583, VC585, VC402, VC471, VC473, VC477, VC500, VC571, VC573, VC584, VC5W20E, VCA1031 £2.50
VC651, VC681, VC685, VC750, VC780, VC781, VC785, VC787, VC793, VC772, VC600, VC682, VC684, VC693, VC699, VC700, VC772, VC7810, VC782, VC7822, VC7282MK2, VC783, VC785, VC786, VC800, VCF3, VCA100, VCA102, VCA104, VCA202, VCA303, VCA211, VCA234, VCA501, VCA602, VCD801, VCD802, VCH852, VCH881 £2.50
VC220 £2.50

SAISHO
VR2000, VC3800 £2.50

SOLARA
SV6500, SC6600 £2.50
SV7300, SV8200, SC8300, SV9200, SC9300 £2.50
SV7400, SV8400, SV8420, SV8500, SV8520, SC8550, SV8600, SV8620, SV8700, SV8710, SC8720, SV8800, SV8830, SV9500, SV9600, SV9810 £2.50
SV8000, SV8100 £2.50

SAMSUNG
SV716, SV717, VB510, VB520, VB610, VB616, VB617, VB619, VB620, VB626, VB627, VB629, VB900, VB910, VI510, VI520, VI611, VI616, VI621, VI626, VI900, VI910, VX510, VX520, VX616, VX617, VX619, VX626, VX627, VX629 £2.50
SVX301, SVX303, SVX305, SVX307, SVX319, SVX322, VB710, VB770, VB8220, VB971, VB8225, VI730, VI770, VI790, VI8220, VI8225, VK8220, VX710, VX712, VX720, VX730, VX750, VX770, VX790, VX8220, VX835, VX970, VX971, VX972 £2.50

SIEMEN
FM350, RM352, FM355 £2.50
FM361, FM362, FM363, FM364 £2.50
FM391, FM392, FM394, FM461, FM462, FM464, FM468, FM561 £2.50

SONY
SLC5, SLC6, SLC7, SL3000, SL8000, SL8080, SL8200, SL8600, SL36, SL37, SLJ10, SLT6ME, SLT7ME, SLC9, SLC20, SLC24, SLC30, SLC33, SLC44, SLHF100, SLF1, SLF11, SLF25, SLF30, SLF60, SLF100, SL200, SLF60PS, SLF90E, SLH150, SLHF850, SLK88, SLK95, SLT20ME, SLT30ME, SLT50ME £2.50
BMC100, BMC200, BMC500 £2.50
SLV201, SLV202, SLV301, SLV302, SLV401, SLV402, SLV801, SLV802 £2.50

TOSHIBA
DV80, DV90, DV96, SC97, V200, V201, V202, V205, V207, V300, V309, V500, V509, V55, V57, V61, V63, V65, V66, V67, V700, V71, V73, V74, V75, V77, V81, V83, V85, V86, V93, V94 £2.50
V5470, V5480 £2.50
V91, V951 (Pressure Roller Assembly) £6.25

VCR BELT KITS

AKAI
VP7100, VS9300, VS9500, V9700, VS9800 £1.30
VS1, VS2, VS4, VS5, VS12, VS15, VS53, VP88, V56, V58, V59 £1.00
VS10 £0.65

AIWA
AV66 £1.25
AV77 £1.40
G700 £1.60
G900 £1.80

ALBA
VCR3000X, VCR4000 £1.30

AMSTRAD
TVR123, VCR4600, VCR4700, VCR5200 £1.60
VCR7000 £0.80
VCR6000, VCR6100 £1.80

AUTHENTIC
N850 £1.20

DECCA
VR8300 £1.20
VRH8945DK £0.80

FERGUSON
3292, 3V00, 3V01, 3V16, 3V22, 8900, 8901, 8902, 8903, 8904, 8906, 8909, 8912, 8922 £1.35
3V23, 8923, 8924, 8929 £0.65
3V29, 3V30, 8930, 8931, 8340 £0.90
3V31, 3V32, 8341, 8342 £0.85
3V35, 3V36, 3V38, 3V39, 3V49, 8343, 8344 £0.70
3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V56, 57, 8945, 8947, 8948 £0.65
3V58, 3V59, 3V64, 3V65, 8950, 8951, FV10, FV11, FV12, FV13, FV14, FV20, FV21, FV22, FV26, FV30, FV32, FV33 £1.05

FIDELITY
HIS200, VCR600, VCR6100 £1.80
CVR100 £1.60
VTR1000 £1.00

FISHER
VBS7000 £2.45
VBS9000 £1.20
FVHP520, FVHP530, FVHP420 £0.60
FVHP615, FVHP618, FVHP620, FVHP622, FVHP710, FVHP711, FVHP715, FVHP716, FVHP720, FVHP721, FVHP722, FVHP725, FVHP730, FVHP830, FVHP840, FVHP905, FVHP906, FVHP907, FVHP908, FVHP910, FVHP911, FVHP915, FVHP916, FVHP918, FVHP5000, FVHP5005 £1.00
FVHP5050, FVHP5075, FVHP5100 £1.00
VBR335, VBS7500, VBS7600, VBS9900 £1.00
VBS3500 £0.75

FUJITSU
HS760, VX715, VX720D £1.60

FUNAI
V1, V25, VCR4600, VCR4800, VCR5200, VCR5400, VCR5600, VCR6600 £2.10
VCR4530, VCR5840, VCR5843, VCR6600, VCR6800 £1.80
VIP3000, VIP5000 £1.60

GEC
4005 £1.50
V4004 £1.00

GOLDSTAR
GHV1221, GHV1232, GHV1241, GHV1242, GHV1243, GHV1244, GHV1245, GHV1246, GHV1248, GHV51, GHV8000, GHV8210, GHV8215, BCP4100, VCP4130, GHV1290, GHV1291, GHV1295 £0.80
GHV1296, VCP4200, VCP4300, VCP4301, VCP4305, VCP4306, VCP4310, VCP4311, VCP4315, VCP4320, VCP4321, VCP4325, VCP4326, VCP4000 £1.20
GHV1247, GHV8200 £1.50

GRUNDIG
MV5400, MVS440, VS5400, VS410, VS5440, VS450, VS460 £0.56

HINARI
VXL2 £0.80
VXL7, VXL8, VXL9 £1.80
VXL4, VXL35 £0.70
VXL5, VXL6 £1.60
VXL3, VXL20 £0.90

HITACHI
VT11, VT14, VT17, VT19, VT33, VT34, VT35, VT38, VT39, VT88, VT165, VT330 £1.00
VT5000, VT5500 £1.20
VT7000, VT8000, VT8500 £0.60
VT680, VT6500, VT6800, VT9300, VT9500, VT9700, VT9900 £0.50
VT52, VT61, VT62, VT64, VT65, VT85, VT86, VT640 £1.50
VT3000 £1.50
VT100, VT110, VT111, VT113, VT115, VT118, VT120, VT125, VT128, VT130, VT138, VT145, VT150, VT175, VT220, VT225, VT250, VT225, VT258, VT260, VTL30 £1.50

ITT
VR3605, VR3905, VR3935, VR3954, VR3985 £0.90
VR3913, VR3914 £1.00
VP3826, VR3906, VR3916, VR3926, VR3946, VR3948, VR3976, VR3986, VR3995, VR3997, VR6948 £0.65
VR3927, VR3928, VR3977 £1.40
VR3993, VR3994 £0.85
VR3953 £0.65
VR3912 £1.50
VR3917 £1.50
VR3929, VR3968 £0.85
VR3907 £1.00

JVC
HR3300, HR3330, HR3360, HR3660, HR4100 £1.30
HR7200, HR7300 £0.70
HR7350, HR7600, HR7610, HR7650, HR7655 £0.75
HR7700 £0.75
HRD110, HRD111, HRD120, HRD121, HRD225 £0.90
HRD140, HRD150, HRD157, HRD158, HRD160, HRD250, HRD257, HRD455, HRD565, HRD566, HRD725, HRD755, HRP50 £0.80
HRD170, HRD180, HRD210, HRD230, HRD300, HRD320, HRD370, HRD400, HRD430, HRD530, HRD700, HRD750, HRD950, HRS5000, HRS5500 £1.10

MATSUI
VX850 £0.75

MITSUBISHI
HS200, HS318, HS319, HS410 £2.00
HS300, HS301, HS302, HS307, HS310 £1.50
HS303, HS304, HS306, HS320, HS330, HS400, HS700 £1.50

NEC
N830, N831, N832, N83 £1.00
N895 £1.30
PVC2300, PVC2400

NATIONAL
NV300, NV332, NV333, NV340, NV366, NV600, NV688, NV777, NV788 £1.35
AG6010, AG6015 £1.00
NV2000, NV2010, NV3000 £1.50
NV7000, NV7200, NV7500, NV7800 £0.95
NV8600, NV8610, NV8620 £1.60
NV230, NV250, NV260, NV280, NV370, NV380, NV430, NV450, NV460, NV465, NV630, NV730, NV770, NV780, NV810, NV830, NV850, NV870, AG1000, AG1200, AG1500 £1.25

PHILIPS
VR6460/VR6920 £1.70
VR6540 £1.00
DV186, DV190, DV286, SV468, DV471, DV562, DV571, DV761, VR6180, VR6182, VR6185, VR6285, VR6290, VR6291, VR6293, VR6362, VR6367, VR6390, VR6391, VR6393, VR6467, VR6468, VR6470, VR6561, VR6570, VR6581, VR6670, VR6676, VR6760, VR6761, VR6762, VR6870, VR6970, VR8875, VR72SB8, VR68SB4, VR86SB1, VR92SB3 £0.85
VR5442, VR6542, VR6843, VR6943, VR44SB9 £0.70

SAISHO
VR200 £0.90
VR3800 £0.75

SALORA
SV6500 £1.00
SV6600 £1.50
SV8000 £1.20
SV8100 £0.60
SV8500, SV8520, SV9500 £1.50
SV7300, SV7400, SC8400, SC8420, SV9200, SV9300 £1.20

SAMSUNG
SV16, SV717, V616, V1621, V1626, VX616, VX626, VX627 £0.85
VB520, VB610, VB616, VB617, VB619, VB620, VB626, VB627, VB629, V1510, V1520, V1611, VX510, VX520, VX617, VX619, VX629 £1.00
VB900, VB910, V1900, V1910 £1.10

SANYO
VTC5000, VTC5150, VTC6000, VTC6500, VTCM10, VTCM11, VTCM20, VTCM21, VTCM30, VTCM31, VTCM50 £0.75
VTC5300, VTC5350, VTC5400, VPR5800 £1.00
VTC5500 £0.95
VTC9100, VTC9300 £2.20
VTC1100, VTC1300, VTC1500, VHR1100, VHR1150, VHR1200, VHR1300, VHR1500 £0.90
VHR2100, VHR2300, VHR2500, VHR2700 £1.50

SHARP
VC200, VC381, VC383, VC384, VC386, VC388, VC390, VC393, VC2300, VC8381, VC9100, VC9300, VC9500, VC9700 £1.25
VC6300 £1.50
VC7300, VC7500, VC7700 £1.50
VC8300 £1.50
VC300, VC387, VC471, VC473, VC477, VC481, VC483, VC486, VC488, VC496, VC8481 £1.00
VC402, VC500, VC571, VC573, VC581, VC582, VC583, VC584, VC585, VCSF3 £0.90
VC600, VC651, VC681, VC682, VC684, VC685, VC693, VC699, VC700, VC772, VC781, VC782, VC783, VC785, VC786, VC7F3, VC800, VC7810, VC7822, VC6F3, VC6V3, VCA100, VCA102, VCA103, VCA104, VCA202 £0.70
VC7750, VC8000 £1.50

SONY
SLC6, SL36ES, SLJ10, SLT6ME £1.40
SLC5, SLC7, SL37E, SLT7ME £1.40
SLC9 £1.65
SL8000, SL8080, SL8200, SL8600 £2.00

TOSHIBA
V55, V57 £0.85
V5250, V5280 £2.30
V33, V53, V96, V9600, V9680 £0.85
V61, V63, V65, V66, V67 £1.50

TRIPLERS

UNIVERSAL £4.00
THORN 9000 SERIES £7.50
PHILIPS G9 £6.50
G8 520/550 £6.50
KT3 £4.00
DECCA 100 SERIES £6.50
120/130 £6.50
ITT CVC 20/30 £6.00
CVC 825 £7.50
RANK T20A £6.50
UNIVERSAL TO FIT
20AX TUBE £8.00
30AX TUBE £8.00

DIODE SPLIT TRANSFORMER

LEADS TO FIT CHASSIS CODE:
CTX TYPE £2.50
G11 TYPE £2.50
KT4 TYPE £2.50

VIDEO MOTORS

AMSTRAD
VCR7000 REEL MOTOR £17.00

AIWA
AV77 CAPSTON MOTOR £25.00

AKAI
VP7100, VS9300, VS9500, VS9800, CAPSTON MOTOR £21.00
VP7100, VS9300, VS9500, VS9800 DRUM MOTOR £19.50

AUTHENTIC
N850 REEL MOTOR £19.00

BLAUPUNKT
RTV211, RTV214, REEL MOTOR £13.00
RTV325 LOADING MOTOR £8.00

DECCA
VR8300 REEL MOTOR £19.00

FISHER
BVR330, VBS3500, VBS7500, VBS7600, VBS9900 REEL MOTOR £6.30

FERGUSON
PU 45979 CAPSTON MOTOR £21.00
HR3300, HR3660, HR4100, 3V00, 3V01, 3V16, 3V22, 3292, 8900, 8901, 8902, 8903, 8904, 8906, 8909, 8912, 8922
PU 55371V CAPSTON MOTOR £19.50
3V35, EV36, 3V38, 3V39, 8943, 8944, HRD110, HRD111, HRD120, HRD121, HRD225
PU 46414 DRUM MOTOR £19.50
HR3300, HR3320, HR3330, HR3360, HR3600, HR3660, HR4100, 3V00, 3V01, 3V16, 3V22, 3292, 8900, 8901, 8902, 8903, 8904, 8906, 8909, 8912, 8922
PU51281V REEL MOTOR £19.00
3V29, 3V30, 3V31, 3V32, 3V39, 8930, 8931, 8941, 8942, HR7200, HR7300, HR7600, HR7610, HR7650, HR7655

FERGUSON & JVC
PU 58635V CAPSTON MOTOR £29.00
3V58, 3V59, 3V64, 3V65, 8950, 8951, FV10B, FV11R, FV12L, FV13H, FV20B, FV21R, FV22L, HRD170, HRD180, HRD230, HRD370, HRD430
PU 58636W REEL MOTOR £17.00
3V58, 3V59, 3V64, 3V65, 8950, 8951, FV10B, FV11R, FV12L, FV13H, FV14T, FV20B, FV21R, FV22L, HRD170, HRD180, HRD230, HRD370, FRD430, HRD530
LOADING MOTOR £8.00
3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V56, 3V57, 8945, 8947, 8948, HRD140, HRD150, HRD157, HRD158, HRD160, HRD250, HRD257, HRD455, HRD565, HRD566, HRD725, HRD755, HRP50, R73AF
PU60201V CAPSTON MOTOR £34.00
HRD330, HRD330, HRD337, HRD400, HRD520, HRD530, HRD700, HRD750, HRD950, FV14T
HRD140, HRD150 CAPSTON MOTOR £30.00
HRD250, HRD565, HRD566
3V29, 3V30 CAPSTON MOTOR £30.00
8930, 8931

HINARI
VXL2, VXL4, VXL20, VXL35
LOADING MOTOR £8.00
VXL20 REEL MOTOR £13.50

HITACHI
5678154 CAPSTON MOTOR £20.00
VT52, 61, 62, 63, 64, 65, 640
VT3000 CAPSTON MOTOR £21.00
VT3000 DRUM MOTOR £19.50

ITT
VP3826, VR3906 LOADING MOTOR £8.00
VR3916, VR3926, VR3946, VR3948, VR3076, VR3997, VR6948
VR3912 CAPSTON MOTOR £21.00
VR3912 DRUM MOTOR £19.50
VR3605, VR3905 CAPSTON MOTOR £19.50
VR3935, VR3954, VR3985
VR3913, VR3914 REEL MOTOR £19.00
VR3993, VR3994

MITSUBISHI
288P02801 MOTOR REEL SPOOLING £35.00
HS300, 301, 302, 310
288P02806 MOTOR REEL SPOOLING £31.50
HS303, 304, 320, 330, 700
288P03401 MOTOR REEL TAKE-UP GEN £21.00
HS303, HS320, HS700

NEC
N830EG, N831EG CAPSTON MOTOR £19.50
N832, N833EG
N895 LOADING MOTOR £8.00

NATIONAL
MYN 135V5L REEL MOTOR £13.00
NV300, NV332, NV333, NV340, NV366
VEM0212 MOTOR REEL GEN £30.00
NV730/NV770
VEM0217 REEL MOTOR £19.00
NV7000
MAX13V9LP CAPSTON MOTOR £30.00
NV300, NV332, NV333, NV340, NV366, NV600

ORION
NEVHL, VC150, VC180 REEL MOTOR £13.50
VH201, VH205, VH212, VH250, VH254, VH228, VH3, VH300, VH303, VH312, VH700, VH780, VH820, VH844, VH900, VH974, VH1000, VH1204, VH2000, VH2004, VH2204, VH3030, VH3050, VH3060, VH4008, VHF2A, VP200, VR2948, VR2949, VR2956, VR2957

ORION Cont.
NVH_, NVHML LOADING MOTOR £8.00
VH250, VH254, VH288, VH300, VH404, VH412, VH512, VH530, VH535, VH600, VH630, VH635, VH640, VH666, VH704, VH730, VH735, VH744, VH770, VH774, VH820, VH844, VH850, VH888, VH893, VH900, VH974, VH1012, VH1204, VH1440, VH1500, VH1660, VH1800, VH2004, VH3030, VH3050, VH3060, VH4010, VH4015, VH4020, VH5010, VH5015, VHF2A, VP220, VR2948, VR2949, VR2956, VR2957, VR2966, VR2980, VXL20, VXL25, VXL30

PHILIPS
VR6540 REEL MOTOR £16.00

SAISHO
VR705, VR805 REEL MOTOR £13.50
VR905, VR2000

SAMSUNG
VB510 REEL MOTOR £11.00

SANYO
4-529V-10800 (RM11) REEL MOTOR
VTC5000, VTC5150, VTC5300 £6.30
VTC5400, VTC6000, VTC6500
VTC3000 CAPSTON MOTOR £25.00

SHARP
RMOTV 1008GEZZ REEL MOTOR £13.50
VC200, VC381, VC384, VC385, VC386, VC483, VC3300, VC8381, VC9100, VC9300, VC9500, VC9700
RMOTV 1007GEZZ REEL MOTOR £16.00
VC300, VC402, VC471, VC477, VC481, VC482, VC488, VC496, VC500, VC571, VC573, VC581, VC582, VC583, VC584, VC5F3, VC8481, VC8581,
VC7822, VCA102 CAPSTON MOTOR £32.00
VCA202, VCA234, VCA602

SONY
BHF 1100D CAPSTAN MOTOR £25.00
SLC5, SLC7, SCL37, SL3000

THOMSON
VK300, VK301 CAPSTON MOTOR £21.00
VK302, VK303, VK305, VK3301,
VK300, VK302 DRUM MOTOR £19.50
VK303, VK306, VK308, VK3301

TOSHIBA
V55, V57 CAPSTON MOTOR £19.50
V61, V63 LOADING MOTOR £8.00
V71, V73, V74 REEL MOTOR £10.50
V75, V81, V83, V85, V86, V93, V94, V300, V500, V700, DV90
V71, V73, V74 CAPSTON MOTOR £9.50
V75, V81, V83, V85, V700
V86, V93, V94 CAPSTON MOTOR £15.00

CASSETTE HOUSING

GRANADA
VHSDP1 CASSETTE LIFT ASSEMBLY £15.00
VHSVJ2 £24.00

FERGUSON & JVC
3V38, 3V39, 8943, 8944, 8951, 3V35, 3V36, 3V49, HRD110, HRD111, HRD120, HRD121, HRD225 £24.00
3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V57, 8945, 8947, 8348, HRD140, HRD141, HRD150, HRD157, HRD158, HRD160, HRD250, HRD257, HRD455, HRD565, HRD566, HRD725, HRD755 £24.00
8348, 8950, FV10B, FV12L, FV13H, FV14T, FV20B, FV21R, FV22L, FV26, FV395, HRD230, HRD430, HRD530 £24.00
3V58, 3V59, 3V64, 3V65, FV11R, 8950, 8951, HRD170, HRD180, HRD370 £24.00

ITT
VR3605, VR3905 £24.00
VR3916, VR3926, VR2946, VR3948, VR3976, VR3986, VR3995, VR3997, VR6948 £24.00

NATIONAL
NV730 £31.00

NEC
N830EG, N831EG, N832, N833EG £24.00
N895 £24.00

PHILIPS
CASSETTE LIFT ASSEMBLY
E9120366 £15.00
DV186, 190, 286, 471, 562, 761, VR6180, 6182, 6185, VR6285, 6290, VR6291, 6293, 6362, 6367, 6393, VR6467, 6468, 6470, 6561, 6670, VR6760, 6761, 6870, 6970 £15.00

TELEFUNKEN
VR2970 £24.00

THOMSON
V320, V321, V323, V326, V4200, V4300 £24.00
V342, V343, V352, V353, V360, V364, V368, V4210, V4230, V4260, V4400, V5500, V6000, V8540 £24.00

TOSHIBA
V55, V57 £24.00
V65, V66 £24.00

PANASONIC MODE SWITCHES

NV2000, 2010, 7000, 7200, 7800 (VSS0048) £4.00
NV230, 260, 430, 810, 870, 2300, 4300 (VSS0110) £2.50
NV830 (VSS0091) £3.00
NV300, 333, 340, 366, 688, 777, 778 (VSS0060) £4.00
NVG21, 25, NVH65, NVD80 (VSS0175A) £2.50

ON/OFF MAIN SWITCHES

GRUNDIG
PART NO: 29703-29102
USED ON: C7500, C7500TT, C8500, C8502, C8712, C8714, C8894, M66-190, M66-190/99, M70-195, P40-345, ST66-1602, T55-340, V7722
PRICE: £3.25

ITT
PART NO: 13/1074
USED ON: CP0200, 0211F, 0323, 0323/1, 0341/15, 0345F, 0351, 0351/1, 0361, 0361/1, 9350, CT0500, 0500/1/T, 0500T
PRICE: £3.50
PART NO: LFC 005
USED ON: CVC40
PRICE: £3.25

MATSUI/SAISHO
USED ON: MATSUI-2190, SAISHO-FST2130TX
PRICE: £3.50

PHILIPS
USED ON: K30, K35, K40, KT3, KT4
PRICE: £1.50

SONY
PART NO: (POWER SWITCH + REMOTE SWITCH)
USED ON: KV1612 MK1, KV1612 MK2, KV1614, KV2052, KV2056, KV2062, KV2066, KV2212, KV2216, KV2252, KV2256, KV2704, KV2705, KV2706, KV2752PE3, KV2756PE3, KX20PS1, KX20PS2, KX27PS1
PRICE: £3.50
PART NO: (POWER SWITCH + REMOTE SWITCH)
USED ON: KV2022, KV2024
PRICE: £3.50
PART NO: 155482011 (POWER SWITCH)
USED ON: KV1810 MK1, KV1810 MK2, KV1820, KV1822, KV2000 MK1
PRICE: £7.50
PART NO: 155496711 (POWER SWITCH 26mm)
USED ON: KV1400, KV1440, KV2040, KV2060
PRICE: £2.00
PART NO: 155258800 (POWER SWITCH 21mm + REMOTE SWITCH)
USED ON: KV2020
PRICE: £2.50
PART NO: 155277400-21 (FUNCTION SWITCH)
USED ON: KV1612 MK1, KV1612 MK2, KV2052, KV2056, KV2212, KV2215, KV2216, KV2252, KV2256, KV2704, KV2705, KV2706, KV2752PE3, KV2756PE3
PRICE: £0.50
PART NO: 155336300 (FUNCTION SWITCH)
USED ON: VARIOUS
PRICE: £1.00

VIDEO LAMPS

UNIVERSAL VIDEO LAMPS 9V 80mA (310mm WIRES) £0.30
PANASONIC VIDEO LAMPS £0.50
SHARP VIDEO LAMPS £0.50
HITACHI 5381682 (VT63/64) VIDEO LAMPS £1.35

VIDEO SENSOR LAMPS

AIWA, AKAI, ALBA, AMSTRAD, BLAUPUNKT, FIDELITY, FISHER, FUJITSU, FUNAI, GEC, GOLDSTAR, GRANADA, GRUNDIG, HINARI, HITACHI, ITT, JVC (HRD SERIES), MATSUI, MITSUBISHI, NEC, ORION, NATIONAL, PHILIPS, SAISHO, SALORA, SAMSUNG, SANYO, SHARP, SIEMEN, SONY, TELEFUNKEN, THOMSON, FERGUSON, TOSHIBA
(SENSOR LAMP CODE NO. VL05) £1.60
AKAI, GRANADA (VHSTJ2), HITACHI (VT3000), ITT (VR3912/VRP3833), JVC (HR2200/3300/3330, HR3660), MITSUBISHI (HS200), TELEFUNKEN (VR510, VR519/610), THOMSON (VK300/305/306/3301), FERGUSON (3V00/3V16/3V22/3V24/3292/8900/8901/8902/8903/8909/8912/8922/8925) £0.30
(CASSETTE LAMP 9V 80mA 310mm WIRES CODE NO: VL01)
BLAUPUNKT, ORION (VH1/2A), NATIONAL (NV2000, NV2010, NV3000, NV8150, NV8200, NV8400, NV8600, NV8610, NV8620), SHARP (VC2300, VC6000, VC6200, VC6300, VC7300, VC7700, VC8000, VC8300) £0.50
(CASETTE LAMP 6V 150mA CODE NO: VL02)
AKAI (VS10), GRANADA (VHSXJ3), ITT (VR3993, VR3994), JVC (HR2650, HR7600, 7610, HR7650, HR7655), TELEFUNKEN (VR530, VR535, VR539, VR550, VR630, VR650), THOMSON (V309, V316, V357, VK309, VK411, TX8000), FERGUSON (3V31, 8941, 8942) £0.50
(CASSETTE LAMP 9V 80mA 310mm SKEQ CODE NO: VL06)
AUTHENTIC (N850), DECCA (VR8300), GRANADA (VHSTJ3, VHSWJ1, VHSEJ3), ITT (VR3913, 3914, 3963), JVC (HR7200, 7300, 7350, 7700), TELEFUNKEN (VR450, 520, 529, 540, 549, 620, 640, 920, 1920), THOMPSON (V4100, VK308, 309, 312, 410), FERGUSON (3V23, 3V29, 3V30, 8923, 8924, 8929, 8930, 8931, 8940) £0.50
(CASSETTE LAMP 9V 80mA 210mm SKEQ CODE NO: VL07)
GRANADA (VHSAY3), SHARP (VC200, 381, 384, 385, 386, 388, 390, 393, 9300, 9500, 9700) £0.70
(CASSETTE LAMP 5V 115mA CODE NO: VL08)

NATIONAL LINE OUTPUT TRANSFORMER

TLF 146-11B £17.00
TLF 15542F £25.00
TLF 14568F £26.00
TLF 14567F £26.00
TLF 14715F £27.00
TLF 14749B £20.00
TLF 66098 £28.00

CASSETTE DC MOTORS

6V MOTOR £1.70
9V MOTOR £1.70
12V CW MOTOR £1.70
12V CCW MOTOR £1.70
13.2V CCW MOTOR £2.90

CASSETTE TAPE HEADS

MONO HEAD £0.90
STEREO HEAD £1.10
MINI HEAD £2.30
AUTO REVERSE HEAD £2.60

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SONY FLYBACK TRANSFORMERS

Part No	Models	Price
1-439-218-00	KV-2002E, 2010E, 2200E, 2016, 1820E, 2010SE, KV-2012ME, 2016ME, 2016ME, 2010ME	£14.00
1-439-256-11	KV-2704EC, 2704UB, 2704ET, 2704E(A), 2704E	£35.00
1-439-288-21	KV-2216UB, 2217UB, 2215EI, 2215FE, 2212EX, 2215ET	£30.50
1-439-289-21	KV-2705F, 2706FE, 2705UB, 2705E, 2706UB, 2720EC	£40.00
1-439-303-00	KV-2064EC, 20PS1, 2082ME7, 2066EC, 2080SA, KV-2082E(ESP)	£27.00
1-439-311-00	KV-1440AEC, 1440AS MK2, CPS-14CD3, CPV-14CD2, KTX-1350NF, KTX-1430UB	£20.00
1-439-332-21	KV-2756, 2730EC, 2730FE, 2764EC, 2752UB, 2752F	£36.00
1-439-333-00	KV-1882EC, 1882UB, 1882F, 1882CH, 1882AEB, 1882AM, KV-1882ME3, 1882HK, 1882AS, 18TR1, 882EC(PS), 1770R	£20.00
1-439-363-21	KV-18HT1A, 18FX1MT, 18G2, 1802M7, 1802GE, ADM-186, KV-2082UB, 2086UB	£22.00

FLYBACK TRANSFORMERS

FERGUSON

000-4208-001	TX9	£14.00
000-4-208-002	TX9	£14.00
000-4-235-002-01G	TX90	£14.00
000-4-247-001	TX90	£14.00
000-4-247-001 HT1	TX90	£14.00
060-3-093-001	TX100	£14.00
(110) 060-3-087-001	TX100	£14.00
(110) 060-3-084-001	TX100	£14.00
060-3-088-001	TX100	£14.00

GRUNDIG

29201-019-05		£8.00
29201-024-11		£14.00
29201-024-04		£14.00

PHILIPS

PS 140-17112	G11	£14.00
PS 140-10306	G90AE	£11.50
PS 140-10353	G90B	£15.50
PS 140-10151	K12	£15.00
PS 140-10283	K30 K30111	£15.00
PS 140-10246	K40	£13.00
PS 140-10247	KT4	£14.00
PS 140-10149	KT2	£9.00
PS 140-10161	KT3	£9.00
PS 140-17033	G8	£10.00
PS 140-17089	G9	£10.00
PS 140-10328	NC3	£14.00

ITT

	CVC20	£11.50
	CVC25	£11.50
	CVC30	£11.50

HITACHI

2432981	CPT 1444	£15.00
2434274	CPT 2174 CPT2176 CPT 2179	£18.00
OUTPUT TV MODULE	HM6251 (REF 2370551)	£5.50
	HM6232	£5.50

IDLERS & PULLEYS REPLACEMENTS

AKAI

VS1-2 VS4-5 VS15	FF-REW IDLER	M1327773	£4.50
VS3 6 12 56 58 59			
VS1-2 VS4-5 VS15	T-UP IDLER	BV327815	£6.00
VS3 6 12 55 59			
V9700	IDLER	BV321979	£6.00
VS125 126 155	IDLER ASSY	MZ366960J2	£11.00
VS165 240 244 245 247 248 250 512 515 516			
VS22 38 105 112 115 116 205 220			
VP7100 VS9300	T-UP IDLER	PU47752	£4.50
VS9500 VS9800			
VP7100 VS9300	UNLOADING IDLER	PU46381	£4.00
VS9500 VS9800			
VP7100 VS9300	REW IDLER	PU46380	£6.00
VS9500 VS9800			
VP77 VS10	REEL IDLER	BV327815	£3.00
VP88	IDLER	BV336067	£5.00
VS1 3 4 9 12	REEL TABLE	BR347731	£5.50
VS15 56			
VS23 35 37 53 55	CLUTCH	ML373043	£13.00
VS66 75 VS477			
VS9700	FF IDLER	BV321761	£3.20
VS9700	REW IDLER	VV321762	£4.25

AMSTRAD

VCR7000	IDLER	150280	£1.50
TVR1 VCR4500	CLUTCH	150873	£3.75
VCR4600 VC5200 VCR9000			
TVR1 VCR4500	GEAR HOLDER	151284	£3.50
VCR4600 VCR5200 VCR9000			
TVR1 VCR4600	REF CLUTCH		£3.50
VCR5200			
VCR6000 VCR6100	CLUTCH	153202	£3.80
VCR4500 VCR9000	CLUTCH		£4.00
VCR4500 VCR4600	MOD KIT	(TAPE CREASING)	£4.50
VCR4700			
MOD KIT TAPE CREASING FOR AMSTRAD			
VCR4500 4600 4700			£4.50

FERGUSON

3V00 3V01 3V16	T-UP IDLER	PU47752	£4.50
3V22 3292 8900 8901 8904 8906			
3V16 3V22 8902	T-UP IDLER	PU49280	£5.50
8903 8909 8912 8922			
3V23 3V29 3V30	REEL IDLER	PU48967	£2.50
3V31 3V32 3V35 8923 8924 8929 8930 8931 8940 8941 8942			
3V23 3V31	ROLLER ASSY	PU49042A	£4.00
3V29 3V30 3V31	T-UP IDLER	51402	£1.25
3V32 3V35 3V36 3V38 3V39 3V49 8930 8931 8940 8941 8942			
3V29 3V30 3V31	T-UP CLUTCH	PU51380	£2.25
3V32 8930 8931 8940 8941 8942			
3V35 3V36 3V38	REEL IDLER	PU55374	£2.85
3V39 3V49 8943 8944			
3V35 3V36 3V38	T-UP CLUTCH	PU55373	£2.00
3V39 3V49 8943 8944			
3V58 3V59 3V64	IDLER ARM	PU58645	£2.25
3V65 FV10 FV11 FV12 FV13 FV14 FV20 FV21 FV22 FV26			
FV30 FV32 FV33 8950 VC141L			
3V42 3V43	CLUTCH ASSY	PU55822	£13.50
3V42 3V44 3V45	CLUTCH ASSY	PU57658	£11.50
3V48 3V53 3V54 3V55 3V57 8947 8948			
3V42 3V43 3V44	T-UP CLUTCH	PU56043-1-4	£2.80
3V45 3V48 3V53 3V54 3V55 3V56 3V57 8947 8948			
3V42 3V43 3V44	SUPPORT CLUTCH	PU56044-1-5	£2.80
3V45 3V48 3V53 3V54 3V55 3V56 3V57 8947 8948			
3V00 3V01 3V16	LOADING IDLER	PU43681	£4.00
3V22 3292 8900 8901 8902 8903 8904 8906 8909			
8912 8922			
3V00 3V01 3V16	REW IDLER	PU46306	£6.00
3292 8900 8901 8904 8906			
3V16 3V22 8902	IDLER	PU49281	£1.70
8909 8912 8922			
3V16 3V22 8902	IDLER	PU49283	£1.00
8909 8912 8922			

FISHER

FVHP420 520 530	FF-REW PULLEY	HI638531	£1.00
FVHP615 618 620	COMP. IDLER ASSY	FI1430420400300	£3.30
FVHP622 710 711 FVHP720 721 722 FVHP725 730 830			
FVHP840 905 906 FVHP908 910 911 FVHP915 916 918			
FVHP615 618 620	GEAR IDLER ASSY	FI1430490400900	£4.50
FVHP622 710 711 FVHP720 721 722			
FVHP725 730 830 FVHP840			
FVHP615 618 620	REEL T-UP ASSY	FI1430410400900	£5.50
FVHP622 710 711 FVHP720 721 722			
FVHP725 730 830 FVHP840			
FVHP905 906 908	GEAR IDLER ASSY	FI1430490402400	£4.00
FVHP910 911 915 FVHP916 918			
FVHP975 980 990	IDLER	FI1430420400700	£4.50
FVHP998 5000 5005			
FVHP5050 5075 5100			
FVHD40 55 140	REEL DRIVE ROLLER		£6.00
FVHP1 10 20			
FVHP975 980 990	GEAR		£3.00
FVHP975 980 990	CLUTCH	FI1430510404200	£9.50
FVHP420 520 530	IDLER		£2.60
FVHP420 520 530	TAKE UP IDLER		£3.60
FVHP930	LOADING GEAR		£2.00
VBS3500	REEL DRIVE PULLEY		£5.20
VBS3500	IDLER		£3.00
VBS7000	REW IDLER		£1.20

GOLDSTAR

GHV1221 1232 1240	CLUTCH GEAR	4350384	£2.50
GHV1241 1242 1243 GHV1244 1245 1246 GHV1247 1248 8000			
GHV8200 8210 8215 GHVP51 VCP4100 4130			
GHV1221 1232 1240	IDLER		£1.70
GHV1241 1242 1243 GHV1244 1245 1246 GHV1247 1248 8000			
GHV8200 8210 8215 GHVP51 VCP4100 4130			

HINARI

VXL3 VXL20	REEL IDLER	40000009	£1.50
VXL2	IDLER		£1.50
VXL4 VXL35	IDLER		£2.75
VXL4 VXL35	CLUTCH		£6.50
VXL4 VXL12 VXL25	LIMITER POST		£1.30
VXL30 VXL35 VTV300			
VXL5 VXL6	CLUTCH		£3.75
VXL5 VXL6	GEAR HOLDER		£3.50
VXL7 VXL8 VXL9	CLUTCH		£3.80

HITACHI

VT11-33 VT63-64	CLUTCH ASSY	6879515	£7.50
VT14 17 19 38 57 86 88 34 35 39 52 61			
62 65 85 330 640 VT165			
VT120-220 100 110	CLUTCH ASSY	6865824 6886972	£7.50
111 113 115 118 120			
125 128 130 135 138 145 150 175 225 250			
255 258 260 VTL30			
VT6000-8300 7000	FF-REW IDLER	6413663	£2.80
VT8500-8700			
VT8000-8300 7000	PLAY IDLER	6414221	£3.60
VT8500-8700			
VT8000-8300 7000	FF-REW PULLEY	6383531	£0.80
VT8500-8700			
VT9300-9500 6500	FF-REW IDLER	8681471	£3.30
VT680 6800 9700 9900			
VT9300-9500 6500	PLAY IDLER	6861462 6861461	£3.20
VT680 6800 9700			
VT9900			
VT9300-9500 9700	IDLER	681505	£3.00
VT9900 6500 680 6800			
	IDLER	667043	£3.80
VT11-33 VT63-64	FF-REW IDLER	5860971	£1.50
VT14 165 17 19 34 VT35 38 39 52 61 62			
VT65 85 86 88 330 640			
VT100 110 111 113	FF-REW ARM	6886792	£2.75
VT115 118 116 120 125 128 130 135 138 145 150			
VT175 220 225 250 255 258 260 VTL30			
VT400 405 410 413	FF-REW ARM	6897094	£1.30
VT416 413 418 420 425 426 428 430 431 435			
VT438 450 498 510 518 520 525 526 530 535			
VT536 540 545 546 548 570 575 576 580 585			
VT586 VTM625 626 630 635 636 640 645 646 VTS80 85			
VT400 405 410 413	CLUTCH BASE	6895951	£3.25
VT414 415 418 420 425 426 428 430 431 435			
VT438 450 498 510 518 520 525 526 530 535			
VT536 540 545 546 548 570 575 578 580 585			
VT558 VTM625 626 630 635 636 640 645 646 VTS80 85			
VT3000	T-UP IDLER (LARGE)		£4.50
VT3000	REW IDLER		£6.00
VT680 6500 6800	FS-BRAKE	6861505	£3.00
VT9700 9900			

HITACHI TV

OUTPUT MODULE HM 6251	£5.50
OUTPUT MODULE HM 6232	£5.50

JVC

HR330 3660 4100	T-UP IDLER SML	PU49280	£5.50
HR7200 7600 7650	T-UP CLUTCH	PU53462A	£2.25
HR7655 7300 7350 7610			
HR7200 7300 7350	REEL IDLER	PU48967	£2.50
HR7600 7610 7650 7655 7700			
HR7600 7610 7650	ROLLER ASSY	PU49042A	£4.00
HR7655 7700			
HR3300 3660 4100	T-UP IDLER LRG	PU47752	£4.50
HR7200 7600 7650	T-UP IDLER	PU51402A	£1.25
HR7655 HRD110 HRD111 HR7300 7350 7610 HRD120-121 225			
HRD110 HRD120-121	T-UP CLUTCH	PU55373	£2.00
HRD225 HRD111			
HRD110 HRD120-121	IDLER ARM	PU55374-3-8	£2.85
HRD225 HRD111			
HRD170 180 210 230	IDLER ARM	PU58465	£2.25
HRD320 370 400 430 470 530 700 750 950 3000			
HRS5000 HRS5500			
HRD455 HRD725	CLUTCH MECH	PU558822	£13.50
HRD140 150 157 158	CLUTCH MECH	PU57658	£11.50
HRD160 250 257 565 566 755 HRP50			
HR3300 HR3330	REW IDLER	PU46380	£6.00
HR3660 HR4100			
HRD140 150 157 158	TAKE UP CLUTCH	PU56043-1-4	£2.80
HRD160 250 257 455 565 566 725 755 HRP50			
HRD140 150 157 158	TAKE UP CLUTCH	PU56044-1-5	£2.80
HRD160 250 257 455 565 566 725 755 HRP50			

MATSUI

VX730 735 750 755	CLUTCH	850A00005	£6.50
VX810 820 850 880 990			
VX730 735 750 755	LIMITER POST LEVER ASSY		£1.30
VX770 800 810 880			
VX990			
VX800A VX900	IDLER REEL		£1.50
VX800A VX820	REEL UNIT CLUTCH		£3.50
VX850 VX900	ASSY IDLER		

MITSUBISHI

HS306 307 318 319	GEAR ASSY	522P00201	£6.25
HS400 410 710			
HS337 338 347 349	IDLER	552B01701	£6.50
HS411 412 421 HSB10 HSB20 HSB30 HSE10 HSE20 HSE30 HSE70			
HS306 307 318 319	IDLER	641C34301	£2.00
HS400 410 710			
HS347 349 412	IDLER	522B02002	£3.00
HSB10 HSB20 HSB30 HSE10 HSE20 HSE30 HSE70			

MITSUBISHI Cont.

HS337 338 411 421	IDLER	552801601	£3.50
HS200	TAKE UP IDLER (LARGE)		£4.50
HS200	UNLOADING IDLER		£4.00
HS200	REWIND IDLER		£6.90
HS306 307 318 319	SUPPLY REEL	522A00101	£3.20
HS400 410 710	DISK		
HS306 307 318 319	TAKE UP REEL	522A00102	£3.20
HS400 410 710	DISK		
HS320	REEL DISK	522C05301	£3.70
HS337 338 411 421	REEL DISK	522P00601	£5.40
HS300 301 302 310	PULLEY	522C05201	£2.25
HS306 307 318 319	GEAR WHEEL	641D71101	£1.60
HS400 410 710			
HS306 307 318 319	GEAR WHEEL	641D71001	£1.50
HS400 410 710			

NEC

N830 N831 N832 N833	TAKE UP CLUTCH		£2.25
N830 N831 N832 N833	TAKE UP IDLER		£1.45
N830 N831 N832 N833	REEL IDLER		£2.85
N895	TAKE UP IDLER SMALL		£6.40
N911 N915 N916 N917	REEL DRIVE PULLEY		£5.50
N9012 9013 9014 9016 9033 9034 9054 9055 9066 9110			
N9510 9520 9530 9610			

NATIONAL

NV322 NV600 NV688	IDLER UNIT	VXP0463	£2.75
NV777 NV788 NV332 AG6100 6200 6800 6810			
NV300 NV333 NV340	IDLER ARM	VXL0997	£3.60
NV366			
NV300 NV330 NV333	IDLER UNIT	VXP0401	£0.75
NV340 NV366			
NV300 NV330 NV333	PLAY IDLER	VXP0433	£2.75
NV340 NV366 NV8620			
NV300 NV332 NV333	ACTION GEAR	VDG0016	£0.60
NV340 NV366 NV600 NV777 NV788 NV2000 NV2010 3000 7000			
AG6010 AG6015			
NV333 NV688 NV2000	LOADING GEAR	VXP0325	£2.00
NV3000 NV7800			
NV300 NV332 NV333	INTERMEDIATE GEAR	VXG0017	£0.65
NV340 NV366 NV600 NV777 NV788 NV2000 NV2010 3000 7000			
AG6010 AG6015			
NV330 NV333 NV340	CAM GEAR	VXG0158	£1.00
NV366 NV777 NV788			
NV230 NV250 NV260	IDLER ARM	VXP0521	£1.70
NV290 NV370 NV380 NV430 NV450 NV460 NV465 NV470 NV480			
NV630 NV650 NV730 NV780 NV810 NV830 NV850 NV870			
NVG7 NVG9 NVG10 NVG11 NVG12 NVG14 NVG15 NVG16 VG18			
NVG30 NVG400 AG1000 AG1200 1500 1810 2100			
AG2200 NVH65 NVH70			
NV370 NV430 NV870	CAM GEAR	VDG0200	£1.20
NV730 NV830 NV850 NVG10 NVG12 NVG18			
NV730 NV770	IDLER UNIT	VXP0581	£2.50
NV2000 2010 3000	IDLER UNIT	VXP0331	£1.00
NV2000 2010 3000	IDLER UNIT	VXP0329	£1.00
NV2000 NV3000	CAM GEAR	VDG0069	£1.00
NV7000 7200 7800	IDLER UNIT	VXP0344	£1.00
NV7000 7200 7600	CLUTCH	VXP0343	£4.00
NV8150 8200 8300	IDLER UNIT	VXP0245	£0.90
NV8400 8600 8610 8620			
NV8200 8400 8600	PLAY IDLER	VXP0243	£0.95
NV8610 8620			
NV8620	CLUTCH	VXP0343	£4.00
NV332 NV600 NV686	IDLER	VXP0488	£3.50
NVG20 NVG21 NVG25	PULLEY UNIT	VXP0767	£5.00
NVG40 NVG45			
NV230 NV250 NV280	WORM WHEEL	VXP0604	£2.00
NV430 NV450 NV460 NV465 NV650 NV730 NV770 NV810			
NV870 NV890 AG1000			
NV370 NV380 NV630	IDLER	VXP0523	£3.50
NV780 NV830			
NV370	CLUTCH GEAR	VXP0595	£1.00
NVG7 NVG11 NVG12	WORM WHEEL	VXP0891	£1.50
NVG14 NVG15 NVG18 NVG30 NVG120 NVG130 NVG400 NVH70			
NV2000 2010 3000	LOADING GEAR	VDG0035	£0.80
NV7000 7200 7800 8050			
NV230 NV250 NV370	LOADING GEAR	VXP0520	£1.50
NV430 NV450 NV460 NV630 NV730 NV770 NV780 NV810			
NV830 NV890 NVG7 NVG10 NVG12 NVG15 NVG30 NVG120			
NVG130 NVG400 NVH70 AG1000			
NV230 NV250 NV260	CLUTCH GEAR		£2.50
NV290 NV430 NV450 NV730 NV770 NV810 NV870 NV890			
NVG7 NVG10 NVG11 NVG12 NVG14 NVG15 NVG16 NVG30			
NVG120 NVG130 NVG400 NVH70 AG1000			
NV230 NV250 NV260	LIMITER ROLLER		£1.50
NV290 NV300 NV333 NV340 NV366 NV370 NV430 NV450 NV460			
NV465 NV630 NV650 NV777 NV780 NV788 NV810 NV830 NV850			
NV870 NV890 NV2000 NV2010 7200 7800 NVG7 NVG10 NVG12			
NVG14 NVG15 NVG16 NVG30 NVG120 NVG130 NVG400 NVH70 AG1000			

ORION

MULTIPLE MODELS	IDLER	850A200004	£3.50
MULTIPLE MODELS	IDLER	850A200005	£6.50
VH1 VH2A	IDLER		£1.20
VH1 VH2A	IDLER		£1.20
VH1 VH2A	DRIVING GEAR		£0.80
VH1 VH2A	INTERMEDIATE GEAR		£0.88
VC150 VC180 VH200	IDLER		£1.50
VH201 VH205 VH212 VH250 VH254 VH288 VH300 VH303 VH312			
VH404 VH555 VH700 VH704 VH708 VH712 VH780 VH844 VH900 VH3 VH33			

SAISHO

VR605 VR800 VR900	CLUTCH	850A20000	£6.50
VR1100 1200 1600 2500 3200 3300			
VR3500 3600 3800	LIMITER POST		£1.30
VR1100 1200 1600 2500 3200 3300 3500 3600 3700			
VR605 VR800 VR900	IDLER		£3.50
VR2500 3200 3300 3500 3600 3800			
VR705 VR805 VR905	IDLER		£1.50

SANYO

VHR1110 1150 1200	IDLER	143-0-662T-14730	£5.00
VHR1300 1500			
VTC5000 5150 6000	FF-REW IDLER	143-0-741T-20001	£3.00
VTC6500 VTCM10 M11 M20 M21 M30 M31 M50			
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VIDEO SERVICE KITS *(Cont.)*

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TP660	1050P
TP661	1050P
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A617402/655602	1000P
A512120/230	1000P
A514790	1000P
A5088470	1000P
A518612	1000P
SCL002	1000P
C2096	1000P
A511940	1000P
655602H	1000P
ITT	
IFB13, 14, 15	900P
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RG305	900P
RG306	900P
FS9/1-10/1	900P
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DC11	1000P
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010270601	1000P
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NOKIA	
SATELLITE	1000P
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CMC1, TC3519	1050P
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390C9500	1000P
ORION	
RC53	1000P
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EUR51200	900P
TC2200	900P
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69117194	1050P
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KT3 TEXT	900P
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RC5901	900P
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T6772	1000P
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TC358	1050P
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86173	1000P
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JXDE	1000P
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RC628	1000P
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FC616	1000P
FC631	1000P
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SONY	
RM604, RM605, RM606	900P
32 CHANNEL	900P
RM613	900P
RM632, RM636	900P
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RC70	900P
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FB632	1000P
FB639	1000P
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3V31-32	900P
3V57-58	1050P
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BLAUPUNKT 210	1600P	LOT08
GRUNDIG 2922010	1600P	LOT09
ITT CVC800/1/3	1500P	LOT10
ITTD218/37 EQ	1600P	LOT11
NORMENDE 5255	1600P	LOT12
SABA 81000 200	1600P	LOT13
SALORA T236 EQ	1650P	LOT14
SABA 811-50-24	1600P	LOT15
SABA 770223500	1600P	LOT16
TELEFUNKEN AT1	1450P	LOT17
TELEFUNKEN EQ	1400P	LOT18
SALORA FM0218B	1600P	LOT19
NORMENDE 5255	1600P	LOT20
ITT CVC 1150/1	1500P	LOT21
ITT COMPACT 80	1500P	LOT22
FE TX100 GREEN	1450P	LOT23
HINARI CT4/5 5113	1500P	LOT24
SELECO 6320410	1600P	LOT25
BLAUPUNKT 8667	1600P	LOT26
ITT COMPACT B1	1450P	LOT27
ITT CT3326 MUL	1500P	LOT28
ITT D066/37 EQ	1600P	LOT29
ITT 3546 EQ	1500P	LOT30
LUXOR 5810110	1600P	LOT31
SABA 849380920	1600P	LOT32
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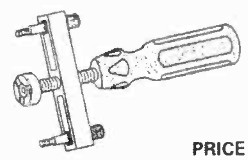

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- 20mm O/B (PKTS OF 10) 500MA, 630MA, 800MA, 1A, 1 6A,2A,2 5A,3 15A .80

I.C's
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- SAA1293-02 5.95
- SAA1293-03 6.95
- SAA1293A 03 9.95
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- STK5332 4.95
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- MATSUI 1410 20'40 18.95
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- AMSTRAD 6000 9.95
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- BU426A 1.45
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- T9054V 3.50
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- ONYX SOLDER PUMP 9.95
- ONYX TIPS 1.50
- PERMABOND ADHESIVE 3.95
- SILICON GREASE 1.85
- SOLDA MOP .80
- SOLDER 0.5KG 18SWG 8.50
- SOLDER 0 5KG 22SWG 8.75
- WELLER GUN TIPS (2) 1.25

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VCR4000
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- CAPACITOR BACK-UP 1.85
- PINCH ROLLER 3.95
- REEL IDLER 3.95
- REEL PULLEY 1.95

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VCR4500
- BELT KIT 1.95
- GEAR ASSEMBLY 9.95
- MODIFICATION KIT 6.50
- PINCH ROLLER 3.50

VCR4600
- BELT KIT 1.95
- GEAR ASSEMBLY 9.95
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- PINCH ROLLER 3.95
- REEL IDLER 3.95
- VCR6000 BELT KIT 1.95
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3V29/30
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- CASSETTE LAMP .70
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- REEL IDLER 2.95
- TAKE UP CLUTCH 2.95
- TAKE UP IDLER 1.95

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- CAPSTAN MOTOR 21.50
- CASSETTE HOUSING 25.95
- LOADING BELTS (5) 1.95
- MAINS TRANSFORMER 23.95
- PINCH ROLLER 3.95
- REEL IDLER 2.95
- TAKE UP IDLER 1.95
- TAKE UP CLUTCH 2.95

3V44/45
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- CASSETTE HOUSING 25.95
- PINCH ROLLER 3.95

3V65/FV11
- BELT KIT 1.75
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- CASSETTE HOUSING 29.95
- PINCH ROLLER 3.95
- REEL IDLER 2.75

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- REEL IDLER 5.50
- PINCH ROLLER 3.50
- TENSION BAND 2.60

FVH615/720
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- CLUTCH ASSEMBLY 5.95
- PINCH ROLLER 4.50
- REEL IDLER 5.95

FVH905/910
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- CLUTCH ASSEMBLY 19.95
- REEL IDLER 5.95

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- FF/REW PULLEY .95
- PINCH ROLLER 3.95
- PLAY IDLER 3.95
- REEL TABLE 3.95
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- FF/REW IDLER 2.75
- FF/REW PULLEY .95
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- BELT KIT 1.95
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- CAPSTAN MOTOR VT33E 23.95
- CLUTCH ASSEMBLY 7.95
- FF/REW IDLER Genuine 2.50
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- CAPSTAN MOTOR 27.50
- CLUTCH ASSEMBLY 7.95
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VT120/130E
- BELT KIT 1.95
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- FF/REW IDLER 3.75
- PINCH ROLLER 3.95

PANASONIC VIDEO SPARES
NV230/430
- BELT KIT 1.95
- PINCH ROLLER 3.95
- REEL IDLER GENUINE 2.95

NV333/366
- BELT KIT 1.95
- PINCH ROLLER 3.95
- PLAY IDLER GENUINE 4.95
- REEL IDLER GENUINE 1.25

NV370
- BELT KIT 1.95
- MODE SWITCH 3.95
- PINCH ROLLER 3.95
- REEL IDLER GENUINE 2.95

NV730
- BELT KIT 1.95
- PINCH ROLLER 3.95
- REEL IDLER GENUINE 3.95

NV777
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- REEL IDLER GENUINE 1.25

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NVG7/10/12
- BELT KIT 1.95
- MODE SWITCH 3.95
- PINCH ROLLER 3.95
- REEL IDLER GENUINE 2.95

PHILIPS VIDEO SPARES
VR6460/6520
- BELT KIT 1.95
- PINCH ROLLER 3.95
- REEL IDLER 2.95
- REPAIR KIT 12.95

VR6462/6560
- REPAIR KIT 12.95
- CASSETTE HOUSING 16.95
- PINCH ROLLER 3.95
- REEL IDLER GENUINE 4.95

VR6467/6760
- REPAIR KIT GENUINE 21.50
- BELT KIT 2.95
- CASSETTE HOUSING 17.95
- PINCH ROLLER ARM ASSY 7.50

SANYO VIDEO SPARES
VTC5000
- BELT KIT 1.00
- REEL MOTOR GENUINE 7.95
- REEL PULLEY GENUINE 5.95

VHR1100/1300
- BELT KIT 2.25
- PINCH ROLLER 3.50
- REEL DRIVE ROLLER 5.95

VHR3100/3700
- BELT KIT 1.95
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- REEL DRIVE ROLLER 5.95

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VC9300/381
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VC681
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Note that we are unable to answer technical queries over the telephone and cannot provide information on spares other than that given in our Spares Guide.

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COVER PHOTO
This month's cover photograph shows a Philips 3A chassis receiver. See servicing article on pages 857-861.

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The Multichannel World

So BSkyB has turned out to be a financial success. In the year to this June it contributed a profit of £26·7m to News International in comparison with a loss of £13·3 for the previous year. Since News International owns fifty per cent of BSkyB, it seems that the satellite broadcaster must have made a profit of about £53 for the year. Good going. From September 1st, BSkyB's viewers have had the option of paying between £4 and £20 a month for the broadcaster's services, depending on the number and type of channels taken. If all goes well for BSkyB, this will further enhance its profitability. While dish sales have hardly been booming in recent months, BSkyB has only to hold on to its present market share to do well. There are considerable prospects for improvement however. At present 80 per cent of households in the UK are not able to receive satellite TV. BSkyB is certain to be able to increase its viewer base.

Although BSkyB doesn't face much competition from other satellite broadcasters at present, this situation is unlikely to last. Ted Turner for one is increasing his portfolio of Astra channels. Then there will be Eutelsat's Hot Birds at 13°E, with transmissions starting about this time next year. Powers are going up all the time. Eutelsat II F1-5 have 50W travelling-wave output amplifier tubes; F6 (the Hot Bird) is to have 70W tubes while Hot Bird Plus, at present in the planning stage, would be equipped with 110W tubes. It is of course one thing to launch satellites, another to lease channels. We shall have to see what will be on offer from 13°E – the wide footprints indicate that Eutelsat is thinking more in terms of transeuropean services.

What's at present on offer from the skies could pale into insignificance once digital transmission for direct broadcasting arrives. This will bring with it 150-channel satellites. Sorting out the signals at the receiver end shouldn't be a problem – one big chip along Nicam lines is likely to do most of the work. What use will be made of all these channels, since it's unlikely that there will be anything like that number of broadcast services? David Elstein, BSkyB's director of programmes, envisages 50 channels being allocated to one premium film, providing ten-minute film start intervals. If you couldn't be bothered to watch the film through, you could see the beginning and end at the flick of a switch!

The interesting question is how cable will respond to all this. It's an old battle. Back in the Forties there was considerable debate about whether to use cables or radiowaves for broadcasting. Some felt that the simpler terminals would make cable operation cheaper. On that occasion the off-air services won the argument. Cable was left to serve the few locations that presented geographical problems for radio transmissions

This time round the situation is far more open. Fibre-optic cables carrying multiplexed digital signals can handle as many channels and services as satellites can. There is, in addition, the possibility of integrating TV/radio distribution with telephony and other services. In the USA AT&T is holding preliminary talks with leading cable television and local telephone companies with a view to AT&T providing the basis of a national, interactive multimedia communications network. Then again, all this could be provided via satellites, though cable possibly has an advantage in simplifying the provision of local services.

However it turns out, the whole business of domestic communications could be very different in even ten years' time. It will be interesting to see whether direct satellite transmissions and cable can provide complementary services. This is likely to resolve around the question of comparative costs – and one can expect a lot of political lobbying. There will certainly be some considerable business opportunities. With these, timing will be all important to success. To get back to BSkyB, it increasingly appears that this was an example of the right decision being made at the right time – with a bit of luck as well of course!

Service Briefs from Toshiba

The following information has been provided by Toshiba in the interests of carrying out correct, effective repairs to the company's products. It's based on Toshiba's Technical Bulletins.

Models 155R9B/T9B

Set reverts to the standby mode after fifteen minutes (usually longer). Will work normally if switched off and on again: The cause is static charge building up on the core of the line output transformer until, under dry-humidity conditions, it finally discharges to the adjacent resistor R440. As a result the microcontroller chip QA01 temporarily stops. The cure is to fit repair kit part no. TCP00742.

No raster because of field collapse: If R327 (10Ω, 0·5W) has gone open-circuit to cause this fault replace it with a 13Ω, 1W resistor, part no. 24532130.

Model 156T9B

Set reverts to standby: See note under Models 155R9B/T9B above.

Model 175T9B

Audio buzz at u.h.f. near ch. 33: Coils L601 and L602 are too close to each other. Move them apart.

Model 210T6B

No teletext and the on-screen display is in monochrome: 12V supply to the μPC1417CA RGB/text switch chip ICV02 is low at 10·3V because R447 that shunts the TA78012AP 12V regulator Q408 is open-circuit or dry-jointed. Replace R447 (20Ω, 3W, part no. 24007649).

Model 215T9B

Comes on o.k. but if channels are changed when the set has warmed up the tuning won't lock to any station: Replace diode DA07 (1N4148) which is leaky.

Model 218D9B

No colour with an 0·5in. wide vertical black band at the left-hand side of the screen, 4in. from the edge: Sand-castle pulse is incorrect because R219 (4·7kΩ) at pin 35 of the TA8659N chip IC501 is open-circuit. Replace or resolder R219.

Model 219T9B

Buzz on sound at low level: Separate the cables that are loomed together across the i.f. screening can.

Models 255R7B/T7B

Dull blank raster with no sound when standby is selected: The 145V h.t. switch is permanently on. Check Q803 (2SC2023, part no. 23314246), Q804 (2SA1321, part no. A6547303) and Q806 (BC557B, part no. 23114546) for shorts and replace as necessary.

Models 255R7B/255T7B/255R8B/255T8B/256T9B/284T8B/285T8B

TDA8170 field output chip IC303 fails, normally short-circuit sometimes with outer case damage. Simple replacement may result in repeated failure: Replace IC303 (TDA8170, part no. 23318301), the 6·8V zener diode D303 (part no. 23118102T), and the 2·7Ω resistor R327 (part no. 24557279). Remove D305 (BYD33J) and fit a 47Ω, 1W resistor (part no. 24553470) in this position. Refit D305, with the same polarity as before, on the print side of the PCB: stick vinyl tape betwen the PCB and the diode to prevent it shorting.

Model 258T7B

Bright white raster with no picture: Replace D205 (1N4148) which is open-circuit and probably physically broken.

No luminance with teletext: Replace D204 (1N4148) which is open-circuit and probably physically broken.

Poor contrast with the control having no effect and pin 15 of the μPD6336C chip ICA03 stuck at 5·2V: Replace DA70 (1N4148) which is open-circuit.

Intermittent flashing and a negative picture when set has warmed up, raster eventually going blank: Replace the 0·01μF disc ceramic capacitor CV03 which is leaky. It's connected to pin 5 of the TA8628N chip ICV01 on the back terminal PCB.

Poor TV and teletext contrast: Replace R549 (470Ω, 0·5W, part no. 24552471) which is open-circuit.

Field jitter: Replace D301 (1N4148) which is open-circuit.

Model 259D9B

Picture permanently blanked off in all modes (r.f./video/scart): Replace QV07 (BC547A, part no. 23114689) which is short-circuit base-to-emitter. It's on the back terminal PCB.

Loss of colour with some pictures when using a Sega Megadrive video games computer: Line sync pulses from the Sega computer are wider than broadcast pulses. Change C371 to 0·1μF (from 6,800pF).

Crackling on Nicam sound: Replace R111 (10Ω) which is open-circuit. It's on the rear terminal PCB.

Note that the circuit references for CG60/RG34 and CG48/RG30 in the Nicam circuit diagram at the rear of the manual are reversed – correct the diagram.

Model 285T8B

Very intermittently fails to come on from standby. Replacing the TDA4601 chip IC801 may provide a temporary cure: Change R818 from 20kΩ, 3W to 15kΩ, 3W – note that this is a safety resistor. Change the 22μF, 16V capacitor fitted in parallel with diode DF80 but on the print side of the PCB to 100μF, 16V. Add a 5·1kΩ, 1/8W resistor in parallel with D812, on the print side of the PCB. All three components are available as a kit, part no. 23305114.

Power supply fails to start after replacing a faulty TDA4601 chopper control chip (IC801): Incorrect chip fitted – it must be a Siemens device.

Reduced height initially. Gradually increases as the set warms up until picture is approximately twice the normal size: Replace the 7·5V zener diode D315, part no. A7110160. It's the vertical drive limiter at pin 31 of IC501.

Search tuning fails to stop: Replace the 0·01μF disc ceramic capacitor CA31 which is leaky.

No field lock: Replace the TA8659N chip IC501 (part no. B0379470).

Intermittent audio screeching at switch on: Replace the AN7171NK chip IC606 (part no. 23318195).

Note that early sets didn't select Nicam sound automatically on changing channels. To correct this remove diode DA36 which is near the microcontroller chip ICA01.

Model 1400TBT

No line or field sync: Print break at pin 10 and/or pin 11 of the teletext unit. In later sets the fitting was improved.

Models 2100RBT/2100TBT/2101TBT/2500TBT

Dead set due to chopper transistor Q802 going short-circuit: Replace Q802 with revised type 2SD1556(E), part no. A6871313, and remove R822 (39Ω) from its base circuit.

Hum bars, mainly on colour (red): Cause of the problem is pick-up of 50Hz on the tuner's tuning line from the adjacent power supply earth. Modifications details are available from Toshiba Technical Advice (0276 694 555).

Model 2100TBT

Power supply pulsating, h.t. low: Replace C820 (120μF, part no. 24086871) which is open-circuit.

Intermittent display of the AV symbol on the screen: Resolder dry-joint on the red lead on the component side of the PCB, between points identified as C and C.

Models 2100TBT/2101TBT/2500TBT

Red and blue diagonal lines on the screen on certain u.h.f. channels (31, 45 and 69). Worse under poor signal conditions: Cause is interference generated by the internal 55·5MHz clock in the text unit. Fit a CF72308 chip (part no. 23319586) in position ICF01 in place of the original CF72303 chip and connect two 1N4148 diodes in parallel but with opposite polarity between pins 11 and 12 of ICF01, on the print side of the PCB (insulate them from the print to avoid shorts). Note that the original type of chip won't work with these diodes fitted.

Model 2112DBT

Set trips after a few minutes. Prior to this the picture is too wide: There is no feedback for h.t. control because the TLP621 optocoupler D830 is faulty. Replace it (part no. A8643106).

No colour at switch on. Colour appears after a few minutes. Freezing and heating does not instigate fault condition: Replace the BC547A transistor Q546 (part no. 23114689) which is open-circuit base-to-emitter when cold.

Set turns off intermittently (line oscillator shuts down): The TA8783N colour decoder and timebase generator chip IC501 senses sudden increases in beam current at pin 52, disabling the line drive. To prevent spurious operation of this circuit, remove R844 (1MΩ) and fit a 330kΩ resistor in parallel with C543.

Model 2500TBT

Diagonal black or coloured lines on colour. Lines vary with the setting of the colour control: Replace C515 (22μF) which is open-circuit. Use a 50V type. Original capacitor may show rust-type contamination.

Failure of the TDA8170 field output chip IC303 – normally goes short-circuit. Replacement may result in repeated failure: Replace IC303 (TDA8170, part no. 23318301). Remove the 6·8V zener diode D303 and fit a link in this position. Add a 47μF, 35V capacitor (part no. 24796470) with its positive terminal to pin 7 of IC303 and its negative terminal to chassis. Add an 820Ω resistor (part no. 24552821) between pins 6 and 7 of IC303. Fit these two components on the print side of the PCB, with vinyl tape to provide insulation between them and the print.

Models 2505DBT/2805DBT

Field collapse with a couple of lines of scan visible above the centre line: Check for a ramp waveform at pin 15 of the TA8739P EW correction chip IC371. If the waveform is missing replace IC371 (part no. B0383680).

Cracking noises from the surround sound speakers when very loud noises, e.g. explosions, occur: Excessive audio input to the Dolby decoder is being clipped. Contact Toshiba Technical Advice (0276 694 555) for modification details.

Models 2527DB/2927BB/3327DB

Blank grey screen, no remote control operation, no LEDs alight, no on-screen graphics, no sound: The TA8218 sound output chip IC670 has failed (usually pins 9 and 13 going short-circuit), as a result of which circuit protector ZP81 has gone open-circuit. Replace IC670 (part no. B0377305) and ZP81 (part no. 23144451). With this fault it's very important to replace the following six diodes (all type 1N4148, part no. 23115599) which may well have been damaged: D670/1/2/3/4/5.

MORE TO FOLLOW, INCLUDING VCR NOTES

Test Report: Wavetek Series 2000 DMMs

David Botto

The major claim for Wavetek's new-generation 2000 series digital multimeters is that they have greater measurement and trouble-shooting ability than any other hand-held meters. They certainly offer a wealth of functions and features, including an impressive fault-finder mode that's unique to the Wavetek Corporation.

There are three versions. Models 2010 and 2020 both have a basic d.c. accuracy of 0·25 per cent while the d.c. accuracy of the top-of-the-range Model 2030 is 0·10 per cent. Models 2010 and 2020 have the same ranges and functions as the 2030 however. For the purposes of this test report we were provided with a 2030. Complete with holster and battery it weighs 525g. Without the holster it measures 175 x 90 x 34mm. Size is a factor to be considered: every workshop I visit seems to suffer from an acute shortage of bench space. You can slot either one or both of the test probes into the back of the holster (see photograph) for 'third-hand' operation. The tilt-stand has two positions so that its angle on the bench can be varied. A specially designed Flex-Strap enables the meter to be hung vertically from any convenient fixing point.

An MN1604 alkaline or equivalent 9V battery provides the power required, its life time being typically two hundred hours. There's a low-voltage annunciator that provides a warning when only twenty hours' use remains. If the meter is left on, an auto power-down circuit shuts it off after half an hour of inactivity.

Digital Count

Today's professional service engineer needs a quality DMM with at least a 3·75- or 4-digit readout. If you measure 9·627V with a 3·5-digit meter for example it will register a misleading 9·6V. This is not sufficiently accurate when dealing with the complex equipment that can nowadays arrive on the bench.

The Wavetek Model 2020 DMM in its holster with tilt stand, showing one probe slotted into the back.

The series 2000 DMMs have a 4·5-digit, 10,000-count, solid-black LCD readout. The extra-large 15mm digits are a joy to read and can be seen clearly from across the workshop. A nice touch is the little range indicator number that appears above the decimal point. The display has the best set of function annunciators I've come across. Rapid autoranging ensures maximum resolution at all times.

Bar-graph Pointer

The 40-digit analogue bar-graph 'pointer' in the display is fast and is equal to or better than a well-damped, quality moving-coil movement. It updates twenty times a second, displaying information faster than the digital display. I found it excellent for circuit peaking and nulling, for locating noisy resistances and the presence of a.c. on a d.c. voltage.

Range Protection and Safety

Professional service engineers appreciate the importance of safety and overload protection with a DMM. The series 2000 is designed to meet the demanding specifications of UL1244, CSA, IEC348 and ICE1010. The meters are housed in robust, flame-retardant, high-impact resistant thermoplastic cases and are protected against shock and vibration to the tough standards of MIL-T-28800, class II. Further protection is provided by the sturdy, grey rubber holster.

In addition the meters provide visual and audible warnings of dangerous measurements. OL in the display, accompanied by a continuous tone, indicates the presence of an overload on the selected voltage or current range. Measured a.c. or d.c. voltages in excess of 25V are accompanied by a lighting bolt symbol and a double audio tone (it's now recognised that voltages as low as 25V can in certain circumstances be dangerous). If you connect a test probe to the 10A socket and select anything other than current there's a continuous 'peep-peep' sound and FErr appears in the display.

The maximum permitted voltage between any terminal and earth is 1kV. The resistance and voltage ranges are protected against voltage transients in confomity with IEEE-587 STD category B (1·25 x 50µsec, 6kV). High-energy, 600V fuses of either 0·25A or 15A rating protect the current ranges. When a factory recommended fuse is installed the high-current input is protected to an energy limit of 100,000A.

Ranges and Functions

A sturdy rotary switch is used to select the required range while a set of clearly-labelled buttons gives access to the powerful features incorporated. Models 2020 and 2030 have an amber backlight that illuminates the display at the touch of a button: in my view this is an essential when working in poor lighting conditions.

The five a.c. voltage ranges cover from 0·01mV to 1kV. On both the a.c. and the d.c. voltage ranges the input impedance is 10MΩ. With all models the accuracy is 2 per cent + eight digits over the specified range of 45Hz to 2kHz (45Hz to 400Hz on the 100mV range).

Model 2010 is an average-responding r.m.s. instrument. Most digital multimeters use this technique: an average-responding converter determines the average value of an a.c. signal by rectifying and smoothing it then multiplying the result by 1·11 to obtain the r.m.s. value. This 'scaling factor' of 1·11 is accurate when a sinewave signal is being measured, but in TV, VCR and microcomputer servicing complex waveforms are often present. With these, significant errors can occur when an average-responding instrument is used.

Models 2020 and 2030 use true-r.m.s. conversion to measure two types of r.m.s. values. When both a.c. and d.c. voltages are present, the user sets the instrument to 'd.c. volts' and then presses the second function button: the display shows the total effective a.c.-plus-d.c. voltage present. To measure true a.c.-only r.m.s. values, the range switch's a.c. position is selected.

An important aspect of true-r.m.s. a.c. measurements is the 'crest factor'. The crest factor of an a.c. waveform is the ratio of its peak to its r.m.s. value. It varies with the shape of the waveform. With a sinewave signal the crest factor is 1·414, with a squarewave it's 1 and with a triangular waveform it's 1·733. A full-wave rectified sinewave has a crest factor of 1·414 true r.m.s. a.c. on d.c., 3·247 true r.m.s. a.c. only.

A meter that uses true-r.m.s. conversion is given a crest-factor specification, which indicates its ability to measure the r.m.s. value of different a.c. waveforms correctly – to handle a signal with large peak values compared to its r.m.s. value without saturation and degradation of the stipulated accuracy. At half scale Models 2020 and 2030 measure signals with a crest factor between 1 and 3 with no loss of performance. At or below 2,500 counts, signals with crest factors up to 5 can be measured accurately.

To find an unknown crest factor, measure the peak voltage using the meter's peak-hold feature. Divide this reading by the measured r.m.s. voltage. Few DMMs offer this facility, which is extremely useful.

For d.c. voltages there are five ranges from 0·01mV to 1kV. With Model 2030 the accuracy is 0·10 per cent + two digits. Table 1 shows the results of some of my test checks with the 2030. You'll see that the measured values are far better than the claimed ones.

Table 1: Typical d.c. voltage checks.

Precision source	*Measured value*
1·2V	1·206V
5V	5·002V
10V	10V
12V	12V
24V	24V
30V	30V

The seven resistance ranges cover from 0·01Ω to 20MΩ. A good feature is that in the autorange mode an open-circuit is indicated by the appearance of the word 'open' in the display rather than by some ambiguous symbol. In the range-lock mode OL is displayed. In the autorange mode the relative mode setting enables you to compensate for the resistance of the test probe leads. This is an exceptionally useful facility when, for example, checking the windings of VCR motors. It's also possible to zero the meter to a known

Table 2: Pulse detector readings.

Frequency	*Pointer range*	*Percentage*
1Hz	1-4·75	55·3
1kHz	2·75 average	55·7
100kHz	3·25 average	65·8

Table 3: Frequency checks.

Precision counter	*Model 2030*
1Hz	1Hz
22Hz	0·022kHz
30Hz	0·030kHz
50Hz	0·050kHz
200Hz	0·200kHz
1000Hz	1·000kHz
20kHz	20·00kHz
70kHz	70·00kHz
1·401MHz	1·4011MHz
2MHz	2·000MHz
3·5MHz	3·500MHz
3·880MHz	3·880MHz
4MHz	4·000MHz
4·019MHz	4·019MHz
4·022MHz	4·021MHz
4·2MHz	No response

input value then check for deviation and tolerance.

Tests showed that the accuracy on the kΩ ranges is as good or better than my precision standards. The two MΩ ranges were found to be well within the claimed 0·7 per cent and 1·2 per cent.

The 100mV test voltage used on the kΩ ranges is low enough to allow in-circuit component tests without switching on semiconductor devices. A special conduction test provides both visual and audible diode and transistor checks.

The pulse detector function, which is standard with all three models, removes the need for a separate logic probe and the bother of having to find and make connections to 5V or 12V supplies in the equipment being tested. TTL and CMOS logic circuits are easily checked. So are the logic levels and clock oscillator signals with microcprocessor and microcontroller chips. Pulses as fast as 50nsec can be measured.

The bar graph shows percentage of range for d.c. volts. Using a pulse generator, I checked digital pulses at frequencies as low as 1Hz both visually and audibly. At this frequency individual pulses peep and are clearly shown by the bar-graph pointer. In excess of 20Hz the tone changes, sounding continuously. The bar-graph pointer shows percentage of range – see Table 2.

Many DMMs have capacitance ranges, but most stop short at a range of around 20μF. The 2000 series instruments measure from 100pF to 2,000μF – though I felt that an additional range covering values between 10pF and 100pF would have been an advantage.

Three frequency ranges cover from 1Hz to 1·9999MHz. I found however that I could measure sine and squarewave signals from a signal generator up to slightly above 4MHz – see Table 3. When used with the frequency prescaler project described in my article in the February 1992 issue of *Television* the 2030 will measure frequencies up to 150MHz or 199MHz.

To make duty-cycle measurements set the instrument to 'frequency' and press a function button: duty cycle then reads out as a percentage.

Special Features

Range lock enables you to lock the meter scale to the currently displayed range with all functions except frequency. The probe hold feature enables you to make a measurement and disconnect the probes from the circuit, the measured value remaining in the display until the next measurement is made (the exceptions here are on the capacitance and frequency ranges). The relative mode enables you to measure values with respect to a reference value other than zero: it operates with all functions.

Auto min-max enables you to measure and record the minimum, maximum and running average with signals of either positive or negative polarity. Peak hold works with a.c. and d.c. voltages and current checks – it's a technique for reading voltage and current signals as short as 1msec.

Fault Finder

I found the fault finder an exceptionally useful feature, especially when tracing the cause of intermittent faults. When it's enabled, the fault-finder function produces a tone whose pitch changes in accordance with the value being displayed. It can be used with the a.c. and d.c. voltage, current, resistance and capacitance ranges.

If you suspect that there's an intermittent connection or PCB link, switch the meter to ohms and press the menu buttons to select the fault-finder function. You'll then hear a low-pitched multi-frequency oscillation. A short-circuit produces a low, grumbling clicking noise while with an open-circuit there's no sound. A scratchy sound indicates a short-to-open transition, a high-pitched oscillation revealing an open-to-short transition.

The fast response time of the fault-finder function makes it easy to peak and null r.f. circuits. The function is also ideal for carrying out supply line checks in places that are hard to reach: a 5V d.c. reading has a lower pitch than a 9V d.c. reading for example, a 12V d.c. reading having a higher pitch. You soon get used to these tones, and are able to distinguish easily between say 5V and 12V d.c. readings without having to look at the display.

Summary

The meters are guaranteed for three years, and each one receives a thorough burn-in run and exhaustive computerised testing on all ranges before leaving the factory. The operator's manual is well printed, comprehensive and written in simple, understandable English. In addition a whole section in the manual deals with safety information. Manuals are important: a well-written handbook extends considerably the usefulness of any piece of test gear.

Should you decide to buy a series 2000 DMM, I'd recommend the top-of-the-range Model 2030. Its additional features and greater accuracy are well worth the extra cost. The current price of the 2030, complete with holster, an excellent set of test leads, a battery and operator's manual is £275 plus VAT. The 2020 comes at £231 and the 2010 at £187, both plus VAT. A range of optional accessories is available.

The meters are available from Wavetek Ltd., Astec Building, High Street, Woolaston, Stourbridge, West Midlands DY8 4PG (telephone 0384 442 394). My thanks to Sue Round for the loan of the 2030 and the photograph.

Letters

COST OF MANUALS

Following recent letters about the Technical Service departments of major manufacturers being unwilling to supply information to those who are not main, registered dealers or haven't passed their stringent capability tests, here's another annoyance – the price of service manuals. I recently had to delve into an Amstrad FX9600T fax machine. As it turned out to be in a dire state I rang my regular component supplier to enquire about the availability of a service manual for the unit. "Yes sir, a stock item at £20·16" I was told. Being somewhat taken aback, I said I'd let them know. A phone call to a service manual specialist produced a quote of £18·65 plus £2·35 post and packing. So no saving there. Job temporarily abandonded!

A subsequent call about a VCR manual produced a similar price, so it was not a one-off situation. Looking through my supplier's catalogue, I noticed a wide variation in the price of service manuals, some below £2 and some over £20 according to manufacturer. I realise that a lot of work has to go into the production of a service manual, but after all what are they for? They exist to help us to try to repair the unit for the customer so that he continues to be satisfied with the manufacturer's product. I can imagine the customer's reaction if told that in addition to our standard service charge and the cost of spares he will have to pay £20 for a manual to enable us to carry out the repair. He'd tuck the unit under his arm and disappear out of the door.

A few years back, when manuals were priced at £1 or so, the cost could be absorbed in the repair charge. But at £20, no way! And the chance of getting another repair to do with the same model is becoming quite rare. Do manufacturers really want us to write off their products, some only a year or two old, because we can't afford the service information? With so much competition in the consumer electronics market, I think this policy needs to be reassessed.

Mike Goodall,
Littleport, Ely, Cambridgeshire.

NIKKAI BABY 10 AGAIN

With reference to Chris Avis's comments on the TA7680AP i.f. chip IC101 in the Nikkai Baby 10 overheating (August), we've had this problem on a number of occasions, producing the hum-bar like symptom described and others. There has usually been a cause however. Amongst those we have traced have been a leaky or short-circuit audio coupling capacitor (C111, 0·47µF 35V), a short-circuit f.e.t. in the a.f.c. circuit (Q103, type 2SK30A), faults within the tuner and IC101 itself being faulty internally. There are other possibilities.

L. Mackenzie, T.Eng.,
Edinburgh.

SAMSUNG CD PLAYERS

Mike Leach has been busy fitting laser units (CD Player Casebook, September). He seemed to be a bit uncertain about the one he fitted in the Samsung RCD995, and I think he was right to be doubtful – I bet it's bounced already! The laser unit in this model does fail, but not too often. From the other observations made I would think that the problem was to do with the pickup leads. There are two sets of leads from the pickup. The one consisting of a black and seven white wires provides the laser supply and monitoring and the links to the tracking and focus servos. The end of this lead, which is soldered into the PCB, goes intermittently high-resistance at its crimps. The simple solution is to dismantle it carefully and solder the wires at the crimps. There's another approach: Samsung is aware of the problem and will supply a replacement lead (part no. 13052.901.880). All other Samsung models that use the same CD mechanism, including the RCD990, RCD1300, RCD1350 and RCD2600, suffer from this fault.

I've had the same problem with CD players produced by a number of different manufacturers. Generally Technical Departments either don't know of or admit to it. Only Samsung seems to supply a better lead.

Les Austin,
Stone, Staffs.

FOR DISPOSAL

I have for disposal a full set of *Television* magazines going back to 1983, also a similar set of *Electronics and Wireless World* and a few VCR manuals, including those for the Ferguson 3V29 and Grundig V2000. If anyone is interested, a call to the number below to arrange collection is all that's necessary.

Geoff Lewis, Canterbury, Kent.
Tel. 0227 769 567, fax 0227 768 338.

THOSE NICE SONY PEOPLE

I read Peter Delaney's letter (August) regarding a Sony Model KV2090 with great interest. The last KV2090 that appeared in my workshop was suffering from amnesia. I was told that the channels had to be retuned and stored regularly. In fact the set refused to operate at all unless the mains switch was held in physically. When I consulted the manual I found a technical bulletin stating that a modification kit should be fitted to replace the original Preh switch.

I phoned the number given but was told to ring another one. Some time later this was successful. The set's serial number was checked and the owner's details were requested. I was told that a modification kit would be sent and that the owner would be informed about what was happening. I was then asked for my account number. When I said that I didn't have an account I was told that a kit couldn't be sent and that my customer would be told to take the set to a Sony dealer! So after I'd gone to the trouble and expense of making three trunk calls in an effort to make the set safe, those "nice Sony people" were so pleased with me that they decided to take my business away. I was so angry I told them I'd have to fit another original type switch, which I had in stock, and put the phone down.

In the event I managed to obtain the plastic bracket required from a colleague, and fitted an Alps switch which I also had in stock. After replacing the M58658P EAROM chip and carrying out some resoldering, including the five stand-up wirewound resistors which had been resoldered previously but not with high melting-point solder, I ran the set on test and finally returned it, in a safe condition, to its owner.

So Sony refuses to supply the items necessary to make its sets safe, and these don't seem to be available elsewhere. This idiotic policy doesn't encourage the cowboy element in the trade, which seems to be on the increase in this area, or anyone else to fit the correct component.

Dave Mackrill,
St. Leonards-on-Sea, East Sussex.

Servicing the Philips 3A Chassis

Richard Newman

The 3A chassis was used in Philips' flagship models during the 1986-88 period – they carry the Matchline banner on the front. The chassis had a lot of 'firsts' for Philips, the basic idea being that it could be integrated into a full audio/visual system when coupled to a hi-fi setup. It was the first Philips chassis in the UK to have the picture geometry controlled by a microcomputer chip, making it possible for the service engineer to adjust the height, width, EW and trapezium correction etc. by means of a service remote control unit, then store the settings in memory. It's also possible to give names to programme selections and have an on-screen menu that displays them.

Later sets have Nicam and picture-in-picture (PIP for short). There were some monitor only versions: a Matchline tuner was available to go with these. There was also a monster 33in. version – without the lifting tackle supplied! Another feature that was new at the time was the sets' ability to accept Secam and NTSC signals fed in via the scart sockets.

Colour transient improvement (CTI) to improve colour transitions, mainly between greens and reds, is another feature. The effect is quite remarkable when you look at green and magenta with a colour-bar display – there's virtually no cross-colour.

In short it's a chassis with all the 'bells and whistles'. It's not the easiest chassis to work on however, though reliability is good. The following notes are intended to help engineers who are not too familiar with these sets. Use them in conjunction with the 3A chassis manual, part no. 4822 727 15742. A supplement to cover the model being worked on will also be required.

Access

A lot of the models that use this chassis have a smoked glass screen in front. It's best to remove this first, by sliding the fixing tabs at each corner. You can then put the glass and the tabs to one side. Be careful – the glass is quite heavy.

The first thing that strikes you after removing the back is that the chassis is fairly crowded. The PCBs are mounted in a plastic framework. A main 'monocarrier' panel carries the power supply, the line and field timebases, the sync and picture geometry control circuits, the tuning system and EEPROM memory. To the left of this there's a large upright source-selection panel (SSP) that carries all the interface switching associated with the two scart sockets. Two smaller panels that are plugged into the monocarrier are used for the multistandard colour decoder (MSD) and the teletext decoder. The audio power amplifier with its large heatsink is mounted at the rear centre. Alongside it, but not attached to the main panel, there's the mains filter panel.

If the set is equipped with Nicam, this feature will be found on a subpanel adjacent to the source-select panel. The external speaker connections are next to the two scart sockets.

The microcomputer control panel is mounted at the front of the set and has to be slid out from the front. If you require access to only the control panel the main chassis can be left in the cabinet. Turn the set on its side and remove the two screws from each speaker grille. Remove the grilles. The whole panel can then be withdrawn after removing the two screws at either side.

The chassis as a whole can be slid out, see Fig. 1. The front control panel has to be left in place however. If the set has not been worked on previously you'll find that there's a screw, A, which has to be removed at either side of the plastic frame, towards the rear. Release the mains cable from its relief and unlock tabs B. Lift the rear of the chassis slightly and pull it towards you. Place it as far as possible behind the set. There should be enough slack in the cables to enable the chassis to be tilted to the left and rested on the source-select panel. Some access to the print side of the main panel is possible in this position.

The plastic frame has to be removed to gain complete access to the main panel. See Fig. 1. First remove the cover plate and reinforcement bracket from the scart and speaker sockets by releasing tabs F. Remove the speaker socket subpanel then, by releasing its fixing tabs, the bracket that supports the chroma and teletext boards. Remove the screws from the power amplifier's heatsink and unclip the mains filter panel. Finally unlock tabs I at either side of the frame, release tab J at bottom centre and slide the frame away.

Take care now when working on the main panel as there's no support for the source-select or power amplifier boards.

When you do all this for the first time you'll find that it pays to make a note of where everything goes!

Circuitry

A block diagram of the basic receiver is shown in Fig. 2.

MODEL LIST

Philips	
21CE7550/05S	27CE7790/05R
21CE7650/05S	33CE7533/05B
24CE7570/05S	
27CE7590/05S	*Pye*
27CE7593/45R	68KE7807/05R
27CE7690/05S	68KE7827/45R

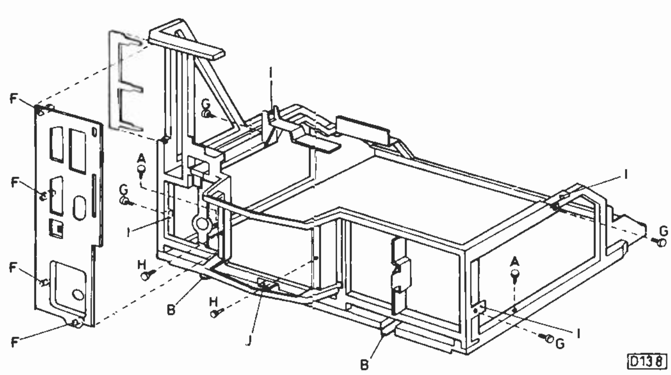

Fig. 1: The chassis assembly.

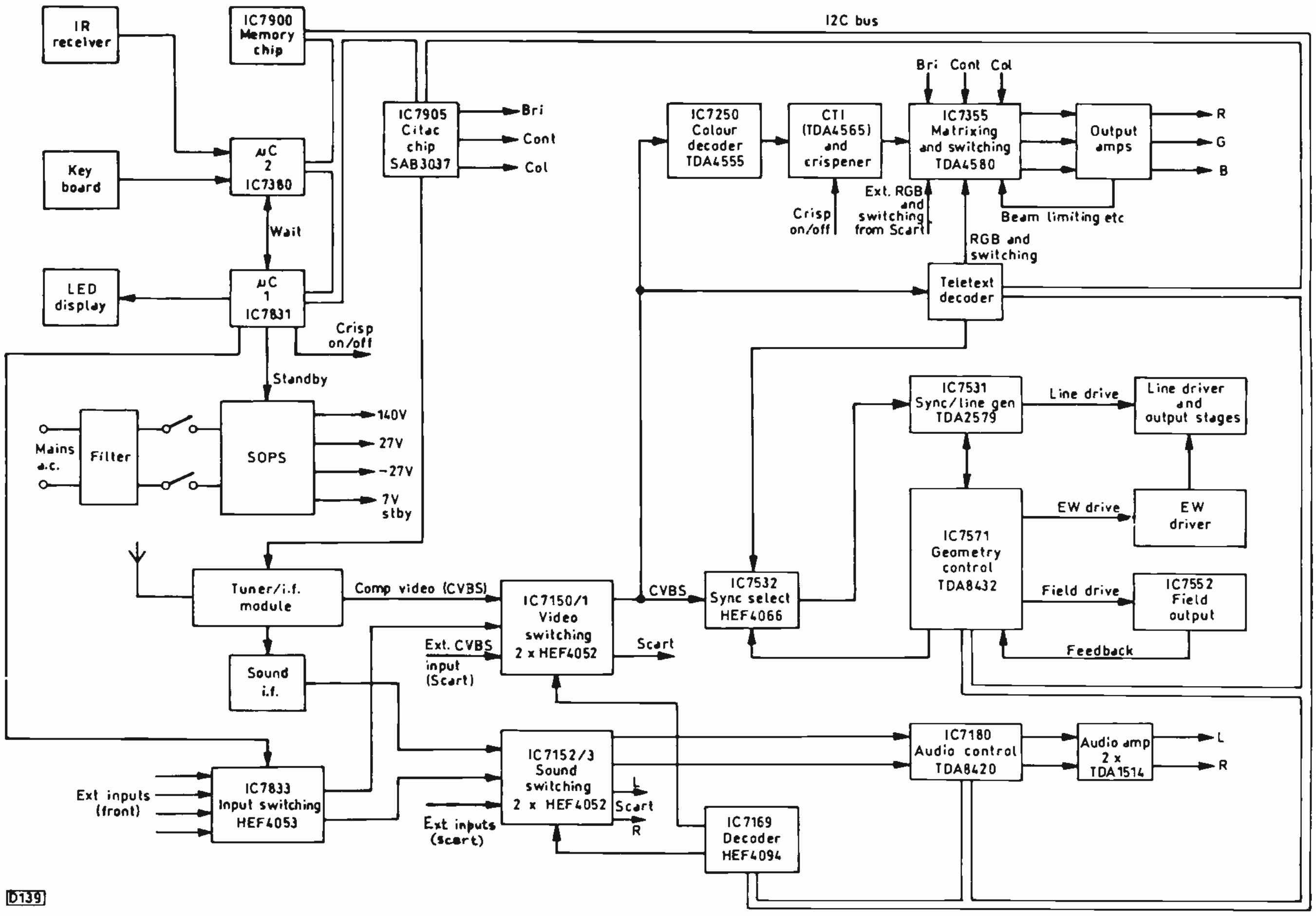

Fig. 2: Simplified block diagram of the receiver.

While the set is complex, most of the circuitry is conventional, particularly in the line, field and power supply sections. As most faults are likely to be in the power supply area we'll look at this first, see Fig. 3.

The Power Supply

As with the previous Philips chassis we've dealt with in these pages in recent months, the power supply is of the self-oscillating chopper type (SOPS). It follows the same basic principles as previously described but has additional protection. It has proved to be very reliable. A start-up supply is obtained by using R3656, R3657 and C2658 to integrate the mains supply. As a result, 22V is available at the zener diode side of R3686. This provides base bias for Tr7674 and the chopper transistor Tr7687 via R3682 and R3687. Tr7670 helps to control Tr7674/7687's switch on by ensuring that Tr7687 switches on at a collector voltage of about 100V. This reduces its switch-on dissipation, increasing the device's life.

It's sometimes difficult to decide where to start looking when there's a fault in the power supply. If R3684 is removed however the optocoupler will no longer affect the control action. The mains input can then be reduced to about 70V by using a variac. Under these conditions the power supply should start to oscillate, allowing measurements to be made. Take care not to increase the variac's setting above 70V, as the main h.t. voltage could then rise excessively. In addition the line output stage should be disconnected by removing plug M17 which is by the line output transformer: connect a dummy load (60W bulb) in its place across the 140V rail – C2701 is a good place to connect it.

You may find it easier to work on the main panel with the power amplifier removed. It can simply be unplugged from sockets M6 and M7. To maintain supply continuity however pin 3 of M6 will have to be linked to pin 4 of M7. Otherwise the set won't work.

Thyristor Thy6698 is the heart of the protection circuit. Its gate monitors four circuits: the audio amplifier is monitored directly, line pulses with an amplitude of 13V are fed via D6701, EW information comes via diodes D6706 and D6702 while the state of the e.h.t. supply is monitored via transistor Tr7499. Excessive current/voltage in any of these circuits will fire the thyristor, shorting out the h.t. line. The power supply will then shut down.

Standby Mode

During normal operation line pulses are rectified by D6642, producing about 7V across C2726. Transistor Tr7735 then provides a 5V supply for the microcomputer chips. Tr7738 provides a power-on reset.

In the standby mode the microcomputer chip IC7831 switches Tr7731 on by taking its base low. Thy6727 then acts as a rectifier and the 7V supply to Tr7735 begins to rise. The voltage developed across R3732 when Tr7731 conducts in turn switches Tr7742/3 on, increasing the current through the optocoupler. As a result the chopper transistor Tr7687 switches off for longer periods, reducing all the supply line voltages. The 5V supply via Tr7735 is maintained by the rectifying action of Thy6727 however.

The Line Output Stage

A conventional line output stage is used. The transformer tends to suffer from dry-joints which can cause all sorts of

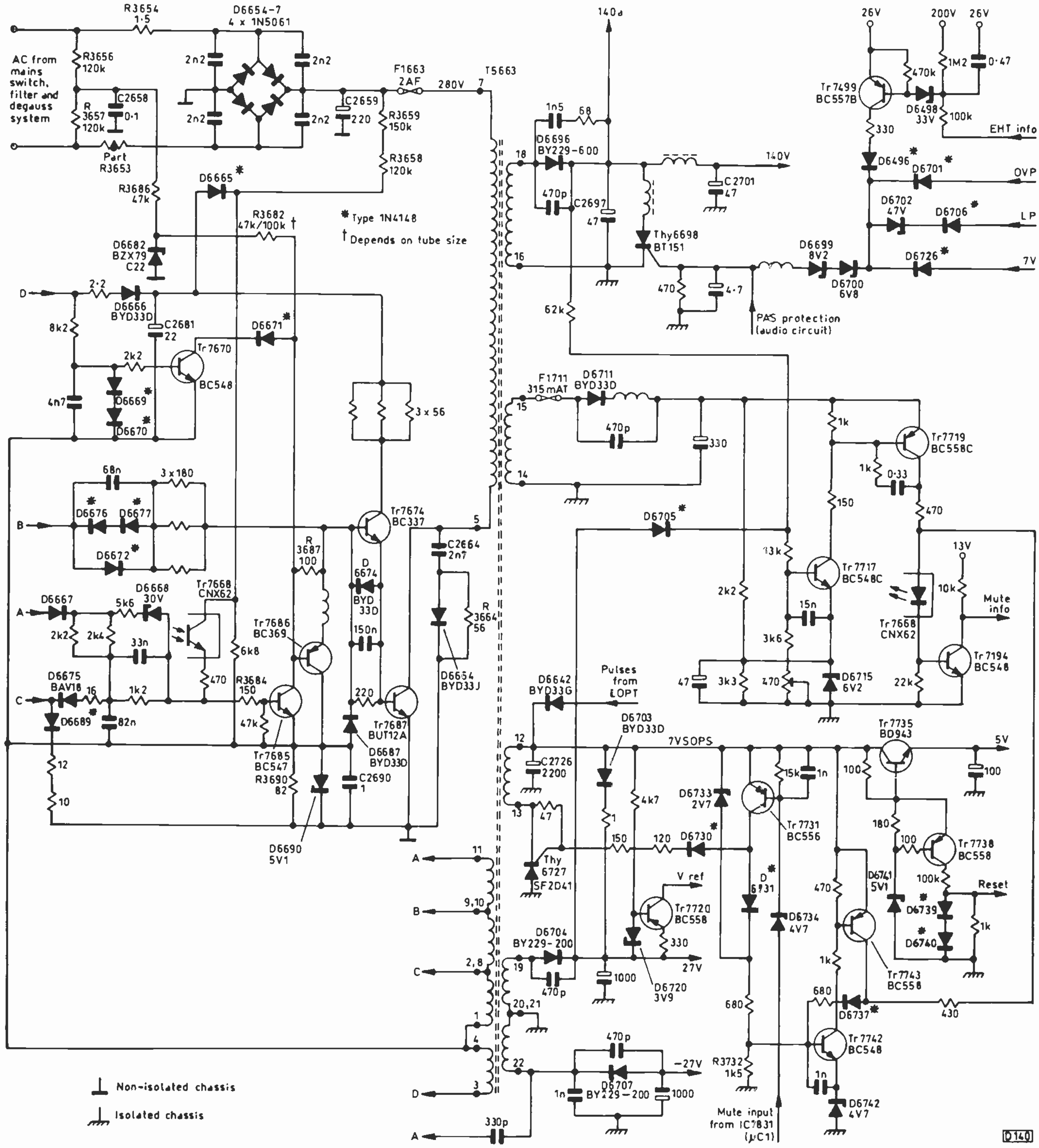

Fig. 3: The power supply circuit. Note that R3653's circuit position varies with different tube/degaussing systems.

intermittent faults. Flyback tuning capacitor C2618 (its value varies with tube size) can split with the result that the line output transistor fails. Use a good-quality capacitor rated at 2kV.

A common problem is failure of the Wickman fuse F1642. This produces a blank raster with flyback lines. It was originally rated at 800mAT and was subsequently re-rated to 1·25AT. The trouble is most common in sets with Nicam and PIP. If you are very lucky you'll find that the fuse is plugged in. So the old one can simply be removed and a higher-rated one fitted. In most sets however the fuse is soldered in and the chassis and plastic frame have to be removed.

The EW diode modulator is driven by Tr7602 and Tr7599. Note that Tr7599 is a BD678 Darlington transistor – not a single pnp device as shown on the circuit diagram.

The Field Output Stage

A standard TDA3654 field output chip (IC7552) is used in larger-screen models (24-33in.), a TDA3653 chip being used in 21in. sets. Little goes wrong here apart from C2555 (100µF) drying out, the symptom being intermittent field scan. As with most modern receivers, the screen is blanked in the event of field collapse. In this condition the voltage at pin 7 of the field output chip goes high. The increased voltage is fed to the colour decoder chip to produce the blanking action. Note that there's an error in the original circuit diagram where pin 1 of IC7552 is shown being connected to pin 5: the link should be shown between pins 1 and 3.

Geometry Control

The TDA8432 chip IC7571 provides geometry control. It does quite a lot of work, controlling the height, field linearity, S correction, centring and vertical beam current correction on the field side, and the width, EW and corner correction, trapezium and horizontal beam current correction on the line side. The selected values for these characteristics are stored in the EEPROM memory chip IC7300 in the control circuit.

The TDA8432 geometry processor chip is digitally controlled via the I2C bus. It also ensures that the height remains the same when a 60Hz NTSC signal is fed into the receiver via the scart socket. The chip receives field sync pulses from IC7531 and provides the field drive for IC7552.

Synchronisation

A standard TDA2579/N6 chip is used for sync pulse processing and to provide the line drive, automatic correction for VCR operation, identification of the presence of a transmission, sandcastle pulse generation and 50/60Hz recognition. At switch-on the chip is powered by a 27·5V supply from the SOPS circuit. This enables the line oscillator to start up. Once the line timebase gets going a 13V supply derived from the output transformer is used. In some sets these two supplies are fed to pin 10, pin 16 receiving a 9V supply from Tr7720 in the SOPS circuit. In others the start-up supply is applied to pin 16 and the running supply to pin 10.

Luminance and Chroma Circuits

Three chips are used in the luminance/chroma section on the MSD panel U1010. The TDA4555 chip IC7250 is a multistandard colour decoder able to handle NTSC 4·43, NTSC 3·58, PAL or Secam signals depending on whichever arrives at its input pin. One of four output pins goes high to switch into circuit the appropriate input filter and crystal. The decoded colour-difference output signals are then passed, along with the luminance signal, to the TDA4565 CTI chip IC7310 which uses a series of delay lines to processes them, virtually eliminating the cross-colour effect as previously mentioned. The luminance signal is then fed to a switched crispener circuit. All three signals finally go to the TDA4580 control chip IC7355. This controls the saturation, brightness and contrast, carries out matrixing, beam limiting and cut-off stabilisation, and enables RGB inputs to be switched through. The RGB outputs are passed to the output amplifiers on the tube base panel.

The Sound Circuits

Most of the sound circuitry is on the source-select panel (SSP). The switching is fairly complex, and I find that the only way to locate the source of an audio problem in this area is to use an audio signal tracer. I prefer this to a signal injector. The sound circuitry looks complex, but fortunately UK sets are not fitted with the part that contains the German-type stereo decoder: the demodulated audio goes straight to the HEF4052 switching chip IC7152, from there to a buffer and then to the power amplifier (PAS) panel.

The circuitry here is conventional. A TDA8420 chip (IC7180) is responsible for tone control, spatial stereo (for Nicam sets) and pseudo-stereo with mono transmissions. These operations are controlled via the I2C bus line. From this chip the audio passes to two TDA1514 power amplifier chips.

The power amplifier panel is difficult to work on, as the heatsink has to be removed to gain access to the print side. This results in swift destruction of the power chips when you start fault-finding! I do however know of one dealer who has made up a test jig to enable the power amplifier to be worked on separately. It consists of two sockets salvaged from a scrapped chassis, with leads attached so that connections can be made to the power amplifier. You have to use a centre-tapped supply connected to pin 5 (positive) and 3 (negative) of L07, with the earth connection to pin 4. The centre-tapped supply should not exceed 12V. Under these conditions the power amplifier won't get too hot whilst fault-finding.

The headphone amplifier is completely separate. It consists of a couple of TDA2611 chips that receive inputs from the tone control chip on the PAS board.

The Control Section

Two microcomputer chips are used in the control section. Microcomputer chip one (IC7831) sends the geometry parameters to the geometry processor chip IC7571 at switch on. It also deals with tuning and the analogue controls. The mask code is W068. Microcomputer chip two (IC7830) deals with the on-screen displays (OSD), keyboard scanning and remote control. The mask code is W050. Earlier versions can be replaced by later ones. These two chips communicate with any other i.c. connected to the I2C control line. The system incorporates a self-test, monitoring all 'slave' devices. If there's a fault with any of these, flashing LEDs on the front panel indicate what it is by means of a code. A table in the manual gives details of the fault code.

The memory is an X2404 type EEPROM (IC7900) which is on the main panel. It stores the geometry parameters, the tuning information, personal preferences, OSDs, teletext page number preferences and system options such as PAL I, PAL B/G, Secam etc. It follows that if this chip has to be replaced, every parameter has to be reset.

For these adjustments to be carried out the set has to be put into the service mode. A remote control unit with a print or sleeptimer function must be used (the type supplied with the set is, intentionally, not suitable for this purpose). The following remote control units can also be used: RC5 standard, RC5375 and RC5610.

To select the service mode press the mono button on the front of the set (not the one associated with the headphone socket), at the same time pressing the print or sleeptimer button on the remote control unit. A black box with four dashes (- - - -) then appears on the screen. The left-hand pair of dashes indicates the parameter to be adjusted, the right-hand pair indicating the selected value. The service manual contains a complete list of all options and adjustments.

Picture height is 02 for example. So if you key in 02 for the left-hand pair, using the number buttons on the remote control unit, the right-hand pair will indicate the set value. This can be adjusted by using the remote control unit's volume plus or minus buttons: the numbers will then run up or down and the height will vary. When the required level has been reached you press the remote control unit's personal preference button (green) and the new value is stored in the EEPROM. You can then select the next adjustment to carry out.

Other Panels

The front end consists of a tuner/i.f. module, type FE644Q, that's not considered to be serviceable. It's the same module that was used in the 2B chassis, which was covered in a previous article. The SAB3037 CITAC (Computer Interface for Tuning and Analogue Controls) chip IC7905 provides an interface between the front end and microcomputer chip one. The tuning system is based on frequency synthesis. Briefly, when a channel change is requested microcomputer chip one generates a frequency which the CITAC chip compares with the output of a prescaler within the tuner. The difference between the two is then adjusted until it's less than 150kHz. The system is then locked in and the CITAC chip switches on the a.f.c. If the set doesn't lock in, a replacement front-end module will usually provide a cure.

The source-select panel (SSP) is basically concerned with signal routeing. Audio and video signals, either internal or external, are switched via this panel under the control of microcomputer chip one. If you have a no-sound or no-vision problem and all the other circuits seem to be o.k. it's possible that one of the switching chips is defective. Try connecting an external input from a signal generator to either external one or two. If signals are then present you'll know where to start looking. Remember to select the relevant input with the remote control unit.

The RGB output stages, on the tube base panel, are conventional, as is the teletext module. The only other panels are the Nicam and PIP ones. PIP is found in only the 33in. monster and is unlikely to give troubles. Nicam has been discussed in detail in previous issues: it's incorporated in only certain models and shouldn't cause problems.

Monitor Versions

The monitor versions were designed to be integrated into a complete audio-visual system and don't have a front end. As mentioned earlier a Matchline tuner was available separately. The control system is much simpler, with only one microcomputer chip. Most of the other functions are the same as with the receiver version, but there are fewer of them. Once again errors on the I2C bus are indicated by flashing LEDs at the front.

Modifications

There were very few modifications to this chassis. With later versions there are microcomputer chip software changes, the mask codes becoming W090 for chip one and W092 for chip two. The fault codes remain the same, but the set remains operational instead of locking out.

The rating of fuse F1642 has already been mentioned.

Sound hum in standby was a problem with some receivers. The cure is to fit a wire link between pin 3 of L06 and pin 4 of L07 on the power amplifier panel. Also change the value of R3741 on the main panel to 820Ω.

The keyboard and foil assembly is not available for Model 27CE7790. Only the foil is supplied: use the original housing.

The video input processor chip on the teletext decoder board was changed from version two to version three. There are five associated component value changes: R3772 becomes 1·2kΩ, R3780 82Ω, R3800 68kΩ, C2773 47nF and C2780 47μF.

Long-distance Television

Roger Bunney

There were Sporadic E openings on most days during June and July, though the season has hardly been one for the record books. Amateur radio activity in the 50MHz band has produced some remarkable results during recent months however. As a result of a combination of SpE and transequatorial skip propagation, signals from Brazil were received in southern Europe, Africa and Holland on May 12th. On June 10th the m.u.f. reached into the 144MHz band, with reception in the UK from various parts of Europe. In theory Band III TV propagation must have been possible, but there have been no reports of such reception. 50MHz transatlantic signals were received on the 3rd, 7th and 12th. Dramatic as this reception has been, one has to remember that amateur transmissions are narrow-band f.m., with bandwidths of perhaps 5-10kHz: for TV reception a bandwidth of several MHz is required, and the signals have to be vastly stronger to obtain recognisable, locked pictures. From the TV point of view there was a fall off in reception during July in comparison with the previous two months. Tropospheric reception was poor, and though there were several intense, long-duration SpE openings there were quite a few days in between with no reception. Here's the TV SpE log:

5/7/93	TVE (Spain) ch. E2.
7/7/93	DR (Denmark) E3.
8/7/93	SVT (Sweden) E2; NRK (Norway) E2-4; YLE (Finland) E2; RUV (Iceland) E4; DR E3, 4; CST/CTV (Czech Republic) R1; ARD (Germany) E2-4; ORF (Austria) E2a, 4; CIS (Russia) R1-4; TVP (Poland) R2; RAI (Italy) IA, B; TVE E2-4.
10/7/93	DR E3; TVE E2, 3; RAI IA, B.
11/7/93	DR E3.
15/7/93	C+ (France) L2-4; TVE E2-4; RAI IA, B; RTP (Portugal) E2, 3; NRK E4.
16/7/93	DR E3, 4; ARD E2; +PTT (Switzerland) E2; Eesti (Estonia) R1; TVR (Rumania) R2, 3; MTV (Hungary) R1-4; RTSH (Albania) IC; RAI IA, B; TVA (Italy) E2, IA; TVE E3.
17/7/93	DR E3; RAI IA, B; TVE E2-4; YLE E2; NRK E2, 3; SVT E2-4.
18/7/93	TVE E2-4; RTP E3.
19/7/93	CIS R2; TVE E2-4.
20/7/93	TVE E2-4; RAI IA; RTP E3.
23/7/93	RAI IA, B; TVA IA; TVE E2-4; TVE-2 E2; RTP E2; CIS R2; Eesti R2.
25/7/93	TVE E2-4; TVE-2 E2; RAI IA; RTP E2, 3; C+ L2, 3; DR E3.
26/7/93	RAI IA; TVE E2, 3; JRT (Yugoslavia) E3; MTV R2; TVR R2.
27/7/93	TVE E2, 3.
28/7/93	TVE E2.

No exotic signals were received during the period, and few matters for discussion arose! Hopefully August will bring more dramatic results. Meanwhile, my thanks to David Glenday (Arbroath), Simon Hamer (Powys), Roger Fussell (Torpoint), Tim Anderson (St. Leonards) and Peter Schubert (Rainham) for sending in reception reports.

Finnish DX-TV expert Petri Popponen paid a visit to the UK recently. During his travels in connection with his work he visited the Channel 3 studio centre in Thailand, whose Ch. E2 transmitter has been received in Europe via F2 propagation in recent winters. He provided the accompanying photographs.

From our Correspondents. . .

Robert Copeman has sent us details of channel allocation changes that will "eventually" come into use across Australia. The Band III changes are as follows: Ch. 9A 203·25MHz vision, 208·75MHz sound (new channel); Ch. 10 210·25MHz vision, 215·75MHz sound (channel shifted up 1MHz); Ch. 11 217·25MHz vision, 222·75MHz sound (channel shifted up 1MHz); Ch. 12 224·25MHz vision, 229·75MHz sound (new channel).

Bud Lloyd-Bennett has written to us about the TV scene in Bahrain. Individuals are now allowed to own their own satellite TV receiving systems, though permission has to be obtained from the authorities. Installation is in the hands of a monopoly supplier and equipment is expensive. The microwave services transmitted by Bahrain TV in the 2GHz band provide a cheaper approach.

Bandula Gunasekera has sent us up-dated information on services in Sri Lanka. Telshan TV operates the following transmitters: Nuwara-Eliya ch. E4 40kW, Colombo (Piliyandala) ch. E3 12kW, Kandy ch. E21 2kW, Deniyaya

Left: The WDAF-TV, Kansas City test card. Centre: A transmitter list shown during the Thailand Channel 3 programme opening sequence. Right: This Channel 9 logo is similar to and originates from the same Bangkok TV centre as Channel 3. Photographs courtesy Petri Popponen.

ch. E4 40kW, Colombo (Tower Building) ch. E21 2kW (all powers are e.i.r.p.). Because of interference problems the Kandy transmitter is to move to ch. E26. At present all transmitters are operating at 30 per cent power. Telshan also relays stereo TV sound in Colombo at 101·7MHz and runs a radio station called FM99 (99MHz stereo). The Ekran satellite at 99°E continues to provide a ch. E54 service. A fifth TV service, East-West TV, is likely to be given a licence shortly. It plans to transmit from the Star Tower Building, Bambalapitiya.

News Items

Israel: The commercial Channel 2 service is to start this month. Three franchises have been awarded: each franchisee will provide programmes for two days a week, Saturdays being shared between the operators (Telrad, Reshet and Keshnet) over successive weeks.
Thailand: The government has given permission for a commercial TV station to operate.
Italy: RAI and Fininvest are likely to lose their third networks.
Lithuania: Vilnius ch. R26 has closed: ch. R11 has been reactivated, relaying SAT-1 programming.
Moldavia: Turkish (TRT) news is being relayed at certain times. The Chisinau TV ch. R3 transmitter at Straseni has an e.r.p. of 800kW.
Russia: Moscow ch. R3 now carries a teletext service called MOSTEXT. The TELEINF text service on the OK1 network has an increased number of pages.
Germany: The RTL-2 network centre in Cologne may move to Munich.

Satellite TV

Eutelsat I F1 is to be moved to either 36°E or 50°E to extend coverage deeper into the CIS republics. Eutelsat plans to position a third satellite at 13°E in early 1996, alongside II F1 and F6. It will be dedicated to TV services, the idea being to rival Astra at 19·2°E. A new Polish uplink station is to operate via Eutelsat II F4 at 16°E.

The BBC is using digital compression for a programme link to CBC, Canada via Intelsat at 53°W. The GI DigiCipher system enables four video channels and up to sixteen audio channels to be carried by a single analogue TV transponder. Further planned World Service links to Japan, the USA and Central America will use the system.

Astra 1F is to be launched in 1996, again at 19·2°E. While 1D and 1E will operate in the band 11·7-12·1GHz, 1F will extend the coverage to the band 12·1-12·5GHz. 1D is to be launched in the autumn of 1994 and 1E in the following spring.

Digital compression is spelling the death of MAC: D2-MAC transmissions via TDF1/2 at 18·5°W ceased on June 30th – these satellites now carry just two radio stations.

Bad news for BSkyB: German satellite magazines are openly advertising and reviewing chips that can be fitted into VideoCrypt decoder boards to unscramble the signals. The August issue of *TeleSatellit* contained a two-page review or a replacement chip set that sells for the equivalent of £90. There was also news of a very smart card that can be bought to hack VideoCrypt.

Thaicom 1, Thailand's first commercial satellite, is to be launched on December 5th, followed by Thaicom 2 next summer. There is a dispute about Thaicom 1's position at 101°E however because AsiaSat 2 is due to be located at 100·5°E a year later. AsiaSat wants Thaicom to be moved to 120/122°E.

Interesting that series 1 and 2 smart cards for the Japanese JSTV service have been used to decode Red Hot Television's Enigma (a VideoCrypt clone) transmissions, though with the inlay 'incorrect card' on the screen!

What a Life!

Donald Bullock

Mrs. Ruff, a large no-nonsense woman, barged into the workshop the other day followed by her lodger Old Pukey. He was struggling with a 24in. Granada teletext set. She strode to the bench, clasped the underside of her sleeve with her fingers, and used her arm as a huge duster to clear the end of my bench.

"Put it here, Pukey" she ordered. Pukey did as he was told.

"I've told him time and time again not to play with the tuner thing while the set's on" she said. "Now he's gone and blown the set up, Mr. Billhook. I wish he'd get out of my house, I do. Straight."

I plugged the set in and switched on. The sound was o.k., but the picture had a series of vertical black lines, about half an inch wide, superimposed on it. I'd never seen a set like it before and had no circuit diagram. Then, as we watched, the lines faded – taking the luminance with them.

Mrs. Ruff looked hard at Old Pukey, muttered a bad word, then pushed him out ahead of her. "Give us a ring, Mr. Billboard" she rasped.

Sorting out the Granada CTV

When I examined the chassis I found that the chroma panel contained a TDA3300B chip that obviously processed the signal. I looked for the luminance delay line but couldn't see it – the chroma one was obvious enough. It seemed best to phone Granada at Bristol. I spoke to Eddie Conway who was most helpful. Looking at the circuit diagram, he advised me to scope the luminance signal as it emerged at pin 35 of the chip then follow it back, suitably delayed by the delay line DL1, via 2R5 (1kΩ) and 2C5 (10μF, 25V). So I searched again for DL1. It was so positioned that it hid its reference number, and looked like a small, square-edged, capacitor. I scoped the signal as Eddie advised and found that it was present up to 2C5 but not thereafter. 2C5 was open-circuit of course, a replacement restoring the picture. My thanks to Eddie for that – drop in for a cup of tea sometime!

Mr Smallpiece's Video

Our next caller was the thin-faced Victor Smallpiece, who had brought his Amstrad VCR4600 Mk. 2 video machine with him. Sensitive and timid, he moved his shoulders around inside his jacket and cleared his throat.

"It's dead, Mr. Bullock" he said. "Belongs to the wife's brother – he uses it for Certain Things." After that he stole away.

I put the machine on the bench and hoped that it would talk to me. But it didn't. It even refused to accept a cassette, switching itself off. When I opened it up I saw that the threading arms stopped too soon. After a few preliminary tests I handwound the mechanism ready to start again, connected a meter across the loading motor and pressed the start button. Up came the d.c. motor voltage and the loading sequence started. Then it stalled, and the voltage rose. The motor had stopped drawing current. A replacement motor fixed the machine, and when Victor phoned I told him that it was working again. "Hump" he said.

Mrs Gunge and the 3V46

Mrs. Gunge walked in with her spotty son Oscar, who was carrying a Ferguson 3V46 VCR. These machines produce excellent results, I know, but around here they seem to be rather accident prone.

"Hi Oscar" I said, "what's eating the Fergy?" Mrs. Gunge poked him aside and answered.

"The picture's faulty, ain't it Oscar?" Oscar made to nod and breathed in to speak.

"And the sound, right Oscar?" Mrs. Gunge continued. As Oscar opened his mouth, his mother's voice hit the air.

"My Oscar just can't watch it Mr. Butcher" she continued.

Oscar breathed in quickly and looked up at me "The tracking. . ."

"Oscar thinks it's the tracking" Mrs. Grunge explained. Oscar studied the floor.

I escorted them to the door then put the machine on the bench. The symptom made it look as though the auto-tracking was out, but this machine doesn't have it. So I busied myself around the control circuitry. Eventually I found a 1μF, 50V electrolytic capacitor, C1, whose value had fallen to half the correct figure. A replacement cured the fault and I was impressed by the excellent picture and sound quality. All that remained to be done was to get the chassis cased up again without any casualties. I managed this and later on Mrs. Gunge and Oscar called back. She paid up and smiled at Oscar.

"Say thank you to Mr. Bloater, Oscar." He raised his chin and opened his mouth, but once again his mother beat him to it.

"Such a funny boy. Mr. Buster. He hardly says a word. Can't think why."

The Sharp VC681HM

A Jaguar crunched into the drive and came to a halt. Out struggled the greasy Mr. Pearshape, in a cloud of cigar smoke. A demure young lady got out of the other side, carrying a Sharp VC681HM VCR. He pointed to the open workshop door. "In there" he said.

Jane obeyed and I took the VC681HM from her.

"Jane's video's playing up" Mr. Pearshape growled, tossing his business card on to the bench. He was a money lender. "Fix it and phone me. I'll do the paying." He turned to Jane and jerked his thumb at the Jaguar. "Into the car, girl" he said.

When they'd gone I put the recorder on the bench and tried it. I selected rewind search. The machine went into fast-forward search for a few seconds then stopped, unlaced and switched off. The cassette remained in place. As I've had mode switch problems with this model and the VC750HM I fitted a replacement. It cured the trouble – a quick repair for a change. Jane would be pleased, and Mr. Pearshape too as it wouldn't cost much. How nice to be able to dispense such happiness.

Another Sharp VCR

My next visitor, Mrs. Tubby the forester, always puts me on edge.

"Ah Mr. Bull" she said. "This set's faulty." She was carrying a

Sharp VCR like the one I'd just repaired.

"What's wrong with it?" I asked.

"It jams and stops."

"Ring me teatime" I said.

When I tried it the machine behaved much as the other one had. Oh dear, I'd used my last mode switch. To prove the point I decided to borrow the switch from Jane's machine. So I set about doing the swap, which took me longer than I expected. When I tried Mrs. Tubby's machine it behaved exactly as before, so the switches had to be put back. I resolved never to be so silly again. I'd wasted time, and this made me feel nasty.

When I'd got Jane's machine right again and Mrs. Tubby's as it was when she brought it in, I looked into it in greater detail and ended up by taking out the master cam. Sure enough its rather thin walls had broken down, a new one completing the repair. The cams are cheap and fitting a replacement always gives me a feeling of satisfaction.

When Mrs. Tubby called I handed her the recorder and gave her the bill.

"You read it, Mr. Borax – my glasses are in the car."

I read it out then came to the bottom line. "Thirty pounds" I said.

She took a blue and a brown from her purse then picked up the machine. When she got to the door she stopped. "This repair is guaranteed" she commented.

"For ever, Mrs. Tubby" I said.

The Panasonic NVJ30

Later that day nice old Arthur Ball dropped in with his Panasonic NVJ30 VCR. His family firm uses it as part of their shop security system.

"I think it needs one of your wash-and-brush-up services" he said. "If you ring when it's ready we'll pick it up."

"I'll have it done in an hour" I said.

When he'd gone I set to. After cleaning the heads and the tape guides I gave the machine a general check over. Just as I'd finished testing it Greeneyes came in. I switched on the phone amplifier and asked her to ring the number. She did so and the phone at the other end was picked up.

"Balls" shouted a voice. Greeneyes slammed the phone down and spun round. "I suppose that was another of your twisted jokes" she fumed.

"That was Arthur Ball's firm" I said. "They'll be wondering who's playing about. Then our phone rang. I picked it up, feeling a bit put out. "Bullocks" I barked. The line went dead. Then it rang again. "Bullock's Television" I cooed.

"Oh, hello Donald. Arthur Ball here. Did you ring us?"

"Yes Arthur, but things seemed to go wrong."

"That's funny. Same here. Gremlins on the line I suppose. We get a lot of it with incoming calls. Just got a foul-mouthed wag when I dialled you. Anyhow, if the recorder's done we'll slip down and collect it."

"See you shortly, Arthur" I replied.

Test Case 370

Our receptionist Pam's husband is a farmer. Thus when it comes to harvest time the long-suffering lady abandons the test case workshop for the open fields and the baling machine. In her absence Service Manager normally mans the phones and the counter. But on this day he was elsewhere – no one in the workshop ever quite knows where he gets to during his frequent absences. So it was that Sage found himself in the front office, and after just one day he decided that dealing with the innards of VCRs and TV sets was far preferable to dealing with their owners and renters.

Sage's particular burden this morning was a Mrs. Twither who told him on the phone, all in one breath, that the TV man had said the video was rolling up, so it must have broken down, and could we come up or should she bring it down? . . . people are always rolling up here. Mrs. Twither subsequently brought the machine to the workshop and explained, in one ten-minute sentence, that its playback pictures were rolling.

Because of Sage's absence from the bench the repair job became a joint project between two of the workshop's lesser lights, Sherlock and Roger. They inserted a known good tape and selected playback. The picture rolled vertically as though there were no field sync pulses at all. A scope connected to the video output socket confirmed that there was nought but noise where the field sync pulses should be, though the E-E picture was rigidly locked when the stop key was pressed and its waveform contained good field sync pulses.

Since only the off-tape pictures were impaired, it seemed that there was a tracking problem of some sort at the point where the tape started the head wrap. If the entry guide's height setting was wrong, the machine would perhaps be able to play back its own recordings even though they didn't conform, from the track geometry point of view, with the VHS format. So said Sherlock, and Roger was impressed. To check on this they made a short recording and played it back. The picture rolled as badly as with the prerecorded tape. This being the case, declared Roger, the back tension was possibly too low. They used Sage's spring-loaded gauge cassette to check the back tension and found that it was within specification at 50gm/cm.

Next the pair of them did what perhaps they should have done at the outset: they connected an oscilloscope to a test point where the off-tape r.f. envelope could be seen and, while using the head flip-flop signal (SW25) to trigger the scope's sweep, they played a good recording. They found that the playback signal was virtually absent at the beginning of each head's sweep: the waveform in fact had a bottle-neck shape, which indicates poor signal transfer from the tape to the playback head. As the signals from both heads were affected to the same extent, there was little doubt that the cause of the fault was some mechanical problem. They cleaned the heads and the lower drum, especially its rabbet (the narrow spiral shelf on which the tape sits), but there was no improvement.

Time to twiddle the guide then! Roger slackened the grubscrew, then watched the scope's screen while Sherlock carefully adjusted the entry guide. The shape of the signal envelope improved a bit as the guide was turned, then deteriorated again. It never became good. In this model the vee-blocks that locate the guide posts are part of the lower-drum casting, so they couldn't have moved. Let's see then: the test tape was o.k., the back tension was correct, and no adjustment of the entry-guide's height would produce correct tracking. The machine was put to one side to await Sage's return. When he came to it and heard the story he cured the trouble in about two seconds, then gave it back to a shame-faced Sherlock to realign. What was the cause of the problem? For the answer turn to page 883.

VCR Clinic

Reports from John Edwards, Nick Beer, Michael Dranfield, Stephen Leatherbarrow, Hugh Allison, Philip Blundell, AMIEIE, Terry Lamoon, Eugene Trundle, Brian Storm, Chris Watton and Bob McClenning

Ferguson 3V35/JVC HRD120

This machine would go dead after a few minutes or sometimes days. There would be no functions and no displays – nothing. We found that slight movement of the rear, vertically-mounted power supply board would initiate the fault. So we removed the board and examined it with a magnifying glass. This showed that pin 4 of CN1, which supplies the board via the mains transformer, was dry-jointed – a slight ring was just noticeable around the solder joint on the PCB. Resoldering cured the fault but for good measure we went over the whole board as some other joints looked a bit dodgy. **J.E.**

JVC HRD720/640/860 etc

We've had the following problem with several of these machines. When the machine is plugged into the mains supply the loading motor attempts to lower the carriage then, after a few seconds, gives up and attempts to return the carriage to the eject position. This is accompanied by buzzing, clanging and crunching noises. We can't be sure of the cause, but the cure is always the same.

Remove the carriage housing and note the position of the alignment hole in the large rotary cam beneath the pinch roller. The hole should be at approximately the 12 o'clock position and over the hole in the deck chassis. If this is not the case, which is likely, rotate the worm drive that runs alongside the cam until the holes line up. When the carriage has been refitted normal operation will in all likelihood have been restored. If not the carriage is suspect – check for faulty end sensors or the mechanics being broken or out of alignment. **J.E.**

Akai VS2

The problem was intermittent sound in the playback and E-E modes. Its cause was an open-circuit screened lead connected to socket J8. As there was plenty of slack we were able to cut back beyond the break, redress the lead then resolder it to the socket pin. Our fault-finding was aided by the fact that movement of the lead made the sound come and go. **J.E.**

Samsung VI1260

The following fault is beginning to show up regularly on these machines: after a few seconds the VCR returns to standby, with no capstan motor rotation. The cause of the fault is always diodes D109, D110, D212, D213. Always check by measuring the voltage across the diode – with a good diode the cathode voltage will be 0·7V less than the voltage at the anode. We have found that with some diodes there is as much as 4V or more across the device, though the diode reads correctly when checked with a meter. Any diode from 1N4001 to 1N4007 will work all right in these positions. It's best to replace all four diodes to prevent comebacks. **M.Dr.**

Ferguson FV33H

When a recording was made and played back the sound switched between Nicam and mono at a cyclic rate. The changes were accompanied by a servo twitch on the picture. A colleague suggested that cleaning the audio/control head might be a good idea. Doing this provided a complete cure. **M.Dr.**

Sharp VCA105HM

Two of these machines have been regular visitors to the workshop over the past couple of months, both with the same intermittent fault: during ejection the tape would get stuck before the process was completed. If the tape was wound out manually everything would be all right until some weeks later when the customer would return the machine with another tape jammed inside.

We approached Sharp Technical on several occasions, as a result of which various parts were replaced, including some kind of modification PCB on the cassette housing, but the fault persisted. As we'd never seen the fault occur it was difficult to know what to do. Finally both machines arrived at the shop together. A careful examination with the machines side by side, one with the tape ejected and the other with the tape stuck, showed that both main decks were in the same position mechanically. This could mean only one thing, that the cause of the fault was the cassette carriage. Very careful investigation of the housing showed that just before the cassette lift arm, item 308, came to the vertical position the clutch could jump out, disengaging the drive to the lift assembly. It seemed certain that the clutch latching bar, item 319, was the cause of the trouble but to be on the safe side and avoid further comebacks we ordered two new cassette housings. Examination of the new housings showed that the latching bar and clutch operating lever (item 321) have been redesigned. We have subsequently fitted just these two items, with no further problems. Part nos. are latching bar MLEVP0140GEZZ (item 319); operating lever MLEVP0139GEZZ (item 321). The new latching bar has a rectangular cutout, the cutout in the old latching bar being angled at one side. **M.Dr.**

Samsung VI611

Here's a quickie on this range of models. For no signals check R6 (3·9kΩ) on the power supply PCB – it feeds the 33V regulator. We've had this resistor go open-circuit on a number of occasions. **S.L.**

Ferguson 3V30/JVC HR7300

Because the optical reel sensor produced no reel pulses this machine would stop in any mode. The 11V supply that should be present at pin 3 of the sensor PCB was missing. It comes via pin 63 on the small subpanel that's mounted to the right of the deck (viewed from above). The track between pins 25 and 63 on this PCB was open-circuit. On another of these machines the same fault was caused by the fact that the lead from pin 63 to the sensor PCB was open-circuit. **S.L.**

Amstrad TVR1

Two well-defined lines, approximately half and two-thirds of the way down the screen, were present during playback.

They looked very much like head switching point signals. Initial panic was followed by recollection that we'd come across this one before: C2 (10μF, 16V) on the lower drum PCB assembly was open-circuit. This fault could well occur with the similar drums fitted to other TVR models. **S.L.**

Ferguson 3V35/JVC HRD120

This machine didn't play back audio because the playback level potentiometer was open-circuit. The result was no audio signal but a very noisy output of crackles, pops and white noise. **S.L.**

Sharp VC9300

I thought everyone knew this dodge, but when a friend rang up and said that he'd undone the screws but couldn't remove the head I thought I'd better pass it on. In this machine there's a little cover over the wires that connect the heads and the rotating transformer. To change the drum you have to remove this cover, which is held by quarter-inch long screws. You can then get to and undo the half-inch long head securing screws. If the head won't budge, simply put the longer screws down the screening cover holes. The thread is the same but as the head screws are longer they bottom on the housing and thus force the head off. I suggest tightening the screws to the bottom by hand, then a further quarter of a turn to them alternately with a screwdriver until the head breaks free. **H.A.**

Toshiba V312

This machine was jammed. On investigation we found that the main cam gear was damaged. The new one came with a modified soft-brake lever enclosed, so it would seem that this is a common problem. **T.L.**

Philips VR522

When a tape was loaded a very nasty noise came from the vicinity of the video heads. I stopped the machine and inspected the heads. There was a very nasty groove in the upper drum. Wondering what could have caused such damage, I looked at the rest of the mechanism and noticed that the left guide arm was at a peculiar angle, pointing into the drum. It locked back into position with a push. I then saw that the impedance roller was loose. After tracing the holding spring and rebuilding the assembly the machine worked normally – except for the need for new heads as they were by now totally useless. I assume that the damage had been done by someone using extreme force to extract a jammed tape. **T.L.**

Akai VS485

When this machine was switched on we found that it was in limbo, with a tape stuck inside. When the tape was released and the machine was once more powered up it worked perfectly. But it's wise with these machines to check the loading gear on the cassette carriage. We found that the half-moon gear was in poor condition while the metal running gear that operates it was very sloppy. A replacement gear cured the first problem, but the other fault required a simple modification that comes from Akai. It consists of a small U-shaped piece of plastic which you glue into position just beneath the metal gear retaining clip. This has the effect of tightening up the gears and preventing damage to the plastic ones. Once it was dry we replaced the carriage and the machine worked perfectly. **T.L.**

JVC HRD640

Don't get caught out like I did with this machine! It came in with a faulty mode switch. We fitted a replacement but the machine bounced back with all these symptoms: momentary formation of a tape loop while unlacing; failure to come out of the pause mode, followed by shutdown; and intermittent tape spillage during eject. What we'd fitted was slide switch PU60973 which looks right and fits perfectly but is intended for an earlier model. The correct part number for the HRD640's mode switch is PU61247. **E.T.**

Panasonic NV730

These machines are now old but since we've had a couple in recently both with the same nasty intermittent fault the following note may be useful to others. The symptom is that the machine suddenly stops during record or playback: when the cassette is ejected you find that there's a crumpled loop of tape hanging from it. The cause of the fault is dry-joints at the connections to the reel-motor voltage-regulator transistor Q1504 which is mounted on an L-shaped heatsink in the rear right-hand corner of the machine. **E.T.**

Philips VR6670

This machine was dead: the 3·3Ω resistor R3024 was open-circuit and the BUT11AF chopper transistor was short-circuit. Cold checks on the rest of the circuit showed that the BC547 transistor Tr7001 was open-circuit. Replacing all three items restored normal operation. **P.B.**

Ferguson FV33

This machine worked normally in the SP mode. In the LP mode however there was a blank screen, though the sound was normal. Embarrassment prevents me from disclosing the full extent of the testing that ensued. Suffice it to say that in the LP mode the FV33 is an audio only machine. If Ferguson manuals included the details in the customers' instruction book I'd have realised this sooner. **P.B.**

Panasonic NVJ47

The complaint we've had with some of these VCRs has been of whistling or buzzing when the machine is switched off. Although I'm unable to confirm the exact nature of the sound, perhaps because of deafness to line and field scan noise as a result of length of time spent in this trade, I can report that a squirt of sealant on T1101 in the power supply puts an end to the trouble. **B.S.**

Hitachi VT33

The ticket said that this one worked for only a few seconds. Simple idler replacement and service I thought. But when I inserted a cassette the lift moved so quickly that it almost pulled me in. Then the power LED went off. When I switched on again and ejected the cassette it came out very fast. I decided to check the power supply to the cassette lift motor and found that the voltage was high. A check around the STK5421 power supply chip then showed that the 9·5VA and 9·5VB lines were both at 17V. A new STK5421 restored normal operation but a new idler and deck service were required. **C.W.**

Hitachi VT17/B and O VHS80

This early Hitachi machine suffered from intermittent capstan motor drive. As it's not uncommon I expected to find a dead spot in the capstan motor. The cause of the fault turned out to be diode D511 on the top panel however. It responded to the hairdryer and freezer every time. **C.W.**

Sharp VC9700

When this machine was first plugged in the clock came on but went off again after about thirty seconds. A large red thing on the print side of the audio panel was getting very hot: a shot of freezer here would bring back the clock for a few seconds after which it would fade away again. A check on the resistance of this positive-temperature coefficient thermistor, which is marked 4R7, produced a reading of 50Ω when cold and a few hundred ohms when hot. A replacement obtained from a scrap machine restored the correct display brightness. **C.W.**

ITT VR3918

Rewind and fast forward were perfect, but when play was selected the machine would instantly unload. The drum didn't rotate, hence no pulses to the microcontroller chip. During play pin 14 of IC4001 was low at only 0·8V instead of 2·5V. Fitting a new LC7142-8017 chip (very expensive) restored the correct voltage and drum rotation. **C.W.**

Matsui VX3000

The cassette went in then came straight back out again. Checks on the switching at the lift and on the end sensors were fruitless. A new OEC0017B system control chip had to be fitted. **C.W.**

Tashiko VVE921/GoldStar GHV12211

Play and fast forward were o.k., but when rewind was selected the machine would run for about thirty seconds then stop. If rewind was pressed again you got another thirty seconds of operation. I followed the usual procedures – changed the reel drive parts such as the idler and belt, and cleaned and lubricated the various parts – but the fault remained the same. Turning attention to the electrical side, I checked the voltage feed to the capstan motor which also drives the reel system. Nothing wrong here, even during rewind. So suspicion fell on the capstan motor itself. When I'd removed it and taken it to pieces I found that the bearings were as dry and tight as could be. Lubrication gave new life to the motor: rewind now worked, and fast forward was much faster. **C.W.**

Philips VR6462

This machine wouldn't accept a cassette. If the cassette was placed in the slot however and a key such as play or stop was pressed, the tape went in and the machine worked normally. The cause of the problem was a shorted switch in the lift housing – as a result the machine thought that a cassette had already been inserted. **C.W.**

ITT VR3907

This machine wouldn't switch off. The channel indicator was lit, so was the power-on LED. If the machine was playing and the power button was pressed the tape would unload but the lights remained on and the E-E voltages remained. We found that a transistor, TR2, in the power supply was leaky. A TIP42 is a suitable replacement. **C.W.**

Panasonic NVG40

There was sporadic loss of sound with this machine's own recordings. The recordings themselves were o.k., as a check with another machine proved, and playback of prerecorded tapes was all right. The answer to the problem lay in realigning the audio/control head assembly in order to provide the microcontroller chip with better pulses. It was muting the sound at pin 18 of IC4001. **B.McC.**

Tashiko VVE922/GoldStar GHV21401

The problem with this mahine was occasional wobbly pictures. The cause was found to be the 1µF, 50V decoupling capacitor C712 in the i.f. unit. Curiously, this changes the action of the a.g.c. potentiometer. **B.McC.**

Grundig VS200

The problem here was occasional tape damage and loading problems. With a little perseverance we found that the switch behind the brake solenoid didn't make contact every time. Thus the machine locked up. Cleaning cured the problem. **B.McC.**

Sharp VC780HM

A colleague had been looking at this one but couldn't work out why it would jam when unlacing. On dismantling the mechanism and carrying out a closer examination I found that one of the two cams – not the cam-switch one – had a broken wall on its hidden side. Replacement and retiming got the mechanism working properly again. **N.B.**

Salora SV8600/Mitsubishi HS337

There was no reel drive as the brakes weren't being released in the fast forward and rewind modes – playback was o.k. The cause of the trouble was that the brake release bar latching lever spring beneath the mode motor assembly was disconnected at one end. **N.B.**

Sharp VC781HM

It's not uncommon to get tape riding in these machines because the pinch roller is worn and deformed or the arm is bent. With this one however the problem was bad riding in the cue mode because of excessive friction prior to the exit guide. Reducing the back tension alleviated the problem, but the cause was the surface of the lower drum. **N.B.**

Salora SV8600/Mitsubishi HS337

This one came in from another dealer who was having difficulty with it – the cassette carriage was up, the guide poles were forward and the pinch roller wasn't engaged! I stripped down the mechanism, cleaned and regreased everything, put the lot back together again in the correct timing sequence and replaced the mode switch. The result: a working machine. **N.B.**

Logik VR960A

A common problem with these small machines is poor/low sound. The cause is simply a worn audio/control head. **N.B.**

Satellite Scene

Comments from regular contributors

Fault Round-up

The following fault reports have been received from Graham Rees:

Amstrad SRD400: The problem with one of these receivers was no video, i.e. a blank raster. When the input/output to the decoder was shorted across the picture was o.k. The cause of the fault was no 5V supply to the decoder because zener diode DP28 was short-circuit. As it's fed from a 2·7kΩ resistor (PR3A) no damage was done.

The cause of the channel display flashing at random was the microcontroller ship IC101.

If you can't set the four-digit pin number, getting only three of them, try replacing the EPROM IC104.

Amstrad SRD510: For a dead receiver check the 47kΩ start-up resistors R602 and R603 which can go open-circuit. Take care as the smoothing block remains fully charged. Alternatively check C612 (220μF).

If the MJF18004 transistor TR600 blows, check C615 (1nF) which can fall in value.

For no 13V supply check whether D607 is short-circuit.

When checking for shorts across the 5V supply remember that the resistance to chassis is approximately 8Ω.

Ferguson SAP4S: The cause of no tuning was traced to the SDA3202-3X chip IT01.

Ferguson SRV1: If there's no 9V supply to the tuner and thus no output, check whether Q2's collector feed resistor R323 (4·7Ω) is open-circuit.

Pace PRD800: There were no on-screen graphics and the microcontroller chip wouldn't reset. The chip itself was at fault: it's mounted on a sub-assembly board.

Pace SS9200: A dead receiver with a blown fuse can be caused by a short-circuit chopper transformer. Alternatively if the BUT11A chopper transistor Q1 has failed make sure that you replace C9 (1μF) as well as a precaution. For tripping check whether C17 (470μF) is open-circuit. For slight mains hum running down the picture, noticeable on certain scenes only, check whether C7 (47μF) is open-circuit.

For lines on the picture check whether C134 is open-circuit.

If the receiver powers down after five minutes, check the microcontroller chip U4 (it can get very hot).

M. Cordner writes: Vertical white lines over the picture on all channels due to failure of the 2·2μF electrolytic capacitor C416 in the tuner in Pace SS9000 series receivers (Ferguson SRV1) has been mentioned before. I fit the replacement with a little heatsink compound against the tuner's case and find that this works very well.

Receiving Lower-frequency Channels

Hugh Allison has been experimenting with LNBs to lower the frequency coverage. He writes as follows:

The average Astra type satellite installation tunes over the band 10·96-11·68GHz. There are however interesting signals available just below these frequencies. Astra 1C for example has two channels below the usual band. There are several satellites that transmit low at or close to 0°. Of particular note is an occasional relay showing scenes through the window of, presumably, a Russian spacecraft. So the question arises, can we modify a standard LNB to lower its frequency coverage?

LNBs incorporate a local oscillator that operates at 10GHz. It's remarkable really that the frequency is held, give or take a few tens of kHz, from freezing cold in winter to the heat of a summer's day. This minor miracle is achieved by the use of a dielectric resonant oscillator (DRO). Its output is mixed with the incoming signals to produce an i.f. output of 960-1,680MHz. The indoor receiver tunes across this band. To tune lower, we need to lower the DRO's frequency.

Since we're talking about experimentation, it's best to obtain a second-hand LNB. Apart from the special screws inside, the original Amstrad blue-cap type is ideal – a second-hand one shouldn't cost more than a tenner. Whatever you do, don't go ripping the family Sky system apart in the hope of finding something better to watch!

Open up your LNB. This has often to be done by drilling out four rivets (no wonder they leak), or alternatively by undoing millions of screws, depending on type. With the cover off you'll usually see a 6BA- or 4BA-sized screw which often has a touch of sealant on it. This is the frequency-set screw for the DRO. Doing the screw up reduces the space within the DRO's cavity and thus ups the frequency. You can try undoing it, which will normally take you down a couple of hundred MHz or so. This is enough to get a few oddball channels and you might care to stick at that.

You can go down farther however. It's quite amazing how wideband the front-end bit of some LNBs is. Many will work quite well in the 10GHz amateur band. To get down to these frequencies you'll have to get to the DRO itself.

Depending on the type of LNB, this will mean undoing more screws. With the blue-cap LNB about a dozen of the previously mentioned special screws will have to be undone. At first glance they look like Allen-key headed screws, but on closer examination the cut-out is more star-shaped. You'll generally find that the DRO is a muddy-coloured object the shape and size of a small Asprin. It will reside more or less under the adjusting screw.

Hunt about in the junk box. You need a small chunk (about an eighth of an inch) of sleeving that will be a tight fit over the DRO. Selastomer sleeving is best, but the outer of coaxial cable will do. Reassemble the LNB.

Results

If you now fit the LNB to a dish pointing at Astra you'll find that the channels have all gone up. So Eurosport for example comes in where CNN used to be. I've been surprised at what can be found simply by pointing a 60cm dish to the south. A 2m dish will obviously bring in more signals. Sound may or may not be present – a receiver with a tuneable sound system is an advantage. Happy hunting!

Modern TV Receiver Techniques

Part 10: Sync and TB Generator Circuits

Eugene Trundle

At any given instant an analogue TV signal describes the brightness and colour of a single picture element (pixel). The picture itself consists of the total number of pixels on the screen: for it to be assembled correctly as an intelligible display, sync pulses that determine the precise screen position of each pixel have to be added to the video signal. The picture is scanned out line-by-line from the top to the bottom of the screen. What are required therefore are time references that determine the start and end of each line and its position on the screen vertically. This is called synchronisation. Sync pulses are added to the video signal generated by the camera so that the signal will produce a locked display whenever it's called up on a screen.

The amount of detail in a picture depends on pixel size and the number of lines used. In Europe the picture repetition rate is 25 per second: in some countries, including the USA, Canada and Japan, it's 30 per second. We'll stick to the European rate in the following summary of the basics.

Interlaced Scanning

While the rate of 25 pictures per second is adequate to give the illusion of continuous, smooth movement in a TV picture, it's not fast enough to avoid a flicker effect: the persistence of vision characteristic of the human eye calls for a 'flash rate' of at least 50Hz (better 60 or 70Hz) if flicker is to be avoided. Later in this series we'll examine how faster rates of field scanning are achieved in flicker-free TV sets. It would however be wasteful of spectrum space to transmit 50 complete pictures per second when 25 are all that are required. Hence the interlace technique, an ingenious and universally-used solution to the problem.

The complete picture (known as a frame) is transmitted in the form of two consecutive fields, each lasting for 20msec. There are 625 lines in a frame, 312·5 in each 20msec field. Not all of these carry video information however, because a period has to be allowed for the beams (three in a colour tube) to return from the bottom of the screen to the top (the blanking period, since the viewer doesn't want to see this). Lines that carry a video signal are referred to as 'active' lines: there are 287·5 active lines per field.

During the first transmitted field 287·5 lines are scanned out from the top to the bottom of the screen, producing a coarse, 'liny' picture. The next field consists of the remaining 287·5 active lines. These are traced out in the gaps between the lines of the first field. For the system to be effective, it's essential that the second set of lines is scanned out precisely between the lines of the first set.

We thus have a field frequency of 50Hz/20msec, while complete pictures are produced at a rate of 25Hz/40msec. The persistence characteristics of the tube's phosphors and the human eye result in the scanned out frame being integrated as a complete, stationary picture in the viewer's mind – then as moving pictures as successive fields are scanned out.

Synchronisation

The sync pulses added to the video information during the blanking periods (line and field – the beams have to return from the right-hand side to the left-hand side as well as from the bottom to the top of the screen) ensure that, when everything is working properly, the scanning is correct. The line scan duration is approximately 64μsec, consisting of a 52μsec active period and a 12μsec blanking/flyback period. During each line flyback period a precisely-timed 4·7μsec line sync pulse is inserted into the waveform. It serves as a reference marker for the start of the flyback.

Field synchronisation is a bit more complicated. The lines that comprise the picture slope downwards slightly from the left-hand side of the screen to the right-hand side because of the effect of the field deflection on them. Because of this odd fields (1, 3, 5 etc.) end half way through a line while even fields start half way through a 64μsec line period. For this and other reasons correct interlacing was particularly difficult to achieve with the old 405-line receivers. When the 625-line system was introduced, a more complex field sync pulse train was adopted. There are five equalising pulses, then five broad (28μsec) field sync pulses, followed by five more equalising pulses. These fifteen pulses last for a period that's equal to 7·5 line scans. There is then a further blanking period that lasts for 17·5 line scans, the total field sync/blanking period lasting for 25 lines.

There's a line-rate component throughout the field sync/blanking period. Its purpose is (or was!) to keep the line timebase synchronised during the field sync/blanking interval.

The sync pulses occupy the 'blacker-than-black' region of the video waveform, extending downwards to –0·3V when the black level is taken as 0V. Since the peak-to-peak level of the overall waveform is taken as 1V, the sync to peak white ratio is 3:7. In principle the TV set's sync circuitry can regard all that's below the zero line as consisting of sync pulses and all that's above it as video information.

Blanking

Because, in a practical circuit, the video signal cannot drop to zero instantaneously, particularly from peak white, and because the leading edge of the line sync pulse is the crucial timing marker, each TV line is blanked for 1·5μsec prior to the advent of the line sync pulse. This 'front porch', as it's known, forms a boundary between the picture information and the pulse. The 4·7μsec line sync pulse is followed by a 'back porch' period of 5·8μsec to give the beams time to return to the left-hand side of the screen before the picture information starts again. The colour burst, which is used to synchronise the receiver's colour decoder, is inserted in this back-porch period – see Fig. 1, Part 6.

For similar reasons there are blanking periods before and after the field sync pulses (a group of five per field). The relatively long 17·5-line interval after the field sync pulses in the field sync/blanking period was originally provided to accommodate the slow flyback action of many early field timebase circuits. It subsequently came to be used for network switching signals, engineering test waveforms

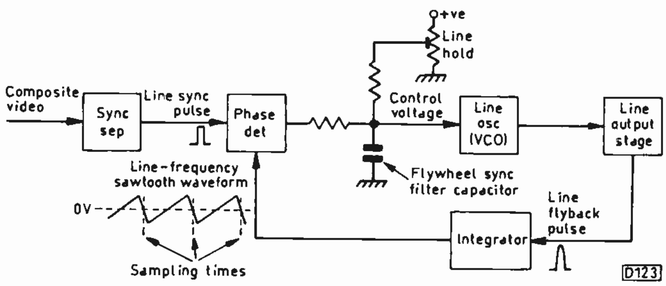

Fig. 1: Basic flywheel line sync arrangement.

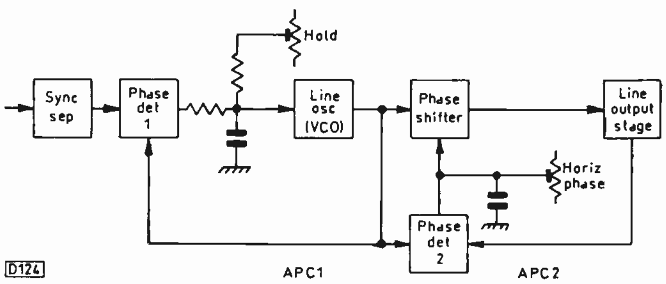

Fig. 2: Dual-loop flywheel line sync arrangement used in all modern TV receivers. In practice the circuitry is much more complex than this basic block diagram suggests.

(known as VITS – vertical interval test signals) and the teletext system, which we'll examine in a later instalment in this series.

Sync Separation

For precise control of the line and field timebase generators it's important that the steep leading edges of the sync pulses are preserved and that no picture information is present in the separated sync pulses. Nowadays the process of separating the sync pulses from the transmitted video waveform is carried out within an i.c., an adaptive slicer being used. This continually samples the pulse amplitude to find the mid-point between black and the sync-tip level, then identifies the timing and direction of all transitions across this point. Many chips also contain a noise inverter/gate that shuts down the sync separator when noise or interference is momentarily present – in the short term lack of sync is less disturbing to the picture than the presence of spurious pulses.

Line Synchronisation

Very early TV sets used direct line synchronisation: the line oscillator free ran at a frequency slightly lower than normal, being triggered to initiate the flyback by the arrival of a sync pulse. This arrangement is very susceptible to noise and interference however, so 'flywheel' systems came into use. These in effect average a large number of pulses over a period of time so that the absence or corruption of one or a few received pulses has little effect on the picture.

The idea is depicted in Fig. 1. A voltage-controlled oscillator (VCO) that free runs at the correct line frequency of 15·625kHz is used. Pulses tapped from the line output transformer provide feedback to the phase detector. These pulses are integrated to produce a sawtooth waveform. The phase detector's other input is the separated line sync pulses. These in effect switch the phase detector on, so that it samples the sawtooth waveform at its other input. If the sawtooth waveform is passing through zero when the sync pulse arrives, synchronisation is correct and the phase detector produces zero output to add to the voltage that sets the line oscillator's frequency. If the synchronisation of the line timebase is incorrect, the sawtooth waveform will be at either a positive or a negative voltage when the sync pulse arrives. This value is detected and fed to the line oscillator via a filter, to speed up or slow down the oscillator as required. To minimise the effect of noise or interference, the filter's time-constant is relatively long. This 'lazy' action gave rise to the term 'flywheel sync'. The requirements differ somewhat with VCR use, as we shall see in a moment.

The i.c.-based line sync systems nowadays used employ two phase-locked loops (PLLs) as shown in Fig. 2. The first (APC1) phase-locks the line oscillator to the incoming sync pulses in the way just described. The second loop (APC2) maintains a constant phase relationship between the output from the line oscillator and the flyback pulses in the line output stage. Loop APC2 compensates for phase/timing errors caused by variations in picture content and brightness. These can be a problem when the e.h.t. and other supplies are derived from the line output transformer.

The advantages of a dual-loop flywheel system are better noise immunity, a symmetrical pull-in and hold-in range, no change in picture position or geometry with variations in picture content or loss of signal/sync, and adaptability to different reception and signal-source conditions. Picture centring in the horizontal plane is easily arranged by including a phase control in the second loop. It sets the position of the picture within the raster, taking up tolerances in the scanning circuit and the picture tube, whose purity adjustment affects picture positioning.

Different signal characteristics and reception conditions call for different characteristics in the flywheel loop. These are catered for by varying the system gain, control range limits and filter response. For DX-TV reception for example a fast lock-in and high noise immunity thereafter are required. With VCR and video-disc operation a short time-constant is required so that there's a quick response to cope with signal timing jitter and the line phase jump at the head switchover points. These can be catered for in the timebase generator chip by automatic adaptation based on sampling and/or programming, either directly or via an I2C bus line. Typically three time-constants are provided: for normal off-air reception; for reception with weak and noisy signals; and for VCR/disc operation. In addition the phase detector in loop one may be gated at line rate to prevent pulses that occur outside the normal timing window for the broadcast sync pulse having any effect.

Field Synchronisation

In its simplest form – one that survived far longer than direct line sync – field synchronisation relied on detecting the broad field sync pulses which were separated then integrated to form a single pulse to trigger the field flyback. Use of an integrator means that the short-duration line pulses have little effect while the broader field sync pulses rapidly build up the output, see Fig. 3. Integration can be followed by a level detector which generates a sharp pulse to initiate the flyback. The field oscillator free-runs at about 47Hz, its catch-and-hold range depending on the width of the window during which the oscillator is responsive to sync pulses. Trade-offs here are noise/interference immunity, provision for oscillator drift, and 'worst-case' frequency error with a VCR used in its 'trick-play' modes. With this type of direct synchronisation good interlacing is crucially dependent on the trigger level, which can be upset by stray line-frequency pulses or noise/hash/hum on the video signal.

Many modern timebase generator chips use an alternative, better field sync system. A divider circuit is used to count the line scans, the field flyback being triggered every 312·5 lines. Once the system is lined up with the timing of the broadcast signals it can manage without any field sync pulses at all. As it's not easy to count half lines the line oscillator runs at double speed, 3·125kHz. Its output is divided by two for line drive and flywheel sync operation, and by 625 to provide field drive. The advantages are a stable, jitter-free display even when the sync pulses are corrupted or temporarily absent, perfect interlacing because of the precise flyback timing, no oscillator drift and no field hold/frequency adjustment, and automatic recognition of 50/60Hz standards, sync and scan amplitude being correct in either case. The divider/reset system has three modes of working, with wide, narrow or extra-narrow search windows, the latter just one clock pulse wide.

A development of this approach is used by chips like the TEA2028, whose scan timing, both line and field, is derived from a 500kHz ceramic-resonator based VCO, with counting down to 15·625kHz and 50Hz for the line and field drives and a PLL that works at line rate. In this case there are neither line nor field hold presets.

Interlace Switching

As we've seen, the interlace system is essential with conventional, analogue TV broadcasting systems to conserve spectrum space (channel bandwidth). With text and computer displays however interlacing produces an objectionable inter-line flicker on the horizontal edges of captions and graphics. Sequential scanning provides a more stable image for these purposes. With a TV set designed for broadcast reception sequential scanning can be achieved by triggering each field at the end of a line, so that the lines of the odd and even fields are overlaid. The fact that this halves the vertical resolution is not important with relatively coarse images such as teletext pages. Interlace switching is normally carried out automatically when text is selected. With some sets it can be programmed for use with external signals from a caption generator or computer.

Signal Recognition

A coincidence detector that puts up a flag when the primary PLL (APC1) is locked to a transmission is often incorporated in a timebase generator chip. It has two purposes: to terminate the channel sweep with a self-seek tuning system and to de-activate an inter-station hiss muting gate in the sound channel.

Sets with on-screen menu and caption facilities need a stable free-running line oscillator to avoid ragged displays when there's no signal input. So some of them incorporate a noise detector to earth the video input pin for the sync separator under no-signal conditions. In other designs the longest available flywheel sync time-constant is used in these circumstances.

Another link between the timebase generator chip and the signal-processing section of the receiver carries the sandcastle pulses, which were described and illustrated in Part 6 (June).

Typical Timebase Chips

As a practical example of the techniques we have been considering this month, Fig. 4 shows a block diagram of the widely-used TDA2579A sync/ timebase generator chip. The peripheral circuitry applies to a Bang and Olufsen chassis.

The composite video signal enters at pin 5. Its black level is then measured and stored in capacitor C42 which is connected to pin 7. The sync slicing level is set by R70 and stored in C41 at pin 6. A noise-inverter circuit in this section of the chip shuts down the sync separator when interference pulses that exceed an internally-set threshold of 0·3V are detected.

Phase detector 1 compares the frequency of the separated line sync pulses with the output from the line oscillator. This is PLL one, the error output from the detector locking the line oscillator by voltage control. The flywheel sync time-constant components C39, C40 and R68 are connected to pin 8. Although this is not shown in Fig. 6, phase detector 1 consists of three different discriminators connected in parallel, each with its own active resistance: the most appropriate one for the conditions present is switched in automatically by a circuit that consists of noise-level and sync ident detectors. Pin 13 provides a three-level output for muting and switching: 0V for no signal; 7·8V for 60Hz sync; and 10V for 50Hz sync.

The free-running line oscillator frequency is set by R77, C76 and the d.c. voltage applied to pin 15 of the chip via R78.

Phase detector 2 compares the timing of the signal produced by the line oscillator with that of line output transformer derived flyback pulses that enter at pin 12. The error voltage thus produced controls, in conjunction with the preset phase control (horizontal centring) voltage applied to pin 14, a phase shifter: this consists of a pulse-width modulator that's in the path between the line oscillator and the line drive output at pin 11. The RC network C33, R57 provides a time-constant for this second PLL.

The field sync pulse generator (output at pin 3) is basically a divider that works with a double line-rate clock signal derived from the line oscillator. It's reset by a seven-stage field coincidence logic circuit that samples the field sync pulses in the manner previously described. The division ratio is switched automatically by the incoming video signal for 50/60Hz operation. The sandcastle pulse generator, whose tri-level output appears at pin 17, produces the required timings and levels from waveforms available within the chip plus a field flyback pulse input at pin 2. In the absence of this input the sandcastle pulse output is reduced to a continuous level of 2·5V. This, applied to the colour decoder chip, blanks the screen to prevent phosphor burn in the event of field collapse.

Fig. 5 shows a block diagram of the sync/timebase generator section of a Japanese chip, type M51308SP, that does much else as well, incorporating a video processor and PAL/NTSC decoder. The timebase section is of interest in using a 500kHz ceramic resonator as part of the line oscillator.

Composite video enters at pin 16, where C211 removes h.f. noise with weak signals. X501, connected to pin 11, is the 500kHz ceramic resonator. The line count-down circuit divides the 500kHz VCO's output by 32, producing 15·625kHz pulses whose phase is compared with that of the incoming, noise-gated line sync pulses in block AFC1. This is PLL1: C503 is the filter capacitor, across which the voltage to control the oscillator is produced. The gain of the AFC1 section is controlled by the coincidence detector block which determines the charge across C502 at pin 9. When loss of sync is detected the AFC1 loop gain is increased by a factor of three while the width of the line sync pulse detection period (the search window) is increased by a factor of four.

The second PLL (AFC2) compares the timing of the internally-generated line pulses with that of line output

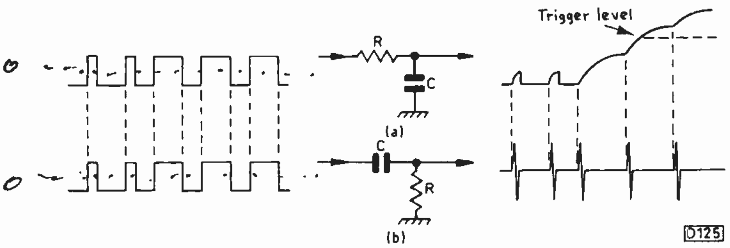

Fig. 3: Use of an integrating circuit (a) and a differentiating circuit (b) to sort out the field and line sync pulses. The time-constant of the integrating circuit is made long in comparison with the duration of the line sync pulses which thus have little effect on the output. If the time-constant of the differentiating circuit is made short in comparison with the duration of the line sync pulses the output will consist of sharp spikes that correspond with the pulse transitions.

transformer-derived flyback pulses that enter the chip at pin 12. An internal capacitor is used as the reservoir. If the flyback pulse is late, the voltage across this capacitor falls. As a result the phase of the drive pulse output at pin 6 is advanced to compensate. The circuit is sufficiently fast-acting to eliminate very short-term picture 'bending' effects.

An output from the line count-down circuit is fed to the field counter which controls a ramp generator. The output from this passes via a driver stage to pin 13.

The Line Driver Stage

The line drive pulses from a timebase generator chip typically have a mark-space timing ratio of 29:35µsec, the 35µsec 'on' period being the time during which the beams are deflected from roughly screen centre to the point when the flyback occurs. With an npn transistor as the line output device an impedance-matching stage is required. It usually consists of a driver transistor and a step-down transformer. The functions of this stage are twofold: it isolates the line generator from the switching impedance of the line output transistor, and provides power amplification to drive the necessary base current into the output transistor.

Fig. 6 shows a typical circuit. The squarewave output from the line generator chip switches Tr1 fully on and off via R1. R2 and C1 damp the primary winding of the driver transformer T1 to prevent excessive overshoots on the drive waveform. R3 limits the base current flowing via the line

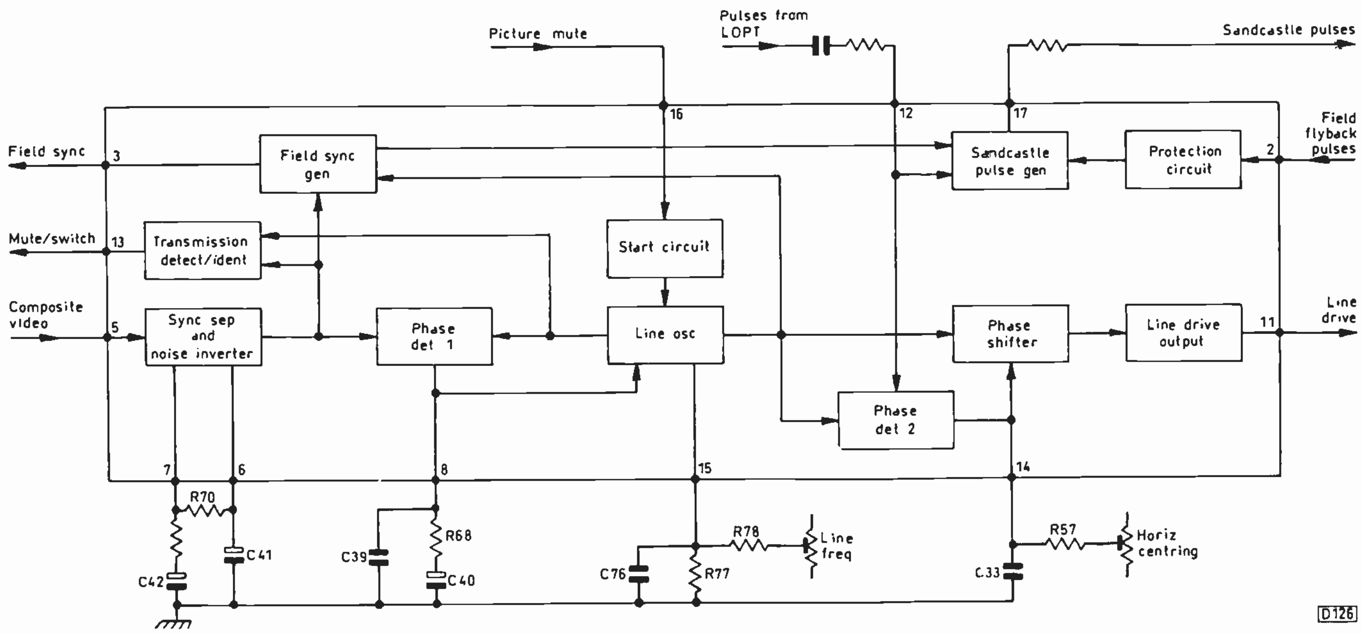

Fig. 4: Block diagram showing the basic arrangements used in the TDA2579A sync/timebase generator chip.

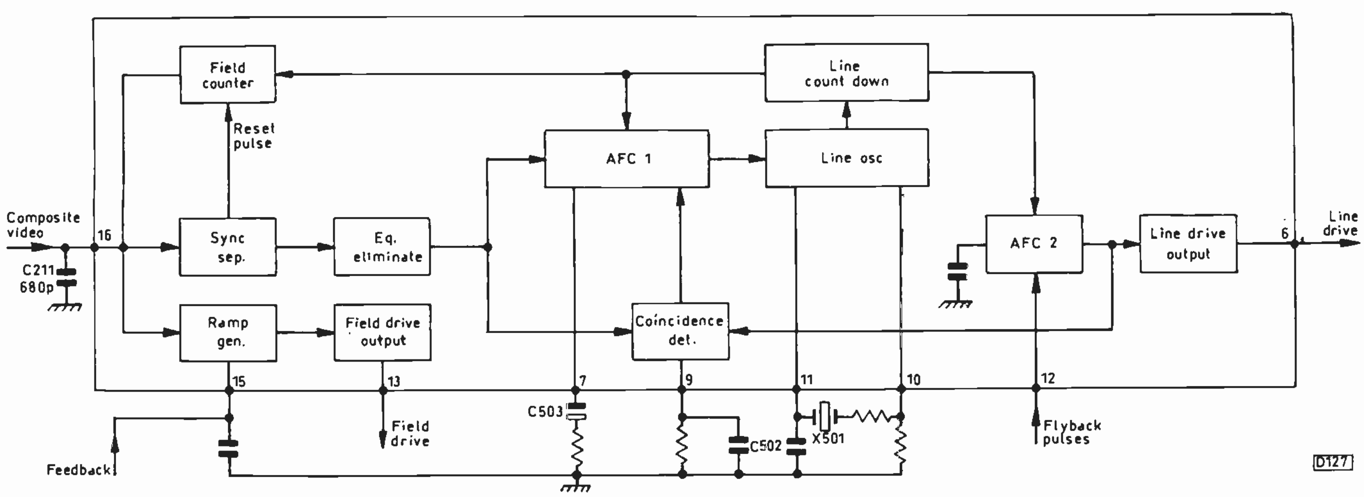

Fig. 5: Block diagram of the sync/timebase generator sections of the M51308SP chip, which also provides video signal processing and PAL/NTSC colour decoding. Line and field hold controls are not required, the basic timing being set by the ceramic resonator X501.

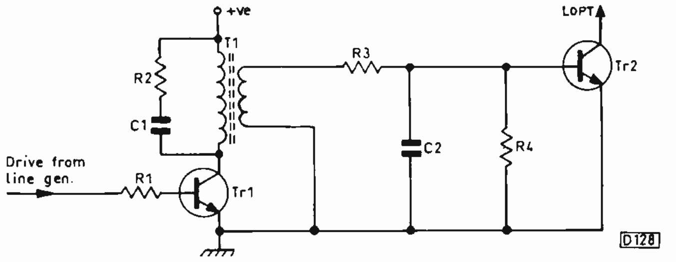

Fig. 6: Typical line driver stage circuit. In practice circuit design varies considerably.

output transistor Tr2, which is operated as a switch.

A low-impedance drive is essential for the line output transistor to switch on and off rapidly. It would otherwise dissipate excessive power during its transitions between the two states. The charge that builds up in Tr2's base region capacitance must be removed by the drive circuit, the process taking 5-10µsec (depending on transistor type) from the start of the switch-off pulse to the transistor starting to cut off. This time must be allowed for in the PLL2 section of the line sync circuit. R4 damps Tr2's base circuit, preventing spurious oscillation during the flyback, while C2 bypasses any flashover current that may reach Tr2's base.

There are many variations in practice in the detail of base-coupling circuitry: some circuits use diodes and small inductors to tailor the drive current waveform shape and timing to suit the type of line output transistor in use. With some types of line output transistor a transformer is not required.

Next Month

It's taken almost the whole of this instalment to get to a transistor switch that opens and closes in synchronism with the video signal! Next time we'll wade into the operation of the line output stage and its peripheral bits and pieces.

Teletopics

MATSUSHITA'S FLAT SCREEN

Matsushita is to start selling a 14in. flat-screen set this month in Japan at Y288,000 (about £1,800). Production will initially run at 1,000 sets a month. The display is not of the liquid-crystal type but is a development, called Flat Vision, that was first announced by Matsushita in 1985. It uses an electron source and a phosphor screen, but the electrons are focused on to sections of the screen by a matrixed electrostatic deflection system. This results in a display less than 10cm deep. Matsushita says that its Flat Vision technology provides the brightness of an LCD with the picture quality of a c.r.t., while being simpler to manufacture than an LCD. Larger, wall-mounted versions are to be developed and HDTV versions are a further prospect. Matsushita expects that its Flat Vision system will take ten per cent of the total world display market by the year 2000.

SATELLITE TV

National Transcommunications Ltd. and Eutelsat have completed joint tests which show that wideband satellite transponders can carry both analogue f.m. TV and digitally-compressed TV signals produced by NTL's System 2000, a multi-channel video compression system. A single Eutelsat transponder was able to carry one analogue and four digitally-compressed channels, or alternatively eight digital channels, at broadcast quality. With a data rate of 8Mbits/sec, four digital channels can be accommodated in the space normally occupied by one analogue channel. Use of a lower bit rate will give even more channels.

Eutelsat's Hot Bird (II F6), to be launched in the autumn of 1994 as a DBS TV satellite, was mentioned last month. Eutelsat is now planning a further DBS TV satellite to be known as Hot Bird Plus, with a proposed launch in early 1996, again at 13°E. It will have either fourteen or twenty transponders and will be equipped with 110W travelling-wave tube output amplifiers so that 40cm dishes can be used for reception in the service area.

Competition from SES will be provided by Astra 1F, which is also due to be launched in 1996. It will be SES's second satellite at 19·2°E dedicated to digital TV and audio transmissions. Astra 1D and 1E will operate in the band 11·7-12·1GHz while 1F will cover the upper part of the DBS band, 12·1-12·5GHz. SES plans to use digital compression so that hundreds of TV channels and even more radio and data services can be provided.

Cambridge Industries has confirmed that it has been awarded the contract to supply satellite receivers and dishes which British Telecom will be selling. The custom-designed receivers will use the latest ASIC technology.

FERGUSON RECALL

A recall of seven colour TV models within certain serial number ranges has been announced by Ferguson. The sets are as follows (Model no. first):

51K5 ANT	serial nos. 500001–510158
51K7 ANT	serial nos. 500001–534578
51L5 B	serial nos. 500001–502500
51L7 GREY	serial nos. 500001–502500
59K5 ANT	serial nos. 500001–04122
59K7 ANT	serial nos. 500001–525863
59K5QANT	serial nos. 500001–500501

No other Fergsuon sets are involved. The problem is deterioration of the on-off switch over a long period of time. Symptoms are overheating or the set occasionally switching itself on while unattended. There have been cases where the corner of the cabinet has burnt away. The sets were produced between September 1988 and March 1989. Ferguson has placed advertisements in the national press asking owners/renters to contact their local Ferguson dealer/rental company for a replacement switch to be fitted free of charge. In the interim, users should disconnect the set from the mains supply at night or when the set is unattended.

VIDEO NEWS

Thomson-CSF has developed an experimental static-head VCR system that can in theory record up to a thousand digitally-compressed TV signals in parallel on metal-evaporated Hi-8 tape. At present nine MPEG-1 channels can be stored. Track width is 18µm, tape speed being 2·6cm/sec. Data is stored at a rate of 20Mbits/sec, of which 12Mbits/sec are available for video signals. The system uses magnetic recording and a magneto-optical playback system based on a 50mW laser, a Kerr transducer and a CCD sensing chip. Basically, laser light reflected via the Kerr transducer is modulated by the information stored magnetically on the tape (the light's plane of polarisation is rotated by the magnetic fields). This works only with digital (two-state) information of course. The system has potential in both the professional and consumer markets.

Toshiba has launched a range of VideoPlus VCRs. Model V213B at £340 is a two-head machine and Model V423B at £380 a four-head version. Both include on-screen programming. Model V513B at £400 includes PDC while Model V813B at £530 has Nicam, PDC and front-mounted sockets.

Hitachi has launched a new Video 8 camcorder, Model VM-E53, whose features include a 24-times digital zoom, a 320,000-pixel CCD imager and remote control. Price is £700.

APPLE LAUNCHES ITS PDA

Apple Computer has launched its first Personal Digital Assistant (PDA) in the USA. It's a portable pen-operated computer designed to organise personal information. Apple's PDA, called MessagePad, will offer a variety of communications facilities including fax, electronic mail, wireless and an infra-red link – some of these will require additional hardware and software however. Price of the MessagePad is \$699 (£466), or \$799 (£530) with an optional fax/modem. It uses ROM card software that includes games, business guides and puzzles. These cost between \$40-\$120 (£26-£80). Around fifteen titles are available initially – Apple promises fifty by Christmas. The company says that over 1,500 developers are interested in producing Newton (PDA) software.

Sharp, which makes Apple's MessagePad at its Japanese plants, plans to market its own PDA called ExpertPad. Price is expected to be around \$899 (£600). Apple plans to launch the MessagePad in the UK shortly at around £599. It will be launched in Japan and Germany later this year and France in 1994. Sharp has not revealed its European launch plans.

SMALLEST DAT PLAYER

Sony has launched what is claimed to be the world's smallest DAT player, Model WMD-DT1. It's about the size of the smallest conventional Walkman and uses a mechanical loading system to reduce size and power consumption. Two AA-size batteries provide a playing time of up to four hours. Price is £250.

WORDPERFECT 6.0

Details of the WordPerfect 6.0 wordprocessor program, mentioned in David Botto's article last month, have now been released. It uses a GUI (graphical interface) and looks like a Windows program while being DOS based. There are all the features of WordPerfect 5.1 plus many more. The Grammatik 5 grammar/spell checker, now a WordPerfect product, is included. You can choose between three editing modes. The QuickFinder function speedily finds any word or phrase in a document. Up to nine documents can be handled simultaneously, and you can switch between them. With a suitable sound card the user can include audio/speech sound files anywhere in a document. The print preview function enables up to 32 pages of text and graphics to be viewed. Fit a fax card in your PC and you can send a fax. These are just a few of the new, advanced features. The suggested retail price is £329 plus VAT.

Next Month in TELEVISION

FREE 164-PAGE CATALOGUE

The November issue comes with a free 164-page banded catalogue from Marco Trading.

THE PANASONIC K DECK

The latest Panasonic VCRs use the new, improved K deck, whose features include faster mode switching, easy gear alignment and less gearing. Simon Nash provides a technical introduction to the new deck.

LINE OUTPUT STAGE OPERATION

Although the line output transistor acts as a simple switch, the operation of the line output stage is complex. For efficient operation and to generate the e.h.t. the stage is tuned, and for EW correction modulation is required. Eugene Trundle explains it all in the next instalment of his current series.

SATELLITE RECEIVER MODIFICATIONS

Some modifications to enable various satellite TV receivers to provide extra features.

THE APPLE NEWTON MESSAGEPAD

Apple's MessagePad, recently introduced in the USA and due for release in the UK by the end of the year, is a sophisticated, pen-operated, handheld computer. George Cole explains what's in it and the features it provides.

PLUS PLUS PLUS

More on the Panasonic digital TV chassis, more Toshiba servicing guidance and all the regular features.

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15/85R	3.84	2SC1413A	1.30	2SD438	0.34	BB105B	0.24	BD190	0.31	BF959	0.18	BYW56	0.46	M192B1	1.86	SG264A	10.62	TA7146P	7.70	TDA1170S	1.16	TEA1002	4.98
17052	3.85	2SC1509	0.51	2SD476	0.97	BC107B	0.20	BD201	0.40	BF960	0.27	BYX55600	0.20	M21C	1.65	SG613	18.79	TA7176P	1.30	TDA1190Z	4.08	TEA1009	1.61
17053	2.38	2SC1520	0.54	2SD525	1.27	BC108	0.15	BD203	0.46	BF966	0.61	CA1310E	0.78	M293	14.63	SGSIF344	6.62	TA7193AP	3.36	TDA1200	0.91	TEA1014	1.87
17088	2.38	2SC1573	0.36	2SD551	5.81	BC109A	0.16	BD232	0.28	BF970	0.30	CA3094	3.06	M490	15.30	SKE4F104	0.97	TA7193P	7.09	TDA1270	1.79	TEA1039	2.15
17089	3.39	2SC1573Q	0.26	2SD613	0.63	BC109B	0.15	BD234	0.25	BFR39	0.35	CD4001	0.14	M491	7.94	SKE4F210	0.87	TA7205AP	1.51	TDA1412	0.77	TEA2018A	1.49
17127	1.77	2SC1675	0.09	2SD636	0.14	BC117	0.14	BD237	0.30	BFR41	0.44	CD4011	0.21	M50115AP	3.24	SKE5F310	1.68	TA7207P	1.68	TDA1506	4.59	TEA2164	2.68
1N4001	0.04	2SC1685	0.17	2SD637	0.12	BC139	0.33	BD238	0.11	BFR90	0.61	CD4013	0.34	M51102L	1.77	SL1430	1.41	TA7210P	1.50	TDA1510	2.54	TEA2165	6.26
1N4002	0.07	2SC1740	0.12	2SD667	0.26	BC140	0.21	BD239	0.29	BFR90A	0.77	CD4016	0.14	M51231P	2.03	SL1431	1.70	TA7214P	3.74	TDA1512	3.17	TIC106D	0.55
1N4003	0.05	2SC1741	0.17	2SD669	0.63	BC141	0.34	BD241	0.41	BFR91	0.43	CD4021	0.43	M51393AP	4.64	SL1432	2.10	TA7217AP	1.27	TDA1515A	2.54	TIC106M	0.75
1N4004	0.07	2SC1815	0.14	2SD669A	0.63	BC147A	0.06	BD243	0.39	BFR96	0.53	CD4052	0.29	M51515L	2.01	SL471	1.70	TA7222	1.24	TDA1516Q	3.56	TIC45	0.59
1N4005	0.06	2SC1826	0.72	2SD716	1.46	BC148	0.12	BD243A	0.43	BFW92A	0.48	CD4053	0.20	M51521L	0.54	SL490	2.31	TA7222AP	1.27	TDA1518Q	3.32	TIL100	0.52
1N4006	0.06	2SC1827	1.00	2SD718	1.45	BC148A	0.06	BD243C	0.44	BFX85	0.55	CD4066	0.30	M5218L	0.48	SN29764AN	1.99	TA7227P	2.29	TDA1670A	2.81	TIP110	0.36
1N4007	0.06	2SC1845	0.20	2SD734	0.24	BC148B	0.04	BD244A	0.34	BFY50	0.34	CD4069	0.17	M5231L	0.55	SN7474N	0.38	TA7230P	1.60	TDA1701	4.86	TIP112H	0.58
1N4148	0.04	2SC1846	0.51	2SD762	1.51	BC149	0.04	BD244C	0.42	BFY51	0.34	CD4070	0.21	M53216P	1.48	SN76013ND	7.99	TA7233P	1.95	TDA1870	3.37	TIP120	0.57
1N4448	0.06	2SC1923	0.14	2SD774	0.43	BC149C	0.04	BD245C	0.72	BR100	0.17	CNX62A	2.95	M54543L	1.61	SN76227N	1.07	TA7240P	2.46	TDA1904	1.21	TIP121	0.42
1N5061	0.38	2SC1942	3.33	2SD787E	0.36	BC157	0.13	BD246C	0.71	BR101	0.98	CR3CM	2.62	M54544L	1.87	SN76666N	1.26	TA7241	2.30	TDA1905	0.94	TIP126	0.48
1N5402	0.12	2SC1959	0.11	2SD837	0.90	BC159	0.06	BD278A	0.56	BR103	0.53	CRO2AM	2.17	M54548L	3.29	SN76705AN	1.70	TA7250	4.03	TDA1908A	1.14	TIP132	0.46
1N5404	0.13	2SC1969	2.46	2SD841	1.34	BC161	0.27	BD317	0.87	BR303	1.22	CV12E	2.70	M54644BL	3.30	STA341M	2.54	TA7267P	2.02	TDA1940	2.77	TIP137	0.48
1N5406	0.12	2SC1983	1.78	2SD856	0.94	BC167	0.42	BD318	1.10	BRX44	1.02	CX10910	7.05	M54648L	6.62	STA401	2.46	TA7270	1.68	TDA1950	1.86	TIP2955	0.83
1N5408	0.12	2SC2001	0.14	2SD869	3.28	BC171B	0.14	BD380	0.34	BRY56	0.43	DTA124EF	0.13	M54898AP	20.45	STA441C	2.80	TA7270P	1.73	TDA2002	0.85	TIP29C	0.30
1N914	0.04	2SC2073	0.51	2SD870	3.81	BC177	0.14	BD433	0.29	BSS38	0.23	DTA144EF	0.17	M58485P	5.95	STK0029	5.88	TA7271P	1.76	TDA2004	1.27	TIP29E	0.46
1S1555	0.22	2SC2078	0.77	2SD871	5.08	BC178	0.11	BD4348	0.34	BT120	1.28	ER1400	2.15	MB3730	2.38	STK0039	7.11	TA7273	3.21	TDA2005	1.36	TIP3055	0.77
1S2076	0.29	2SC2141	1.48	2SD880	0.48	BC182L	0.06	BD435	0.38	BT129	3.26	HA11235	1.95	MB3731	2.20	STK0040	7.40	TA7274P	2.72	TDA2006	1.06	TIP30C	0.17
2N2219A	0.27	2SC2166	1.27	2SD882	0.43	BC182LB	0.06	BD436	0.32	BT139600	1.14	HA11244	3.83	MB3732	2.88	STK0059	9.75	TA7280	2.11	TDA2009	2.29	TIP31A	0.32
2N2222	0.22	2SC2168	0.85	2SD898B	4.23	BC184	0.09	BD437	0.32	BT151/500R	1.10	HA1124A	1.21	MC13002P	5.74	STK025	9.61	TA7299	2.34	TDA2020	3.72	TIP31B	0.30
2N2905	0.21	2SC2236	0.25	2SD904	5.95	BC184L	0.04	BD438	0.31	BT151800	1.15	HA11423	2.02	MC1310P	0.85	STK3042	6.90	TA7313AP	0.62	TDA2030H	0.61	TIP31C	0.44
2N2926G	0.37	2SC2271	0.22	2SD973	0.38	BC184LC	0.10	BD441	0.34	BU205	1.07	HA11440	2.92	MC1327AP	1.62	STK3062	8.88	TA7317P	0.93	TDA2030V	1.05	TIP32A	0.39
2N3053	0.36	2SC2274	0.22	74LS00	0.21	BC204	0.14	BD442	0.29	BU208A	1.16	HA1166X	3.43	MC1330AIP	1.26	STK4131	7.79	TA7325P	0.45	TDA2170	2.55	TIP32C	0.38
2N3054	0.98	2SC2274K	0.22	7805	0.28	BC207B	0.23	BD5103	1.34	BU208D	1.53	HA11713	1.24	MC1350P	1.82	STK4141	9.31	TA7343AP	0.72	TDA2270	1.68	TIP33A	0.92
2N3055	0.77	2SC2314	0.33	7808	0.30	BC212B	0.06	BD529	0.97	BU326A	1.36	HA11741	6.77	MC1352P	1.45	STK4142	8.21	TA7358P	0.78	TDA2530	3.76	TIP33C	0.80
2N3442	1.00	2SC2335	1.43	7812	0.30	BC212L	0.06	BD530	1.10	BU406	0.68	HA11745	5.10	MC1358P	1.59	STK4162M	9.51	TA75358P	0.68	TDA2540	0.88	TIP34C	0.89
2N3702	0.11	2SC2458	0.12	7815	0.30	BC213	0.11	BD535	0.43	BU406D	1.02	HA13001	1.72	MC14528BCP		STK4171	10.50	TA7607AP	2.62	TDA2541	0.72	TIP41A	0.38
2N3704	0.14	2SC2482	0.34	7818	0.41	BC214L	0.09	BD536	0.48	BU407	0.53	HA13108	3.56		1.70	STK4181 II	12.85	TA7609P	1.95	TDA2560	4.46	TIP41C	0.37
2N3773	1.27	2SC2547E	0.24	7905	0.34	BC237	0.10	BD675	0.30	BU407D	0.97	HA13118	1.87	MDA2062	2.21	STK4181A	12.46	TA7630P	1.87	TDA2576A	5.95	TIP42A	0.39
2N3819	0.34	2SC2565	8.46	7912	0.43	BC237B	0.05	BD677	0.32	BU426A	0.96	HA13119	2.03	MJ29550	0.97	STK4332	5.54	TA7640AP	0.98	TDA2577A	4.25	TIP42C	0.37
2N3904	0.11	2SC2570A	0.29	AA119	0.36	BC238	0.11	BD707	0.51	BU426E	2.13	HA13403	4.66	MJ802	2.37	STK4352	1.70	TA7676P	4.25	TDA2578A	2.55	TIP47	0.51
2N4444	3.22	2SC2577	1.46	AA143	0.13	BC238B	0.05	BD839	0.51	BU500	1.32	HA1377	2.42	MJE13005	0.85	STK437	8.30	TA7680AP	3.81	TDA2581	5.75	TIPL791A	1.24
2N6292	0.62	2SC2581	3.05	AC127	0.11	BC239	0.04	BD901	0.51	BU508A	0.95	HA1388	2.63	MJE2955	0.68	STK4392	5.92	TA7698AP	5.93	TDA2581Q	10.15	TIS43	0.66
2SA1015	0.10	2SC2632	0.43	AC141K	0.46	BC252B	0.07	BD902	0.51	BU508AF	1.27	HA1389	2.52	MJE3055	0.51	STK441	11.81	TA7705P	1.68	TDA2582	1.95	TL011CP	1.36
2SA1016	0.17	2SC2655	0.25	AC176K	0.30	BC300	0.48	BD911	0.65	BU508D	1.27	HA1392	1.61	MJE340	0.50	STK459	11.17	TA7769P	1.43	TDA2591	1.15	TL071CP	0.38
2SA1020	0.43	2SC2671	0.68	AC187	0.16	BC301	0.28	BD912	0.63	BU508DF	1.87	HA1397	2.63	ML923	14.26	STK461	10.49	TA8205	3.89	TDA2593	0.75	TL494	1.61
2SA1020Y	0.43	2SC2688	0.30	AC187K	0.33	BC302	0.36	BDV65B	1.16	BU508V	1.43	HA1398	2.33	MN1405VKF	11.08	STK4843	11.10	TA8210H	4.74	TDA2594	2.21	TMP47C432AP	
2SA1095	7.44	2SC2785	0.12	AC188	0.36	BC303	0.22	BDW84C	1.19	BU526	1.41	HA1452	4.86	MN1435VX	14.35	STK5211	15.78	TA8215	4.57	TDA2595	2.41		11.24
2SA1102	2.54	2SC2791	5.44	AC188K	0.82	BC307	0.06	BDW93C	0.59	BU536	1.60	HM6232	10.36	MN1435VXB	10.66	STK5322	6.35	TA8691N	6.67	TDA2600	3.08	TMP47C434N–	
2SA1143	0.17	2SC3150	1.44	AD149	0.52	BC307A	0.06	BDW94C	0.46	BU608	1.44	HM6251	9.52	MN650	2.50	STK5325	5.92	TAG626	1.05	TDA2611A	0.64	3555	17.87

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BU 208A x 5	3.50	TDA 2600 x 2	3.95
BU 426A x 5	3.50	TDA 2579A x 2	5.00
BU 508A x 5	5.00	TDA 3562A x 2	3.99
BU 508AF x 5	5.00	TDA 3654 x 2	2.20
BUT 11AF x 5	3.25	TDA 4501H x 2	2.49
U 321 TUNER x 2	3.00	TDA 4601 x 2	2.50
VIDEO FAULT FINDING GUIDE	9.99	TDA 4601D x 2	2.95
SEMI CONDUCTOR DATA BOOK	9.99	TDA 4501H x 2	2.49
SATELLITE FAULT FINDING GUIDE	£14.95	STR 54041 x 2	7.50

2SA1175	0.25	2SC3153	2.37	AD161	1.02	BC307B	0.06	BDX32	1.70	BU705	1.61	HM7103	14.07	MPSA42	0.23	STK5326	6.20	TBA120	0.53	TDA2611AQ	2.03	UC3844	1.78
2SA1186	3.73	2SC3156	4.22	AD162	0.96	BC308	0.06	BDY20	2.13	BU806	0.82	ICH28I	0.26	MPSA56	0.12	STK5331	3.02	TBA120AS	0.90	TDA2640	4.13	UPA81C	0.94
2SA1208	0.34	2SC3182	3.25	AF124	0.77	BC308A	0.09	BF115	0.41	BU806A	0.80	KA2101	0.83	MPSA93	0.09	STK5332	2.74	TBA120S	0.89	TDA2652	14.32	UPC1181H	6.80
2SA1265	1.95	2SC3225	0.50	AF127	0.59	BC308C	0.06	BF179	0.31	BU80796	0.51	KBL08	0.47	MR854	0.14	STK5333	4.28	TBA120T	0.51	TDA2653A	3.26	UPC1182H	5.95
2SA1286	0.39	2SC3795	1.95	AF139	0.29	BC327	0.10	BF184	0.41	BU826A	1.59	KSR1004	0.09	MSM5840H	15.36	STK5372	3.40	TBA120U	0.39	TDA2680	5.10	UPC1185H	10.20
2SA473	0.71	2SC380	0.12	AF239	0.43	BC327B	0.17	BF185	0.29	BU908	1.17	L200CV	1.13	MVS240	0.53	STK5421	2.60	TBA2800	1.62	TDA3190	1.27	UPC1188	3.83
2SA562	0.17	2SC388A	0.59	AF279	0.34	BC328	0.07	BF194	0.22	BUK444	2.38	LA1201	0.56	NE545B	3.20	STK5422	6.38	TBA395	0.68	TDA3190P	1.36	UPC1212C	0.83
2SA634	0.54	2SC458	0.10	AL102	5.08	BC337	0.09	BF196	0.15	BUT11	0.77	LA1230	1.95	NE555	0.21	STK5451	5.27	TBA520	0.85	TDA3300B	20.88	UPC1228HA	0.56
2SA639S	0.83	2SC536	0.09	AN3821K	7.23	BC337L	0.22	BF197	0.34	BUT11A	0.85	LA1385	1.65	NE555N	0.37	STK5466	4.71	TBA540	1.97	TDA3330	10.78	UPC1230	2.21
2SA673	0.09	2SC710	0.12	AN5265	1.75	BC338	0.06	BF198	0.17	BUT11AF	0.85	LA3161	0.40	NE592	1.85	STK5471	4.51	TBA540Q	0.77	TDA3541	0.95	UPC1230H	2.80
2SA684	0.43	2SC867A	5.25	AN5435	1.45	BC368	0.25	BF199	0.04	BUT12A	0.85	LA4140	0.37	NE646N	2.63	STK5476	5.00	TBA560C	2.02	TDA3560	3.65	UPC1278H	2.66
2SA733	0.17	2SC945	0.12	AN5512	2.14	BC369	0.17	BF200	0.39	BUT56A	1.19	LA4182	1.75	NP1106	11.86	STK5481	6.12	TBA570A	1.77	TDA3561A	3.31	UPC1318	2.96
2SA769	1.27	2SD1051	0.48	AN5515	2.33	BC372	0.47	BF240	0.11	BUW11	0.99	LA4192	1.14	OA47	0.25	STK5482	4.06	TBA651	1.01	TDA3562A	4.21	UPC1335V	3.91
2SA798	0.41	2SD1128	1.02	AN5521	2.14	BC546A	0.06	BF244	0.30	BUW11A	0.90	LA4220	1.29	OA90	0.59	STK6962	2.59	TBA750Q	5.10	TDA3565	2.29	UPC1351C	1.70
2SA872	0.14	2SD1138	0.94	AN5612	2.97	BC547	0.11	BF245A	0.19	BUW41B	1.02	LA4261	2.29	OA91	0.15	STK7216	5.53	TBA800	0.51	TDA3566	3.40	UPC1353	1.34
2SA872A	0.20	2SD1207	0.35	AN5900	1.27	BC547A	0.04	BF245B	0.41	BUW81A	2.29	LA4270	2.73	R2540	2.98	STK7226	8.14	TBA810P	1.66	TDA3571B	3.08	UPC1363C	1.06
2SA940	0.82	2SD1265	0.77	AN6310	4.69	BC547B	0.11	BF255	0.11	BUW84	1.11	LA4282	2.37	R2540X	1.92	STK7308	4.99	TBA810S	0.66	TDA3576	11.90	UPC1363CA	2.13
2SA952	0.17	2SD1273	0.82	AN6326	3.61	BC548A	0.29	BF256	0.24	BUX84	0.44	LA4422	1.27	R2M	0.77	STK7348	4.67	TBA820	0.85	TDA3640	4.75	UPC1365C	1.70
2SA958	1.44	2SD1275	0.88	AN6341	2.29	BC548B	0.18	BF256LC	1.40	BUX85	0.60	LA4440	1.68	R3297	4.27	STK7356	5.57	TBA820L	0.55	TDA3650	9.83	UPC1378H	1.19
2SA966Y	0.41	2SD1276	0.85	AN6610	0.93	BC548C	0.12	BF257	0.36	BUZ71	0.52	LA4445	1.29	R4050	2.38	STK7358	5.46	TBA820M	0.34	TDA3653AQ	1.92	UPC1391H	0.52
2SA970	0.19	2SD1279	7.62	AN6671K	5.35	BC549	0.06	BF258	0.04	BY127	0.15	LA4460	1.48	R4051	2.95	STR1096	4.67	TBA920	0.51	TDA3653B	1.86	UPC1394	1.23
2SA984	0.27	2SD1292	0.41	AN7158	2.73	BC556B	0.06	BF259	0.31	BY133	0.08	LA4461	1.48	RB156	2.07	STR40090	6.80	TBA950	1.68	TDA3654	1.66	UPC1420CA	6.60
2SB1010	0.34	2SD1308	0.77	AN7161	3.56	BC557	0.07	BF324	0.12	BY164	0.67	LA4475	2.29	RGP15	0.41	STR4090	16.36	TBA970	4.08	TDA3810	2.55	UPC1488H	1.28
2SB546	0.53	2SD1397	1.89	AN7171K	4.37	BC557B	0.06	BF337	0.34	BY179	0.80	LA4476	2.29	RGP15J	0.35	STR4211	4.72	TCA270S	1.03	TDA4420	1.27	UPC2002	2.08
2SB633	0.93	2SD1398	2.13	BA145	0.11	BC557C	0.11	BF338	0.43	BY184	0.39	LA4500	2.17	RGP30M	0.30	STR440	6.38	TCA440	1.95	TDA4427	1.89	UPC324C	1.74
2SB643S	0.20	2SD1426	2.54	BA156	0.06	BC558B	0.06	BF355	0.48	BY206	0.13	LA4505	1.79	RM11C	0.68	STR441	6.27	TCA660B	0.43	TDA4442	3.49	UPC4558C	0.51
2SB644	0.34	2SD1427	2.89	BA157	0.07	BC559	0.11	BF392	0.23	BY207	0.18	LA4508	2.29	S2000AF	1.19	STR451	14.69	TCA800Q	1.65	TDA4500	3.79	UPC574	1.07
2SB688	1.28	2SD1432	4.88	BA158	0.07	BC560C	0.21	BF393	0.17	BY210400	0.19	LA4520	1.11	S2055AF	1.81	STR50020	9.02	TCA910	1.21	TDA4501	5.08	UPC580C	2.55
2SB772	0.43	2SD1439	3.05	BA159	0.25	BC635	0.19	BF422	0.19	BY224600	5.10	LA4700	3.81	2530A	1.98	STR50103	5.92	TCA940	3.40	TDA4503	3.38	UPD1937C	3.15
2SB772Q	0.43	2SD1453	1.87	BA317	0.19	BC637	0.15	BF423	0.14	BY226	0.16	LA5112	5.89	SAA1004	1.14	STR54041	6.75	TD3F900H	6.57	TDA4505E	4.64	X0065CE	2.20
2SB793	0.31	2SD1497–02		BA318	0.04	BC639	0.14	BF435	1.97	BY227	0.14	LA5512	0.61	SAA1121	11.22	STR5412	8.27	TDA1004A	3.40	TDA4600	1.70	X2402	4.62
2SB819	0.48		7.05	BA5102A	1.46	BC640	0.06	BF450	0.19	BY228	0.38	LA7223	2.54	SAA1174	5.10	STR58041	6.35	TDA1011	1.27	TDA4600/2	2.14	ZPY120	9.17
2SB861	0.97	2SD1497–06		BA536	1.14	BC879	0.39	BF458	0.30	BY229	1.64	LA7520	2.75	SAA1250	2.92	STR6020	10.15	TDA1011A	1.47	TDA46002D	3.54	ZTX650	0.51
2SB891	0.43		7.06	BA5406	2.12	BC880	0.38	BF459	0.29	BY229600	0.84	LA7800	1.44	SAA1251	5.74	STR6020KIT	11.23	TDA1013A	1.45	TDA4600F	1.70	ZTX753	1.01
2SC1008	0.17	2SD1541	4.66	BA6109	1.85	BCY70	0.07	BF469	0.34	BY229800	1.02	LA7801	1.27	SAA1351	8.23	T6064V	2.63	TDA1015	0.99	TDA4601	1.56		
2SC1061	0.83	2SD1555	2.80	BA6209	1.31	BD131	0.28	BF470	0.33	BY238	0.31	LA7820	2.03	SAA3027P	7.62	T6076V	3.34	TDA1020	1.27	TDA4601D	2.42		
2SC1096	0.50	2SD1577	4.33	BA6219	1.45	BD132	0.21	BF480	0.67	BY255	0.14	LA7830	1.27	SAA5010	4.60	T9013V	5.23	TDA1035SB	4.15	TDA4605	3.64		
2SC1114	1.16	2SD1649	2.03	BA6222	1.61	BD135	0.33	BF493S	0.34	BY298	0.15	LM1303N	0.88	SAA5012	3.31	T9034V	1.45	TDA1035T	1.87	TDA4950	1.09		
2SC1162	0.31	2SD1650	2.47	BA656N	0.84	BD136	0.20	BF597	0.16	BY299	0.12	LM1877	1.45	SAA5030	6.42	T9035V	1.50	TDA1037	8.50	TDA7240A	2.36		
2SC1213	0.14	2SD1876	4.88	BA718	0.77	BD137	0.45	BF757	0.43	BY476A	0.68	LM317T	0.52	SAA5050	4.68	T9038V	6.09	TDA1044	1.43	TDA7270S	8.17		
2SC124	0.44	2SD1877	2.12	BAS11	0.32	BD139	0.29	BF758	0.32	BYD14J	0.31	LM324N	0.35	SAB3013	5.81	T9053V	0.92	TDA1060	1.58	TDA8140	2.38		
2SC1306	1.16	2SD1911	5.06	BAV18	0.07	BD140	0.24	BF759	0.36	BYD33G	0.68	LM339N	0.15	SAB3021	6.15	T9054V	1.65	TDA1082	4.25	TDA8153	5.10		
2SC1318	0.10	2SD234	0.89	BAV20	0.26	BD168	0.76	BF760	0.24	BYD33J	0.27	LM358	0.23	SAB3035	6.35	T9064	1.20	TDA1083	1.19	TDA8170	2.58		
2SC1364	0.29	2SD313	0.56	BAV21	0.19	BD175	0.29	BF762	0.29	BYV10–40	2.20	LM358N	0.42	SAF1032P	5.50	T9065V	4.66	TDA1151	0.51	TDA8180	5.35		
2SC1384	0.34	2SD350A	1.23	BAW62	0.17	BD179	0.34	BF869	0.25	BYV95C	0.44	LM380N	0.82	SAF1039	2.44	TA7063P	1.14	TDA1170	1.59	TDA8190	3.30		

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TELEVISION

TV/VCR SPARES GUIDE 1993

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

Aiwa UK Ltd., Unit 5, Heathrow Summit Centre, Skyport Drive, West Drayton, Middx UB7 0LY.
081-897 2425
Fax 081-899 0055.

Akai UK Ltd., Haslemere Heathrow Estate,12 Silver Jubilee Way, Parkway, Hounslow, Middx TW4 6NF.
081-897 6388
Fax 081-759 6118.
See also Thorn EMI UK Rental.

Akura. Spares available from Akura Components Ltd., 44, Deerdykes View, Westfield, Cumbernauld, Glasgow G68 9HP.
0236-457 022
Fax 0236-457 333.

Alba Radio Ltd., Harvard House, 14-16 Thames Road, Barking, Essex.
081-081 594 5533
Fax 081-591 0962.

Ambassador. Brand name used by Sentra Electronics.

Amstrad. Spares available from CPC Ltd., Chas Hyde & Son Ltd. and Amstrad PLC, Brentwood House, 169 Kings Road, Brentwood, Essex CM14 4EF.
0277-228 888
Fax 0277-209 559.

ASA. Spares can be ordered from Finlux.

Autovox. See Comet Group plc.

Baird. See Thorn EMI UK Rental.

Benkson. B. Benkert Ltd., Benkson House, 26 Thames Road, Barking, Essex IG11 0JA.
081-594 7532
Fax 081-594 9919.
Trade only.

Beovision/Beocord. Bang and Olufsen UK Ltd., Eastbrook Road, Gloucester GL4 7DE.
0452-307 377
Fax 0452 303 859.
Trade only.

Binatone International Ltd., Binatone House, 1 Beresford Avenue, Wembley, Middx HA0 1YX.
081-903 5211
Fax 081-903 5521.
Trade only.

Blaupunkt. Merrivale Television Services, 1 Lockside, Tatbank Road, Oldbury, Warley, W. Midlands.
021-544 6250
Fax 021-552 1503.
Trade only.

Bush Radio Plc., Harvard House, 14-16 Thames Road, Barking, Essex IG11 OHX.
081-081 594 5533
Fax 081-591 0962.
See also HRS.

Canon UK Ltd., Unit 4, BrentTrading Centre, North Circular Road, London NW10.
081-459 1266
Fax 081-459 4202.

Cathay. Spares from MG Services, Return Centre, BSS House, Cheyney Manor, Swindon, SN2 2PJ.
0793-497 591
Fax 0793-431 687.

Classic monochrome portables. Spares available from HRS Electronics plc.

Commodore. Spares available from CPC.

Comet Group plc., Service Dept., Unit 5, City Park Ind. Estate, Gelderd Road, Leeds LS12 6DR.
0532-311 024
Fax 0532-310 567.

Connexions UK plc., Unit 3, Travellers Close, Travellers Lane, Welham Green, Herts AL9 7LE.
0707-272 091
Fax 0707-269 444.

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

CPC Ltd., Component House, Faraday Drive, Fulwood, Preston, Lancs PR2 4PP.
0772-654 455
Fax 0772-654 466.
Official spares stockists for Alba/Bush, Amstrad, Commodore, Epson, Ferguson, Fidelity, GEC, GoldStar, Hinari, Ingersoll, Logic, Matsui, Olympia, Olivetti, Orion, Pace, Philips, Pye, Saisho, Sinclair, Sony and Triumph. Other spares available.

Crown. Spares available from Datapart, Electron House, 100 Great Barr Street, Birmingham B94 BB.
021-766 5551
Fax 021-766 5819.

Daewoo Electronic Sales UK Ltd., Unit 640, Winnersh Triangle, Wokingham, Berks RG11 5TP.
0734-695 666
Fax 0734-699 922.
Note: Daewoo brand products only, not OEM products. For the latter, refer to the original distributor.

Dansai TV and Video spares available from Nikkai. Audio spares available from MG Services, Return Centre, BSS House, Cheyney Manor, Swindon.
0793-497 591
Fax 0793-431 687.

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

Definition. Spares available from Wiltsgrove Ltd.

Denon. Hayden Laboratories Ltd., Hayden House, Chiltern Hill, Chalfont St Peter, Gerrards Cross, Bucks SL9 9UG.
0753-888 447
Fax 0753-880 109.

DER. Spares available from Thorn EMI UK Rental.

Doric. Some spares availbale from UK Rental and Retail Ltd.

Dwektron. Spares available from HRS.

Dynatron. Pre 1981 sets see Philips Service, post 1981 sets spares from SEME.

Elftone Electronics Ltd., 4 Beresford Avenue, Wembley, Middx HA0 1YZ
081-902 6222
Fax 081-903 5011.

Etron. Brand name used by Nikkai Imports Ltd.

Expert. Spares from Tatung, GEC, or Luxor depending on chassis.

FERGUSON
THOMSON TECHNOLOGY

Ferguson Ltd.,Service Division, Crown Road, Enfield, Middx EN1 1DZ.

WYE

CATALOGUE 1993/94

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Toshiba (UK) Ltd., Toshiba Technical Centre, Units 6/7 Admiralty Way, Southern Trading Centre, Camberley, Blackwater, Surrey GU15 3DT. **0276-694 000** Fax 0276-600 521. Trade only. See also Chas Hyde, CPC, Thorn EMI UK Rental, UK Rental and Retail Ltd.

Trical. Brand name used by Hinari Consumer Products Ltd.

Trio-Kenwood (UK) Ltd., Kenwood House, Dwight Road, Watford, Herts WD1 8EB. **0923-816 444** Fax 0923-819 131.

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

UK Rental and Retail Ltd., Unit 37, Roman Way Industrial Estate, Preston, Lancs PR2 5BD. **0772-651 551** Fax 0772-655 801. Spares for Ferguson, Finlandia, Granada, Hitachi, Mitsubishi, Salora, Sanyo, Sony, Tashiko, Toshiba. Trade only.

Ultra. See Ferguson Ltd.

Uniden. Crystal Communications, 33 Baker Street, Weybridge, Surrey KT13 8AE. **0932-821 711.**

Willow Vale Electronics Ltd., 11 Arkwright Road, Reading Berks RG2 0LU. **0734-876 444** Fax 0734-867 188. Official spares stockists for Ferguson, Fidelity, GEC, Grundig, Philips, Pye, Sansui, Sharp, Thomson. Other spares available. Also at Enterprise Park, Reliance Street, Newton Heath, Manchester M10 OAL. **061-682 1415** Fax 061-682 9031 and 11 Marhill Road, Carlton, Nottingham NG4 3AJ. **0602-870 789** Fax 0602-878 772.

Wiltsgrove Ltd., 28-29 River Street, Digbeth, Birmingham B5 5SA. **021-772 2733.** Sole distributor for Definition brand. Official distributor for CME, Futek, Ironda, Konig, Nikkai, Philex and Thorn. Other products stocked.

Wintronics. Limited amount of spares available from Lloytron Electronics Ltd.

Wizard Distributors, Empress Street Works, Empress Street, Manchester M16 9EN **061-872 5438** or **061-848 0060** Fax 061-873 7365. Spares stocked include Akai, Alba, Amstrad, Decca, Ferguson, Fidelity, Hitachi, ITT, Loewe, Mitsubishi, Philips, Pye, Schneider, Sentra, Sharp, Sony, Tatung, Toshiba. Some spares for other makes stocked. Trade only.

Yamaha Electronics (UK) Ltd., Yamaha House, 200 Rickmansworth Road, Watford, Herts WD1 7JS. **0923-233 166** Fax 0923-244 930.

Zanussi TV Spares available from Mets, 37 Padgets Lane, Redditch, Worcs B98 0RB. **0527-510 785.**

General/miscellaneous parts suppliers

Allparts Distributors, 101 Rocky Lane, Tuebrook, Liverpool. **051-260 4825.**

AZ Electric, 18 Brookwood Road, Southfields, London SW18 5BP. **081-877 3492/9064.**

Chromavision, 95 Langworthy Road, Salford, Manchester M6 5PH. **061-736 6333.**

Economic Devices, 32 Temple Street, Wolverhampton WV2 4AN. **0902-712 083** Fax 0902-29 052.

East London Components, 63 Plashet Grove, East Ham, London E6 1AD. **081-472 4871**.

Electrovalue Ltd., 28 St Judes Road, Englefield Green, Egham, Surrey TW20 0HB. **0784-434 757** Fax 0784-435 216. Northern branch 680 Burnage Lane, Manchester M19 1NA. **061-432 4945** Fax 061-432 4127.

Express TV Supplies, The Mill, Mill Lane, Rugeley, Staffs WS15 2JW. **0889-577 600.**

GGL Components, PO Box 72, Unit 7, South John Street, Carlisle, Cumbria CA2 5AL. **0228-39 693/20 358** Fax 0228-515 127.

Grandata Ltd., KP House, Unit 15, Pop In Commercial Centre, Southway, Wembley, Middx HA9 0HB. **081-900 2329** Fax 081-903 6126.

J.W. Hardy, 231 Station Road, Stechford, Birmingham B33 8BB. **021-784 8478.**

Harrison Electronics, Century Way, March. Cambs PE15 8QW. **0354-51 289** Fax 0354-51 416.

Irwin Electronics, Unit 200, JC Albyn Complex, Burton Road, Sheffield S3 8BX. **0742-739 622.**

JJ Components, 63 The Chase, Edgware, Middx HA8 5DN. **081-952 4641 also 081-381 1700.**

KSA Wholesale Components, 582 Green Lane, Small Heath, Birmingham B9 5QG. **021-772 2834.**

LRC (Spares), 3-5 Whitfield Street, London W1P 5RA. **071-323 2107.**

Manor Supplies, 172 West End Lane, London NW6 1SD. **071-794 8751/7346.**

Marapet, 1 Hornbeam Mews, Gloucester GL2 0UE. **0452-526 883.**

Nikko Electronics, Dalbani House, 257 Burlington Road, New Malden, Surrey KT3 4NE. **081-336 0566.**

T. Powell, 16 Paddington Green, London W2 1LG. **071-723 9246.**

PV Tubes, 104 Abbey Street, Accrington, Lancs BB5 1EE. **0254-236 521/232 611** Fax 0254-395 361.

Thrifty Spares (Wales), Centrevision House, Sloper Road, Leckwith, Cardiff CF1 8AB. **0222-344 218.**

Visions (GB) Ltd., Unit 4, Rainstar Industrial Estate, Eley Estate, Nobel Road, Edmonton, London N18 0AA. **081-807 7476/7579.**

Vista Electronics, Unit 1B, Wingate Grange Industrial Estate, Wingate, Co. Durham TS28 5AH. **0429-837 100.**

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Idler	VID 1093	£4.85
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V 4004		
Video Head	VID 2506	£14.14
Pinch Roller	VID 1788	£3.15
Belt Kit	VID 7538	£1.27
FF×REW Arm	VID 1020	£1.79
Clutch Plate	VID 1211	£9.27
Capstan Motor	VID 2148	£20.45
Cassette LED	VID 1981	£1.53
Tension Band	VID 1379	£2.38
Repair Kit	VID 7922	£17.24
GOLDSTAR		
GHV-8000×8200×8210×8215		
Pinch Roller	VID 1815	£3.15
Belt Kit	VID 7585	£1.36
Idler	VID 1052	£1.78
Bracket Centre	VID 1223	£13.51
Clutch Gear	VID 1228	£2.29
Limiter Roller	VID 1440	£1.53
Cassette LED	VID 1981	£1.53
Tension Band	VID 1399	£2.04
VCP-4100×4130		
Video Head	VID 2645	£27.24
Pinch Roller	VID 1815	£3.15
Belt Kit	VID 7585	£1.36
Idler	VID 1052	£1.78
Bracket Centre	VID 1223	£13.51
Clutch Gear	VID 1228	£2.29
Limiter Roller	VID 1440	£1.53
Cassette LED	VID 1981	£1.53
Tension Band	VID 1399	£2.04
VCP-4200×4326		
Video Head	VID 2645	£27.24
Pinch Roller	VID 1815	£3.15
REW Belt	VID 7234	£0.43
Cassette LED	VID 1981	£1.53
GRANADA		
VHS-EY1×EY2		
Video Head	VID 2539	£15.20
Pinch Roller	VID 1822	£3.31
Belt Kit	VID 7605	£2.63
Reel Drive Unit	VID 1255	£6.69
Loading Gear A	VID 1268	£1.95
Loading Gear B	VID 1271	£1.36
Capstan Motor	VID 2404	£46.16
Cassette LED	VID 1981	£1.53
Tension Band	VID 1414	£4.17
GRUNDIG		
MVS-400		
Video Head	VID 2596	£15.75
Pinch Roller	VID 1757	£3.13
Belt Kit	VID 7567	£0.85
Idler	VID 1052	£1.78
Loading Gear	VID 1222	£1.57
Clutch Gear	VID 1228	£2.29
Limiter Roller	VID 1440	£1.53
Cassette LED	VID 1981	£1.53
Tension Band	VID 1400	£2.39
Remote Control	IR 8965	£20.79
VS-520 GB		
Video Head	VID 2595	£16.24
Pinch Roller	VID 1821	£9.52
Timing Belt	VID 1482	£8.16
Centre Pulley	VID 1482	£8.16
Cassette LED	VID 1981	£1.53
Tension Band	VID 1401	£0.00
HINARI		
VXL-30×35×4		
Video Head	VID 2518	£21.85
Pinch Roller	VID 1815	£3.15
Belt Kit	VID 7566	£2.38
Clutch	VID 1316	£6.21
Idler	VID 1317	£2.77
Loading Motor	VID 2167	£14.11
Cassette LED	VID 1981	£1.53
HITACHI		
VT-11		
Video Head	VID 2504	£15.84
Pinch Roller	VID 1788	£3.15
Belt Kit	VID 7538	£1.27
FF×REW Idler Arm	VID 1020	£1.79
Clutch Plate	VID 1211	£9.27
Capstan Motor	VID 2147	£23.15
Cassette LED	VID 1981	£1.53
Tension Band	VID 1379	£2.38
Repair Kit	VID 7922	£17.24
VT-16 S		
Video Head	VID 2505	£25.56
Pinch Roller	VID 1788	£3.15
Belt Kit	VID 7538	£1.27
FF×REW Idler Arm	VID 1020	£1.79
Clutch Plate	VID 1211	£9.27
Capstan Motor	VID 2147	£23.15
Cassette LED	VID 1981	£1.53
Tension Band	VID 1379	£2.38
Repair Kit	VID 7922	£17.24
VT 33×330		
Video Head	VID 2504	£15.84
Pinch Roller	VID 1788	£3.15
Belt Kit	VID 7538	£1.27
FF×REW Idler Arm	VID 1020	£1.79
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Tension Band	VID 1379	£2.38
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Capstan Motor	VID 2154	£19.43
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Repair Kit	VID 7924	£15.35
VT-8000×8500		
Video Head	VID 2509	£15.76
Pinch Roller	VID 1788	£3.15
Belt Kit	VID 7803	£0.77
Take Up Idler	VID 1015	£3.65
Wind Roller	VID 1016	£0.94
FF×REW Idler	VID 1023	£3.20
Capstan Motor	VID 2155	£21.00
Tension Band	VID 1381	£2.21
Remote Control	IR 9097	£15.92
Repair Kit	VID 7928	£13.66
Take up Reel Table	VID 1302	£13.00
Supply Reel Rubber Tyre	VID 1300	£0.85
VT-9300×9500×9700		
Video Head	VID 2509	£15.76
Pinch Roller	VID 1788	£3.15
Belt Kit	VID 7802	£0.94
FF×REW Idler Arm	VID 1019	£2.89
Play Idler	VID 1075	£3.99
FS Brake	VID 1212	£1.99
Capstan Motor	VID 2156	£59.55
Cassette Lamp	VID 1951	£1.02
Tension Band	VID 1382	£2.20
Remote Control	IR 9096	£16.95
Repair Kit	VID 7927	£15.67
Take Up Reel Table	VID 1303	£9.43
ITT		
VR-3913		
Video Head	VID 2511	£10.74
Pinch Roller	VID 1814	£3.15
Belt Kit	VID 7812	£1.02
Reel Idler	VID 1036	£2.63
Take Up Clutch	VID 1037	£2.38
Take Up Idler	VID 1038	£1.07
Brake Pad	VID 1361	£0.59
Reel Motor	VID 2169	£28.97
Capstan Motor	VID 2164	£33.80
Loading Motor	VID 2168	£12.64
Cassette Lamp	VID 1947	£0.51
Tension Band	VID 1389	£1.05
Repair Kit	VID 7913	£16.09
Take Up Reel Table Rubber Tyre	VID 1080	£0.68
Supply Reel Table Rubber Tyre	VID 1080	£0.68
VR 3993		
Video Head	VID 2647	£9.18
Pinch Roller	VID 1814	£3.15
Belt Kit	VID 7523	£1.27
Reel Idler	VID 1036	£2.63
Take Up Clutch	VID 1037	£2.38
Take Up Idler	VID 1038	£1.07
Roller Bar	VID 1363	£4.44
Brake Pad	VID 1361	£0.59
Reel Motor	VID 2169	£28.97
Capstan Motor	VID 2187	£47.57
Loading Motor	VID 2168	£12.64
Front Loading Motor	VID 2168	£12.64
Cassette Lamp	VID 1946	£0.59
Tension Band	VID 1389	£1.05
Repair Kit	VID 7914	£13.42
Take Up Reel Table Rubber Tyre	VID 1080	£0.68
Supply Reel Table Rubber Tyre	VID 1080	£0.68
JVC		
HR-3300		
Video Head	VID 2511	£10.74
Pinch Roller	VID 1756	£3.23
Belt Kit	VID 7506	£1.78
Take Up Idler Large	VID 1025	£5.27
REW Idler	VID 1025	£5.27
Unloading Idler	VID 1027	£10.54
FF Rubber Tyre	VID 1029	£0.85
Unloading Idler Rubber Tyre	VID 1207	£0.93
Capstan Motor	VID 2119	£25.34
Drum Motor	VID 2120	£20.20
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Tension Band	VID 1391	£3.65
Repair Kit	VID 7911	£15.27
Take Up Rubber Tyre	VID 1028	£0.94
HR-D110×111×120×121		
Video Head	VID 2647	£9.18
Pinch Roller	VID 1813	£3.15
Belt Kit	VID 7543	£1.16
Take Up Clutch	VID 1031	£2.26
Take Up Idler	VID 1038	£1.07
Reel Idler	VID 1039	£3.40
Brake Pad	VID 1361	£0.59
Capstan Motor	VID 2165	£25.16
Loading Motor	VID 2168	£12.64
Front Loading Motor	VID 2168	£12.64
Cassette LED	VID 1981	£1.53
Tension Band	VID 1389	£1.05
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VX-850		
Pinch Roller	VID 1815	£3.15
Belt Kit	VID 7566	£2.38
Clutch	VID 1316	£6.21
Idler	VID 1317	£2.77
Cassette LED	VID 1981	£1.53
MITSUBISHI		
HS-307		
Video Head	VID 2606	£33.96
Pinch Roller	VID 1808	£3.15
Belt Kit	VID 7542	£1.45
Reel Idler Unit	VID 1040	£9.10
FF Idler Rubber Tyre	VID 1081	£0.77
Capstan Rubber Tyre	VID 1264	£1.36
Cam Gear A	VID 1274	£1.36
Gear 2	VID 1275	£1.53
Cam Gear B	VID 1276	£1.53
Gear 1	VID 1277	£1.45
Cassette LED	VID 1981	£1.53
Tension Band	VID 1393	£2.89
Take Up Reel Table	VID 1307	£4.23
Supply Reel Table	VID 1299	£3.54
HS-318		
Video Head	VID 2607	£43.65
Pinch Roller	VID 1808	£3.15
Belt Kit	VID 7559	£1.61
Reel Idler Unit	VID 1040	£9.10
FF Idler Rubber Tyre	VID 1081	£0.77
Capstan Rubber Tyre	VID 1264	£1.36
Cam Gear A	VID 1274	£1.36
Gear 2	VID 1275	£1.53
Cam Gear B	VID 1276	£1.53
Gear 1	VID 1277	£1.45
Cassette LED	VID 1981	£1.53
Tension Band	VID 1393	£2.89
Take Up Reel Table	VID 1307	£4.23
Supply Reel Table	VID 1299	£3.54
NEC		
N-830 E6×831×832×833		
Video Head	VID 2647	£9.18
Pinch Roller	VID 1813	£3.15
Belt Kit	VID 7543	£1.16
Take Up Clutch	VID 1031	£2.26
Take Up Idler	VID 1038	£1.07
Reel Idler	VID 1039	£3.40
Brake Pad	VID 1361	£0.59
Capstan Motor	VID 2165	£25.16
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Capstan Motor	VID 2166	£53.24
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Tension Band	VID 1387	£2.55
Remote Control	IR 8947	£14.80
Repair Kit	VID 7919	£17.92
Cassette Housing	VID 1315	£21.90
N-9013×9014×9033×9034×9053×9054×9055		
Video Head	VID 2695	£20.10
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PANASONIC		
NV-2000×2010		
Video Head	VID 2520	£9.19
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Belt Kit	VID 7800	£1.79
Idler	VID 1054	£0.90
Idler	VID 1055	£0.95
Cam Gear	VID 1221	£0.82
Intermediate Gear	VID 1216	£1.27
Driving Gear	VID 1217	£0.59
Cassette Lamp	VID 1948	£0.29
Tension Band	VID 1397	£3.49
Repair Kit	VID 7901	£10.86
Take Up Reel Table	VID 1312	£11.47
Supply Reel Table	VID 1310	£7.57
NV-300×333		
Video Head	VID 2520	£9.19
Pinch Roller	VID 1787	£3.74
Belt Kit	VID 7521	£1.53
Play Idler	VID 1048	£2.81
Idler	VID 1057	£0.88
Idler Arm	VID 1220	£4.33
Cam Gear	VID 1215	£1.19
Intermediate Gear	VID 1216	£1.27
Driving Gear	VID 1217	£0.59
Reel Motor	VID 2158	£19.52
Capstan Motor	VID 2421	£40.62
Cassette LED	VID 1982	£1.78
Tension Band	VID 1399	£2.04
Repair Kit	VID 7903	£10.89
Take Up Reel Table	VID 1312	£11.47
PHILIPS		
Video Head	VID 2526	£10.41
Pinch Roller	VID 1757	£3.13
Belt Kit	VID 7530	£0.93
Idler	VID 1052	£1.78
Loading Gear	VID 1222	£1.57
Idler	VID 1370	£2.04
Idler	VID 1371	£6.12
Limiter Roller	VID 1440	£1.53
Cassette LED	VID 1981	£1.53
Tension Band	VID 1400	£2.39
Repair Kit	VID 7906	£8.22
VR-6540		
Video Head	VID 2537	£18.57
Pinch Roller	VID 1815	£3.15
Belt Kit	VID 7547	£1.16
Idler	VID 1060	£1.61
Master Cam	VID 1265	£7.28
Reel Motor	VID 2127	£26.85
Loading Motor	VID 2142	£16.70
Cassette LED	VID 1981	£1.53
Tension Band	VID 1420	£5.78
PYE		
DV-761		
Video Head	VID 2621	£57.10
Pinch Roller	VID 1827	£5.70
Belt Kit	VID 7588	£1.08
Idler	VID 1252	£5.20
Loading Gear	VID 1253	£7.23
Modification Set	VID 1254	£10.61
Tension Band	VID 1431	£4.85
SAISHO		
VR-2000×3800		
Pinch Roller	VID 1815	£3.15
Belt Kit	VID 7565	£1.18
Idler	VID 1060	£1.61
Reel Motor	VID 2121	£16.57
Cassette LED	VID 1981	£1.53
SALORA		
SV 8620		
Pinch Roller	VID 1808	£3.15
Belt Kit	VID 7600	£3.31
FF×REW Idler Arm	VID 1233	£3.66
FF×REW Idler Arm	VID 1234	£3.51
FF×REW Idler	VID 1235	£1.97
Cassette LED	VID 1981	£1.53
Tension Band	VID 1394	£3.64
Take Up Reel Table	VID 1308	£5.37
Supply Reel Table	VID 1305	£4.67
SAMSUNG		
VI-510×520×611×616×621		
Video Head	VID 2648	£17.88
Pinch Roller	VID 1815	£3.15
Belt Kit	VID 7598	£1.40
Idler	VID 1232	£1.53
Idler	VID 1346	£3.81
Reel Motor	VID 2407	£15.77
Capstan Motor	VID 2409	£29.25
Loading Motor	VID 2142	£16.70
Cassette LED	VID 1981	£1.53
VX-710×720×730		
Video Head	VID 2648	£17.88
Pinch Roller	VID 1759	£3.06
Belt Kit	VID 7608	£2.72
Cassette LED	VID 1981	£1.53
SANYO		
VHR 1100 EX×EE×G		
Video Head	VID 2583	£22.68
Pinch Roller	VID 1787	£3.74
Belt Kit	VID 7558	£1.27
Reel Drive Roller	VID 1076	£6.18
Reel Motor	VID 2198	£15.87
Cassette LED	VID 1981	£1.53
Tension Band	VID 1411	£2.72
VHR-1500 EX×G		
Video Head	VID 2585	£48.28
Pinch Roller	VID 1787	£3.74
Belt Kit	VID 7558	£1.27
Reel Drive Roller	VID 1076	£6.18
Reel Motor	VID 2198	£15.87
Cassette LED	VID 1981	£1.53
Tension Band	VID 1411	£2.72
VTC-M10×11×20×21		
Video Head	VID 2530	£20.45
Pinch Roller	VID 1758	£3.15
Belt Kit	VID 7809	£0.77
Reel Drive Pulley	VID 1079	£7.05
Idler	VID 1219	£2.02
Reel Motor	VID 2179	£20.44
Tension Band	VID 1408	£2.13
Supply Reel Table	VID 1319	£9.77
SENTRA		
VX 5000×8000		
Video Head	VID 2713	£16.30
Pinch Roller	VID 1787	£3.74
Belt Kit	VID 7596	£3.81
Idler	VID 1049	£3.44
Cassette LED	VID 1981	£1.53
Tension Band	VID 1399	£2.04

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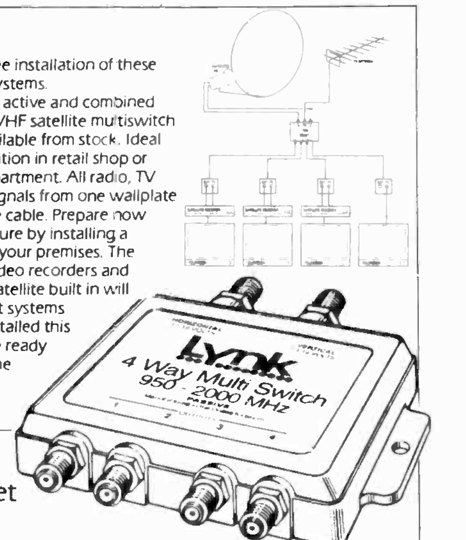

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TV Fault Finding

Reports from Philip Blundell, AMIEIE, Ian Bowden, Terry Lamoon, Keith Evans, Chris Watton, Michael Dranfield, John Edwards, J.K. Potts and Gordon Haig

Philips G90AE Chassis

This set was almost dead – there was a blank raster, no sound, no on-screen display and the remote control received LED didn't flash in answer to a command. As all the supplies were present we carried out checks around the microcontroller chip and found that the reset line was stuck at 2V. Disconnecting the reset pin (IC7720, pin 33) proved that the chip had an internal leak. A new TMP47C434N-3555 restored normal operation. **P.B.**

Grundig CUC2410 Chassis

A tripler arc over had caused quite a lot of damage. The dealer had replaced the microcontroller, colour decoder and i.f. chips and a picture was now present, but there was no sound, either from the speakers or the scart socket. The reason for this was that the Koin line (inter-station mute) was low all the time because the TDA2595 chip was faulty. A new TDA2595 completed the repair. **P.B.**

Mitsubishi CT2965STX

If the set is dead check whether circuit protector Z950 is open-circuit. Originally an SOC3150 was fitted. Mitsubishi recommend fitting a PRF5000 instead, part no. 299P132010. **P.B.**

Philips CM11342 CGA Monitor

This monitor was dead: a squealing noise was heard coming from the power supply when it was switched on. We found that there was no 128V supply to the line output stage as the X-ray protection thyristor was being fired. Use of a variac enabled us to establish that there was no power supply regulation. R3412 (33kΩ) was open-circuit. **P.B.**

Grundig CUC70 Chassis

There was no e.h.t. because the line oscillator wasn't running. The reason for this was loss of the 12V B+ supply as D689 (1N4001) was open-circuit. **P.B.**

Panasonic TX21M1T

This set displayed four symptoms: the tuning would appear to drift off very slightly, the sound was muted, there was no volume on-screen display (the picture ones were all o.k.) and if the sweep tuning was started it didn't stop when a channel was found. The cause of all these symptoms was that the 'signal/noise' switching circuit, which consists of Q1272/3/4 and the associated components, was giving a low (no signal) output all the time. All the components in this circuit were o.k. however. It seemed that the cause of the trouble was insufficient sync drive at the base of Q1272. The sync separator that provides this drive is in IC521, which is on the teletext PCB. Comparison with another set showed that the output at pin 14 of this chip should consist of 8·3V pulses sitting on a d.c. level of 1·7V. In the faulty set the amplitude of the pulses was only 5·5V. We found that the cause of the trouble was C524 (180pF) which is connected between pin 14 and chassis – it was leaky, measuring just over 4kΩ. As a result pin 14 couldn't rise to the full supply level, as it should. The reason for the symptoms was that the set failed to detect that it was on a signal. So the a.f.c. was switched off and the sound muted, which also removes the on-screen display. **I.B.**

Hitachi CPT2118 (G6P Chassis)

When this set was switched on it went to standby. Back off and straight to the two 82kΩ resistors R902/3 in the power supply start-up network. Sure enough one of them was high in value at some 110kΩ. To be on the safe side I replaced them both. **T.L.**

Akura CX10

Here are some quickies on this portable. If the set cuts out intermittently with no standby light, check whether R402 has gone high in value. For no picture check the efficiency diode FR605. For no picture and no sound, or works intermittently, change the d.c. converter chip. You can't miss this – it has a massive heatsink. Overheating of this chip is most of the problem. For repeated failure of D410 (going short-circuit) check the value of R320. It should be 33Ω: if higher, change it. **T.L.**

Fidelity AVS2000

Because of their size these entertainment centres are not our favourite pieces of equipment. This one came into the workshop with a dead TV section. As all the power supplies were in order attention was turned to the line timebase. We found that there was no drive to the line output transistor as the TDA8180 timebase generator chip was faulty. **K.E.**

Salora K Chassis

This chassis seems to crop up under many guises – in this case the set was a Finlandia C59C27. The intriguing symptom was of thick, black horizontal bars that almost obliterated the picture when the set was switched on from cold. After several minutes the bars would gradually disappear, revealing a perfect picture. We didn't have a manual but did have knowledge of a similar fault some years previously. So we proceeded to the field timebase, armed with a can of freezer. Our efforts here revealed that the culprit was C574 (100µF, 40V) which is next to the field output chip. **K.E.**

Alba CTV711

The dead set symptom was the result of several damaged components in the chopper power supply, notably the

BU508A transistor, a diode in the mains bridge rectifier circuit and R801 (2·7Ω) which was open-circuit. After replacing these items and the mains fuse we decided to check a few components around the TDA4600 chopper control chip before we switched on. Our efforts were rewarded when we found that R809 (270kΩ) which feeds pin 4 was open-circuit. **K.E.**

Huanyu 37C-3

We hadn't seen one of these Chinese portables before so we were relieved when the customer handed us a dog-eared piece of paper with the comment "here's the instructions". It turned out to be the circuit diagram. Although the circuit wasn't essential in this case, it does save time poking around identifying components. The problem was line collapse – a bright, thin vertical white line. A resistor in the horizontal centring circuit was badly burnt. It proved to be open-circuit as it had been carrying the full line scan current. The root cause of the problem was the line linearity coil. Repairing and resoldering the coil connections and replacing the 220Ω, 1W resistor (R783) restored the line scan. **K.E.**

ITT 80R/90° Chassis

This set would cut out after about half an hour. If you switched it off and on again it might continue to run all day. We eventually found that the cause of the fault was D772 (1N4148) in the h.t. adjustment circuit. **C.W.**

Amstrad CTV1400

This old-age pensioner was dead and looked very grotty when we removed the back. The cause of the fault was soon found to be no drive at the base of the line output transistor. The line driver transformer was dry-jointed: its legs were so black that it wouldn't solder until they had been scraped clean. **C.W.**

Finlux 3021F

The fault with this set was field collapse. Checks showed that all the components in the field output stage were o.k. The chip had been replaced, but the voltage at the input pins was wrong. After some time had been spent getting nowhere I swapped the whole signal panel with one from a good set. As the fault was still present I suspected a fault on the power/line output panel. Wrong again. The cause of the fault was on the control panel beneath the tube, where the microcontroller and memory chips reside. The SDA2526 memory chip had failed. How silly of me – I really should have looked there first for a field fault! **C.W.**

Genexia CTV1001

This set is very similar to the Nikkai Baby 10. So when hum bars, although faint, began to appear after about half an hour I suspected that the infamous regulator chip was faulty. A replacement didn't cure the fault however. What did provide a cure was slight adjustment of the a.g.c. to the tuner. **C.W.**

Sony KV2215UB

This set was dead. A check showed that the 135V supply to the line output stage was missing at pin 4 of plug D1. When the plug was disconnected a resistance check showed that there was a dead short on the line output stage side. This cleared when pin 1 of the line output transformer was disconnected. The short was between pins 1 and 12 of the transformer. It's worth checking around on transformer prices. I found that the cost of some compatibles varies from £15 to £30, while a genuine original can cost up to some £70. **C.W.**

Ferguson ICC7 Chassis

The line output transistor was short-circuit. As we couldn't find an obvious cause for this we fitted a replacement and switched on. Ten minutes later the transistor failed again. The cause turned out to be a poor connection at the line driver transformer. **C.W.**

Fidelity CTV140

This set had an obscure name on it but appeared to be the Fidelity CTV140. The fault was no contrast. We found that R113 (100kΩ) in the beam limiter network was open-circuit. Also check R111 (100kΩ) and R106 (10kΩ). The Fidelity manual shows a single resistor R106, with a value of 110kΩ, in this position. **M.Dr.**

Ferguson TX85 Chassis

If the set is dead or intermittently dead, check for dry-joints on the vertical add-on filter panel next to the line output transformer, especially the lead-out wires. They tend to pull away from the print because of stress caused by the cable tie around the transformer being too tight. **M.Dr.**

Goodmans 2180

If the set is dead check R105 (150kΩ), R106 (150kΩ), R107 (270kΩ) and R108 (270kΩ). These resistors are near the CNX82 optocoupler in the power supply. **M.Dr.**

Sanyo CBP2145 (E2 Chassis)

When this set was switched on from cold the picture would break up into horizontal lines, with bad 'twitching'. The sound would buzz and pop. If you've not come across these symptoms before, you would be forgiven for switching the set off and reaching for another set to repair. But don't panic! Just replace C364 (10μF, 16V) which decouples the 12V supply. It's mounted close to a high-wattage resistor that runs warm, thus drying out the capacitor. **J.E.**

ITT TX3326 (Monoprint B Chassis)

When this set was switched on a sizzling noise came from within, followed by a thump from the loudspeaker. Then the set went dead. This all happened within a couple of seconds. We found that pin G of the chopper transformer was badly dry-jointed – to the extent that the board had carbonised. A thorough clean up and resoldering job cured the problem. **J.E.**

Philips K30 Chassis

The sound was o.k. but there was a completely blank screen. A check on the tube voltages showed that they were all present and correct. The culprit turned out to be C1586 (100μF, 35V), which is the reservoir capacitor for the –20V supply. **J.E**

Hitachi G7P Chassis

This set would sometimes start then cut out after a few minutes, or run for hours then stop. Tins of freezer and much time with the hairdryer failed to reveal the cause. We eventually found that the two 100kΩ resistors R919 and R920 which feed pin 5 of the TDA4601 chopper control chip had gone high in value – R920 read about 600kΩ and R919 130kΩ. They are rated at 0·5W. When both had been replaced the set worked perfectly. **C.W.**

Grundig GSC100 Chassis

This set was dead and once again we found that the fusible resistor R607 was open-circuit. Resoldering it brought the set back to life. I've had dozens of these sets come in dead. Usually the cause is faulty thyristors or insulation in the line output stage, and often Di511. Recently however the cause turned out to be C2502 (100µF, 16V) on the e.h.t. control (regel baust) panel. That was a new one to me. The curious thing was that tapping the panel would produce line break up, as though there was a dry-joint. **C.W.**

Huanyu 37C-3

This Chinese set had no picture, though the power supply lines were all at the correct voltages and the line output stage was working. The cause of the fault was the 100µH coil L509, which is in the 12V feed to the colour decoder chip IC501. It had gone open-circuit. **C.W.**

Boots CTV1411R (Tatung 190 Chasis)

This set was dead. There was an h.t. supply to the chopper but no drive. The two 15kΩ, 0·5W resistors R802/3 that provide the start-up feed looked a bit flaky on the surface and when tested one of them turned out to be open-circuit. Replacing them both brought the set back to life. **C.W.**

Hikona RM2002

This remote-control set had no sound, although the on-screen display showed that the volume control was operating and there was an audio output. The TA7680 chip IC101 provides the audio output: pin 1 is the volume control pin. A check here produced a reading of 5·8V, which is normal when the volume is turned down (maximum volume is at 0V). The voltage didn't decrease when the control was adjusted. Transistor Q201 was faulty, holding the line high. We found that a BC238 was a suitable replacement once its legs had been arranged to suit the panel. **C.W.**

Alba CTV743

This 14in. portable of Turkish origin came in with the symptoms no start-up and only channel 7 showing in the display. As the chopper circuit was o.k. we turned attention to the line output stage where D406 was found to be short-circuit (fit a BY228) and R435 open-circuit (1Ω, 1W). Before we could switch on a number of solder splashes and dry-joints required attention. All was well when these had been put right. **J.K.P.**

Nikkai Baby 10

This sturdy little set was dead. Both fuses were intact and the relay latched, so attention was turned to the voltage regulator chip IC401 which was found to have a very low output. A quick check with the bench power supply confirmed that IC401 was the cause of the fault. **J.K.P.**

Panasonic TX2 (Alpha 1 Chassis)

If the set is dead and the mains fuse is intact it may save time to go straight for the STR54041M chopper control chip IC801 – it's the usual culprit. **J.K.P.**

Sony KV2215UB

At switch on there was just a low buzz, no sound or vision. Operating the power supply with a lamp as its load showed that it was o.k., so attention was turned to the line output stage. No shorts were found when cold checks were made here. A new line output transformer had to be fitted to restore normal operation. **J.K.P.**

Ferguson TX9 Mk 2 Chassis

There was an intermittent fault on this set: no manual or remote channel change and only the mute light on. We found that the two voltage regulator chips IC102 and IC103 on the PC1551 remote control subpanel were dry-jointed. **J.K.P.**

Hinari CT4

If the symptom with one of these sets is a loud whining noise from the left-hand side, don't waste any time. Just order a new line output transformer. The failure rate is high. **J.K.P.**

Matsui 1480A

If the picture is intermittently blanked off, check that the teletext board is making good electrical contact via its leads. With the method used you may find that the plastic instead of the bare wire is gripped. **G.H.**

Ferguson TX100 Chassis

The voltage at the 119V output from the chopper power supply was slightly negative because the 47µF, 160V reservoir capacitor C121 was faulty. If the relay chatters all the time the line output transistor is usually short-circuit. You can risk fitting a replacement without a repeat. **G.H.**

Grundig CUC70 Chassis

The electrolytic capacitors on the field timebase plug-in module can deteriorate. For reduced height/a non-linear picture with a kink at the bottom on both sides, check C2791 (2,200µF or 3,300µF, both values are used). If the height cannot be set without about half an inch of foldover (shading) check C2757 (1,000µF). If the chip has failed, always check C2758 (100µF). As a clue, you will often find the associated safety resistor open-circuit.

On the signals side, for a multiple image with crinkly verticals and a sort of off-tune effect at switch on check C2217 and C2221 in the tin i.f. module. C2217 is 10µF, 16V on the circuit diagram but we usually find that the value is 47µF. C2221 is shown as 4·7µF, 25V while 1µF, 50V is usually fitted.

If R661 (0·15Ω) on the secondary side of the chopper power supply goes open-circuit it's the end for the chopper transistor, the TDA4600-2 chip and the fuse. **G.H.**

Camcorner

Reports from Simon Bodgett and Brian Storm

Panasonic NVS5B

The fault with this palmcorder was no focus or zoom operation. With a camcorder I always suspect the worst and check for any signs of lens damage due to misuse. This time the user was not guilty. The cause was a faulty zoom motor, part no. VEM0314. **B.S.**

Sony CCDTR45

There was either very poor rewind or no rewind at all. The fault also affected the cassette eject operation as a loop of tape was left. Replacing both turntables and the intermediate gear restored correct operation. **S.B.**

Hitachi VM200

The complaint with this one was of viewfinder flicker. A new connecting cable put matters right. **S.B.**

Grundig VSC45

This machine is a Panasonic clone: the cassette door wouldn't close because the mechanism was in the eject mode. A new loading motor and mode switch restored normal operation. **S.B.**

JVC GRS77

The problem was picture break-up, but only with S-VHS recordings. We traced the cause of the fault to a THE326A non-linear pre-emphasis chip. **S.B.**

JVC GR65

Following impact there was no viewfinder operation – fortunately the problem was confined to the viewfinder. There's a scan-correction capacitor attached to the PCB by long legs that tend to fracture. Careful repair by scraping away the varnish in the winding and resoldering the connection provides a cure. The capacitor can be secured by tape or by use of a hot-glue gun. **S.B.**

Grundig VS8250/Sony CCDF375

There were no camera functions. Tests soon showed that the camera d.c.-d.c. converter wasn't being switched on by the microcontroller chip. The camera/off/play switch was o.k. as the machine would play back, and the switch was being scanned by the microcontroller chip. We eventually isolated the cause of the fault to the circuit that scans the record lock switch on the side case. As the K out line from the microcontroller chip had no scanning pulses on it we fitted a replacement. This was not a good decision: the conditions were the same with the new chip installed. What we found after further investigation was open-circuit print beneath the audio and video output connectors, due to minor corrosion. The scanning pulses were absent because the pull-up resistor for the output port was on the input side of the K in 6 line, the open-circuit giving the impression that the chip wasn't working. Microsurgery was used to repair the damaged print: the alternative would have been a new PCB and a lot of software setting up! **S.B.**

Ferguson FC31

Because of a damaged record switch there were no record functions. I managed to replace the switch and secure it with glue – otherwise the whole cable would have had to be replaced, at great expense to the customer. **S.B.**

JVC GRS70

The fault report said "no recordings and nothing on the viewfinder". Checks showed that the camera power supply circuits were all working correctly, but there was no output from the CCD image sensor because of a bias problem. R24 failed to make contact at one end. **S.B.**

Panasonic NVS5

The complaint with this machine was that it was "stuck in the cue mode". This was not the case. The problem was that the capstan motor was running at a very high speed because of loss of FG control pulses to the servo control circuits. A replacement capstan motor, part no. VEM0384, put matters right. **B.S.**

Panasonic NVMC6

We've had a few of these camcorders in recently with various capstan faults. Symptoms have been wowing, grating noises and, in bad cases, an unlocked capstan. In all cases the cause has been the capstan motor itself. Apparently the metallic coating on the rotor flakes off and rubs on the stator coils. I've found that it is best to replace the complete motor assembly (part no. VEM0284). **B.S.**

Panasonic NVS5

This machine had two intermittent faults. First on occasions the drum wouldn't start to rotate from cold. Secondly there was sometimes bad playback picture disturbance, as if one head was faulty. Fitting a new drum and motor assembly, part no. VEG0927, cured both faults. **B.S.**

Panasonic NVS6

We've had a few of these in with no electronic viewfinder display. In each case the cause has been an open-circuit in the EVF connecting cable, part no. VEE8055. **B.S.**

Panasonic NVS5

A fault we've had several times with these palmcorders is no zoom. The cause of the problem is that an earthing clip on the process PCB slips out of position: as a result its three 'fingers' short out various points beneath the process board. Presumably onset of the fault is helped by a sharp knock in use. Refitting the clip cures the fault. **B.S.**

Servicing Car Audio Equipment

Alan Bouskill

Even in a recession most TV and video technicians baulk at the thought of repairing car audio equipment. The sight of digital displays and cassette mechanisms in small metal boxes seems to be off-putting. My own experience suggests that it's possible to undertake this type of work profitably however. The aim of the following article is to offer advice on diagnosis and take some of the mysteries out of various older models that may come the way of the free-lance engineer once the equipment is out of guarantee.

Power Supply

One basic requirement is a stabilised power supply that provides a nominal 12V output, preferably variable between 10-14V to simulate the varying nature of car electrical systems, for testing motor control circuits. A variable current limit is desirable. Otherwise a 12V, 21W indicator bulb in series with the supply will limit the current to a safe value. It can be switched out when the correct connections have been established. Ability to make incorrect connections is not confined to beginners: you find that some imported models use blue as power positive and red wires for the speakers – take nothing for granted!

With quality car audio the connections are all usually marked. If the positive power lead isn't obvious, trace the dial lamp supply. If it's 12V, apply power to identify the power input – see Fig. 1. Beware as with some Blaupunkt models the dial lamps are fed from a 5V line. If in doubt, check the bulb voltage. Units with a digital display usually have a separate permanent live feed to retain the 'station memory' when the unit is switched off.

Testing

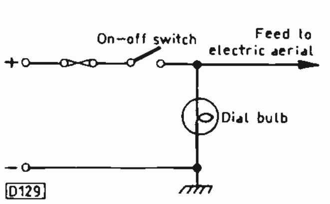
An old car radio aerial will be adequate for test purposes. To reduce interference with weak signals the continuity of the outer screen of an aerial is important. You get the same symptoms when there's a poor earth contact between the aerial base and the car wing. When bench testing low-power units it's feasible to use the outer screen of the aerial as an earth return – this avoids the risk of the chassis connection dropping off when the unit is handled. Don't use this method with high-power systems however as 10A can flow to earth.

When separate, large amplifiers are used in a vehicle they are often separately fused and connected directly to the battery – they require a very 'stiff' supply. Ensure that test speakers are isolated from chassis, as with high-power systems both speaker leads are live. Shorts to earth will usually destroy output chips. Two large electrolytic capacitors connected back-to-back in each test speaker lead will provide some protection in the event of faulty output stages.

Beware of the joystick faders that in some cars transfer power from front to rear. Some use a commoned earth line that shorts out high-power units with disastrous results. For you and your customer's peace of mind, label identified leads – wiring diagrams are easily mislaid. My own preference for speaker connections is two-pin DIN speaker plugs with a range of adaptors and flyleads to suit. Note that in many units standard DIN speaker plugs won't fit side by side. Obtain some of the smaller plugs from a car audio specialist.

Azimuth alignment of tape recorder heads is best done with a good make of test tape. Around 6kHz is an optimum frequency which will show uneven wear with stereo heads. Speed accuracy and stability can be checked by connecting a speaker output to a frequency counter. You can make your own test tapes using a good audio cassette, an audio generator and a first-class deck that's known to be accurate. A simple way of checking speed is to use the circuit shown in Fig. 3 (a variation on a disco flashing-lights circuit) and a quality cassette on which the 50Hz mains frequency has been recorded. When the speed is accurate the bulb is either on or off or beats every few seconds: it flutters rapidly when the speed is very fast or slow.

To check loading and auto-reverse with mechanisms that are difficult to get at an old cassette can be emptied of its innards and cut as shown in Fig. 2.



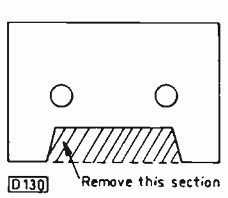


Fig. 1 (left): Identifying the positive power supply connection.

Fig. 2 (right): Dummy cassette for loading and auto-reverse checks.

On-off Switches

Car audio on-off switches are prone to going open-circuit. The contacts erode more rapidly because of currents of up to 2A. Combined switches/volume controls are often complicated and expensive – £25 in one case we had recently. Customers are sometimes unwilling to pay such a price. A compromise measure is to short out the switch within the unit and take the power input lead to the ignition switch so that the unit is on when the engine is running. Better still use the auxiliary position, i.e. the first one when the switch is turned. Note that some cars don't have such a position. Resist the temptation to run the unit from the electric aerial feed as this will be unfused.

Earthing

Always ensure that a separate earth lead is connected between the car chassis and the unit's case, as earthing through the aerial screen cannot be relied on.

Some Faults

A ticking noise from the speakers with the engine off but the radio on proved to be caused by the instrument stabiliser, a bimetallic strip device. Fitting a suppressor capacitor across this two-terminal device provided a cure.

Another memorable installation fault, the symptom being

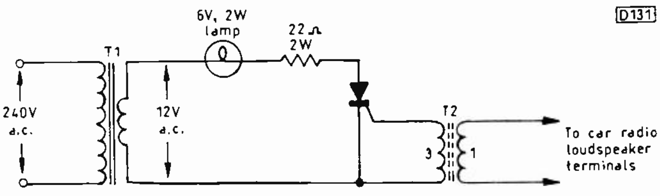


Fig. 3: Speed check circuit. Mains transformer T1 should have a minimum rating of 10VA. T2 is a small audio transformer with a step-up ratio of 3:1 – a transistor amplifier output transformer was used.

described as "the tape slows down on corners", proved to be due to the unit's feed being taken from the indicator wiring. The efforts of the mechanical speed control within the motor to keep up the speed had to be heard to be belived!

Old fuses and fuseholders can go high-resistance and intermittent, leading to bizarre effects. The moral here is not to take anything for granted, especially when the customer fitted the unit.

The Philips AC400 series were particularly popular radio-cassette players. Most had a.m. only, but the AC730 included f.m. Many of them are still in use as the cassette deck is reliable and almost customer proof and features music search. The on-off switch is prone to going open-circuit. Replacement is easy, but don't remove any screws from the front of the unit as some of them hold the channel-selection mechanism together – this makes putting everything back together interesting to say the least! Resolder the speaker sockets as they can work loose, and note that the heatsink above the volume control provides the earth return for the speakers. Clean the pinch roller, the capstan spindle and the head. The speed adjustment is on a small PCB near the rear of the case, accessible through a small hole in the unit's cover. Uneven volume from tapes can be caused by head wear, but the thick-film unit on the tape preamplifier board is not above suspicion and can cause crackles and problems with the music search system. There are different thick-film units – they vary with date of manufacture.

A common problem with the Pioneer KP2940/2950/2980 is that the flat drive belt drops off with the result that the tape gets entangled in the mechanism. The head working loose is another problem. Realign it then secure it with Loctite or similar glue. Check that the main PCB is firmly soldered to the metal chassis near the aerial socket.

Apart from the facia and the control knobs the Ford SRT32P is similar to the Blaupunkt Oxford M26. Always quote the full Bosch number (7643 546 231) to obtain spares from a Blaupunkt dealer as the Oxford name was used for different models. The Ford RST21P was made in Brazil. Its switch very often goes open-circuit. Willow Vale stock a replacement, part no. 17000. Fitting is difficult because the PCB is soldered into the case. Model ESRT32 uses Grundig electronics made in Portugal. The tape is often reluctant to engage with the mechanism as it loads upwards: shorten the two springs that hold the cassette in position, otherwise gravity will win and eject the tape. Lubricate the fast forward/rewind/play lever. Note that while the f.m. performance is good the a.m. bandwidth is wide, leading to interference problems. Some later Ford units have small presets to set the volume on each channel. They are accessible through the side of the case and are often misadjusted by customers.

The Volvo/Mitsubishi RX912 is prone to oscillation with f.m. reception, especially stereo. A cure is to connect a 47kΩ resistor and 3,900pF capacitor in series between pins 3 and 12 of the M51011P chip on the right-hand panel.

The Philips Models 751/752/660 are very good electrically, but a piece of green plastic often breaks off bracket 124 (part no. 4822 259 80209). This results in a variety of tape faults. Make sure that you remove the broken piece from the mechanism.

With older Sharp tape mechanisms, where the tape enters widthways and is ejected some seconds later, check whether the two wires (usually grey and black) to the tape rotation switch SW203 have broken. Replace the entire wire length with a flexible type.

I've encountered more than one Amstrad radio-cassette unit with a smoking decoupling capacitor. Fortunately the large amount of smoke is usually confined to the capacitor area.

Voxson units fitted to some Fiat cars have four DIN speaker sockets, one blank, two for the outputs to the speakers and one for the power input. Open up to find out which one is which, or the unit will also provide smoke!

Early Pioneer units with a moving bar of LEDs instead of a coventional dial cord give good results, but if one of them has been wrenched from the dashboard there will be hairline cracks across the PCBs because of chassis flexing. Repair is not something for the faint-hearted!

In Conclusion

I hope that this article will encourage service engineers to undertake car audio repairs. But a final word of warning is necessary: never underestimate the short-circuit current from a car battery – metal watch straps under dashboards can be very dangerous.

Answer to Test Case 370

– see page 865 –

Lack of signal transfer from the tape to the playback head at the very start of its scan will delete the field sync pulses from the video signal. The result is invariably a picture that rolls or judders vertically. What Roger and Sherlock needed to find out was why the f.m. envelope was so bad at the entry side of the wrap. They had confirmed that the back tension was sufficient, and had adjusted the height of the guide from the roof to the cellar without improving matters. Apart from the possibility that the heads were worn – this, they reasoned, could cause poor tape penetration as the scans commenced – they were stumped for ideas.

Sage, whose capacity for logical reasoning had not left him completely during his sojourn in the reception office, took the view that if the tape's tautness was sufficient and the guide was at the right height, it was either in the wrong place or it or its slant pole was damaged or bent. There was no sign of damage, but close examination showed that the guide didn't go home fully into the vee-block. It's guided in by a metal tongue that locates – or should locate – snugly in a socket just below the vee. In this machine it stopped a millimetre or so short, because the socket was obstructed by a sticky something that resembled brown wax.

Once this had been removed and the tongue and socket had been cleaned up, no difficulty was experienced in setting the entry guide to produce a flat and continuous off-tape signal envelope waveform. Now to try to explain to Mrs. Twither why the pictures produced by her most recent recordings will continue to roll. . .

Panasonic's Digital TV Chassis

Part 2

Ray Meadows

This time we'll take a look at the tuner, i.f., AV switching and digital video circuits in the Euro 1 chassis, also the microcontroller functions.

Tuner and IF

Four different tuner and i.f. pack types are used in the chassis, depending on the country in which the receiver is to be sold. The UK version has a u.h.f. only tuner from Ecom, covering 471·25-847·25MHz. Continental versions equipped to receive v.h.f. and cable channels as well usually have a Philips or Telefunken tuner – one other version featuring D2-MAC reception uses a combination tuner/i.f. pack of Loewe manufacture. We'll concentrate on the UK version except where the differences make circuit explanation easier.

The tuner and i.f. modules are both mounted on the main, analogue circuit board (PCB E). The tuner is an I2C-bus controlled type whose output is fed to the i.f. module via the E PCB. Fig. 1 shows the arrangement in simplified form. The tuner's unbalanced i.f. output passes first to a dual SAW filter, X4704, which supplies separate, filtered outputs to the vision and sound i.f./demodulator chips, IC700 and IC800 respectively. IC700, type TDA3853T, contains all the circuitry required to provide a composite, analogue video output. It also provides an a.g.c. output for the tuner. IC800, type TDA3857, is a complete quasi-split sound demodulator that provides an f.m. audio plus Nicam carrier output which is passed to the digital board for decoding. There is no need to go into the operation of the i.f. section in detail as it follows conventional analogue practice, the differences starting once the signals have left this module. IC502 is not used in UK sets.

The next point to consider is the analogue signal routeing through the AV switching system.

Signal Routeing

When the composite video signal from the i.f. module arrives at the digital board it enters the video/luminance switching chip IC1101, see Fig. 2. This is a TEA6415 cross-point switch which has eight inputs (only five are used in UK sets), five fixed outputs and one variable output. Apart from the video from the i.f. module there are four AV inputs. As the device is connected to an I2C bus, the Central Control Unit (CCU) can control which video (or luminance) signal is passed to the digital circuits for processing, also which signal goes out via AV1 or AV2. A similar chip, IC1106, takes care of chroma switching with S-VHS signals.

A third switching chip, IC1021, is used for the audio signals. This is a TEA6420 which is slightly different, being a dual, five-input, four-output cross-point switch. The point to remember here is that the audio from the tuner doesn't come straight from the i.f. module: it's digitally processed before it reaches this switch, whereas the video signal is processed after it leaves the switch. This is done so that AV signals routed through the scart and S-video sockets are not processed unnecessarily.

The chroma and audio switching circuits are similar to the video/luminance switch shown in Fig. 2.

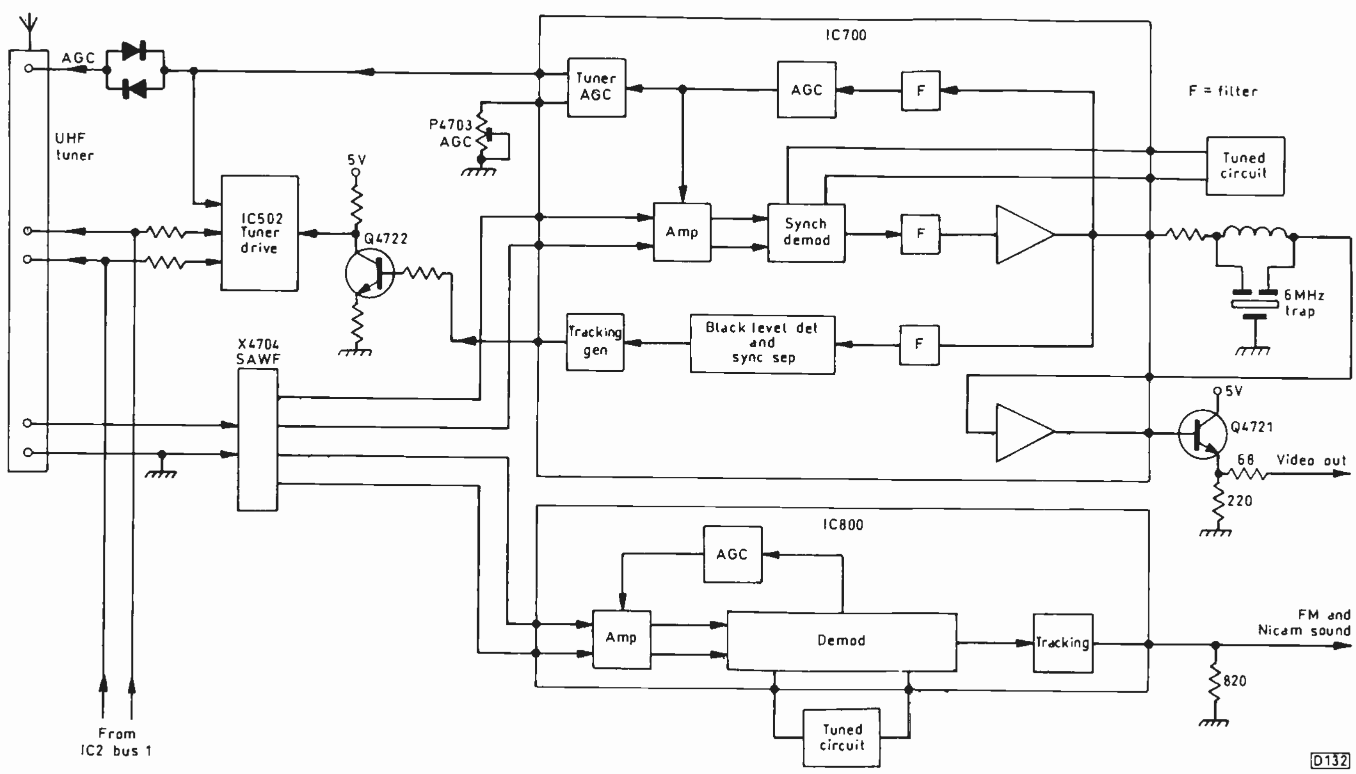


Fig. 1: Simplified block diagram showing the tuner and i.f. arrangements.

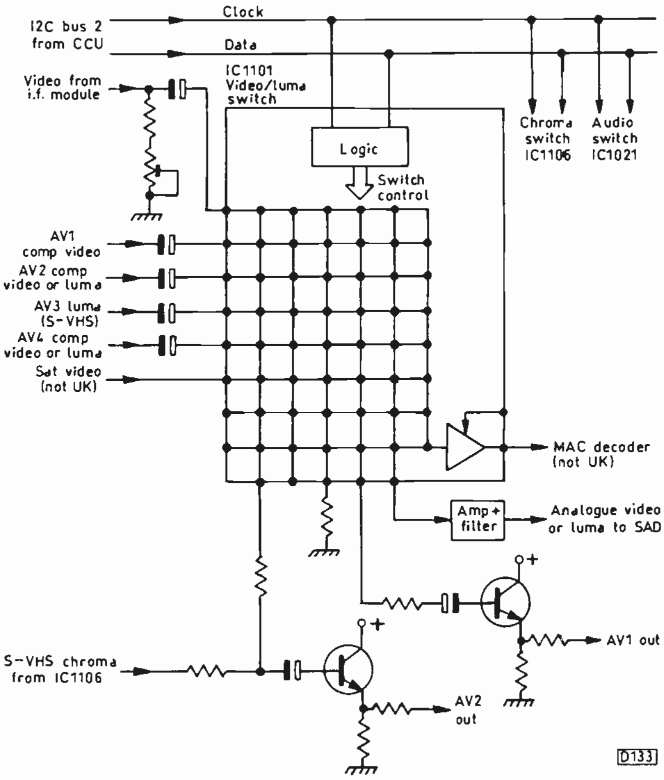


Fig. 2: The analogue video signal path, simplified.

Before we go on to the video processing we should consider some of the CCU's functions: this is the device that manages the complete system.

The CCU and the Buses

The CCU3000 chip, to quote its device type number, is a custom-designed microcontroller chip from ITT-Intermetall. Its core is the familiar 6502 8-bit microprocessor. Internal features include three timers, two IM bus interfaces, four input/output control ports and a 16-bit memory address bus. A 4MHz clock is used, controlled by crystal X1853. This clock also synchronises the deflection processor. A simple reset circuit, consisting of a CR network, is connected to pin 6 – a separate reset circuit based on Q1963 and Q1967, which are connected to the 5V and 12V lines, is used to reset most of the other digital chips at power up.

The CCU chip controls the set's operations via three data buses, see Fig. 3. These are arranged as two I2C buses (two lines each, data and clock) and one IM bus (three lines, data, identify and clock). A second IM bus is used in D2-MAC- and PIP-equipped sets.

The first I2C bus is used for tuner and i.f. control. It's connected to IC1941, an EEPROM chip that holds the tuning data and preset values stored in service modes 1 and 2. It's here that the CCU looks first at switch on. Thus a faulty or missing EEPROM chip will effectively disable the set.

The second I2C bus is connected to the cross-point switches mentioned above and to pins 10 and 12 of scart socket AV2. This bus is used for reading from and storing in the memory module during service modes 1 and 2. Satellite-equipped sets also tag on to it.

The IM bus runs around all the digital processing chips, some of which have already been mentioned. Table 1 provides a complete list of their names and functions.

The Main Clock Unit (MCU) and Video Display Unit (VDU) chips are not connected to the IM bus: they receive modified control signals via the ACVP chip. Continental

Table 1: The digital circuitry chips.

Position/type	*Name and function*
IC1801 CCU3000	CCU – Central Control Unit
IC1301 ACP2371	ACP – Audio Control Processor
IC1401 MSP2410	MSP – Multi Sound Processor
IC1431 AMU2481	AMU – Audio Multiplexer Unit
IC1501 DPU2553	DPU – Deflection Processor Unit
IC1601 SAD2140	SAD – S-VHS/composite video ADC
IC1631 ACVP2205	ACVP – Comb filter and video processor
IC1651 MCU2600	MCU – Master Clock Unit
IC1661 DTI2223	DTI – Digital Transient Improvement
IC1671 VDU2146	VDU – Video Display Unit
IC1761 MN8333	DFU – Digital Features Unit
IC1771 TPU2735	TPU – Teletext Processor Unit

variants of the chassis may also include a Secam Processor Unit (SPU).

In addition to the EEPROM there's a 1Mbit EPROM (IC1871) for system software and a 256Kbyte dynamic RAM (IC1786) that's used as the teletext memory.

One of the most important functions of the CCU is to protect the major components in the set in the event of a fault condition. Field collapse or excessive beam current are, as mentioned in Part 1, sensed at the protection circuit input pin 43 of the CCU. If a fault is detected by the CCU it shuts the set down then attempts a restart five seconds later. If the fault persists, the standby LED will flash at five second intervals but there will be no further attempt to restart. Remember that any fault which results in loss of scan will produce this symptom. Failure of the main 5V line fuse for example will result in the deflection processor

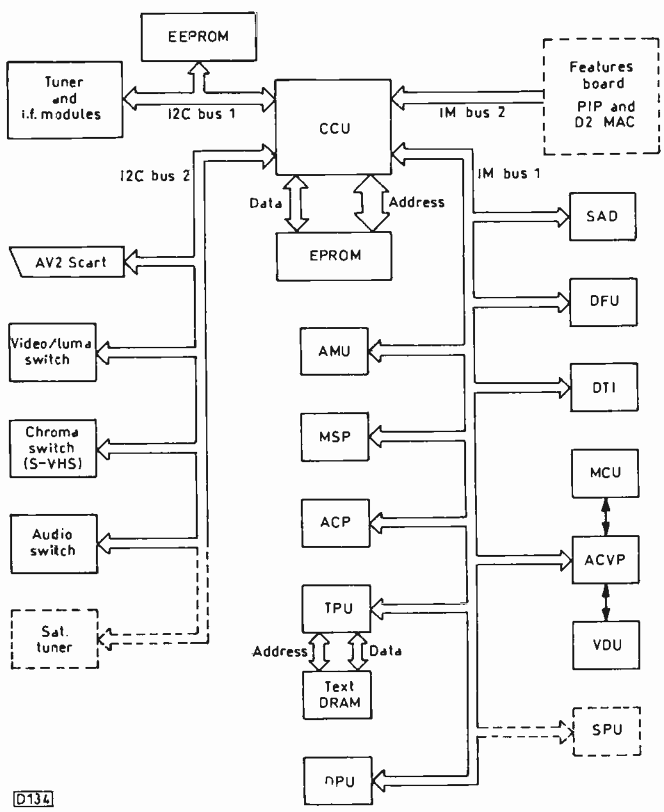


Fig. 3: The main buses. Items shown with broken lines are not incorporated in basic UK models.

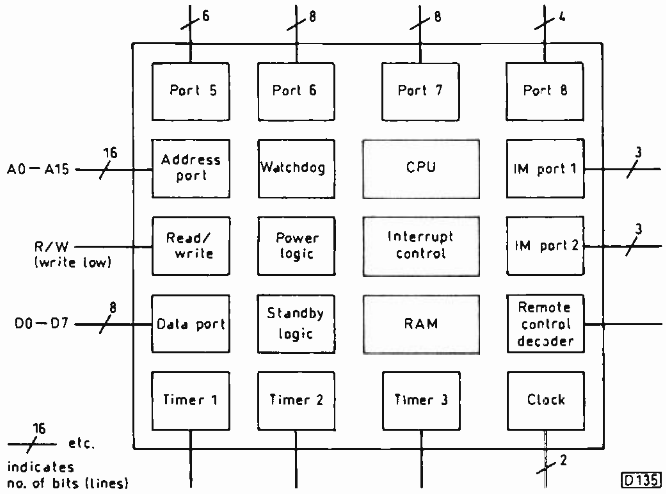


Fig. 4: The main elements in the CCU chip.

being inoperative. Hence no scan (amongst other things), so the CCU shuts the set down.

Another major function of the CCU is to carry out remote control commands. So that it can operate at all times, during standby and power rail failures, the CCU, unlike the other digital chips, is powered by the 5V standby supply. Remote control commands are received by a preamplifier (U6301) at

Table 2: CCU chip pin connections.

Pin(s)	*Use*
1	Supply voltage
2	Chassis connection
3, 4	4MHz clock crystal
5	Standby supply
6	Reset
7-9	IM bus 1
10-12	IM bus 2
13	n/c
14	Delayed H + V pulses from DPU chip
15	n/c
16	Inverted V pulse input (search tuning stop and OSD sync in absence of signals)
17	Read/write control output
18-25	D0-D7 data bus
26-40, 51	A0-A15 address bus
44-47	AV slow switch input from scart sockets (inc. Gold scart 16:9 specification)
48-50	n/c
52	D2-MAC mode on output
53	I2C bus 2 data
54	I2C bus 1 data
55	I2C buses 1 and 2 clock
56	Fast blanking output for external decoder with RGB outputs
57	Reset output for text decoder
58	Reset output for audio circuits
59	Satellite tuner momentary input
60	Remote control input
61, 63-66	On-board controls
62	On/standby command output
67	Standby LED drive
68	Satellite tuner standby LED drive

Some connections are not used in UK sets. Pins 44-50 are used by input/output ports 5-8.

the front of the set on the M PCB, which is fitted inside the on-board control drawer. Signals from this are fed to the digital module via connector W1833. They then pass via an amplifier transistor, Q1839, to pin 60 of the CCU chip. The signal at this pin should be at 5V peak-to-peak – it's only 1V peak-to-peak at the output from U6301. There are no remote control receiver adjustments.

The on-board keys and standby LED in the control drawer are connected to one of the CCU chip's control ports via the same connector, W1833.

On/standby control signals are produced at pin 62 of the CCU chip. They control the operation of the power supply by switching Q1723 on the digital PCB then Q697 in the power supply (see Fig. 2 last month). As an aid to fault-finding, the set can be forced on via Q1723.

Fig. 4 shows the CCU chip's main elements and Table 2 the pin connections.

Now that we have outlined how the signals are controlled we can start to look at the digital processing.

The Video Signal

After leaving the video source switching the composite video or separate S-VHS luminance and chroma signals, depending on source, enter the SAD chip IC1601 (see Fig. 5). To maintain synchronisation, the video chips are all clocked by the MCU chip. This uses two reference crystals, a 17·7MHz one for PAL and a 14·3MHz one for NTSC. A D2-MAC-equipped set must in addition have a 20·25MHz crystal. These frequencies are approximate multiples of the PAL and NTSC colour subcarrier frequencies.

17·7MHz is not an exact multiple of 4·43MHz. This is deliberate. The difference is small enough to lock to a 4·43MHz signal, but in the absence of such a signal, for example at first switch on, the derived frequency results in a reduced line frequency and thus slight overscan. The same applies with the 14·3MHz crystal. During normal PAL reception the burst received from the ACVP chip locks the MCU to 17·72MHz (4 x 4·43MHz). Likewise an NTSC AV signal locks the system to 14·32MHz. When the colour killer is in operation and no burst is received the system free-runs at 17·7MHz. This also occurs with Secam reception.

The SAD chip converts the analogue composite video or separate luminance and chroma signals to 8-bit digital signals. To reduce the effect of bit errors the signals are Grey rather than binary coded. These signals are then time-multiplexed together so that only eight bus lines are required. The relationship between the clock and the digitised, multiplexed YC signal is illustrated in Fig. 5. This 8-bit bus leads to the ACVP chip, where to start with the signal is converted back to binary form and demultiplexed. The bus also provides feeds to the teletext and deflection processor chips (TPU and DPU) which we'll return to later.

The ACVP chip then filters the Y and C signals, using either a bandpass/stop filtering system or a three-line comb filter depending on the video content. Delay and level adjustment are then applied to the luminance signal while the chroma signal is decoded to produce the two colour-difference signals (U and V). Before these leave the chip they are multiplexed together so that a 4-bit bus can be used. At this point the automatic grey-scale control signals (black and peak white plus c.r.t. leakage) generated during the field blanking interval are added. Because of a certain 'bottle-necking' of information, there's a delay of a few seconds between adjustment of the RGB cut-off points in service mode 1 and the actual colour changes seen in the display. The use of this 4-bit bus saves on panel space and chip pins

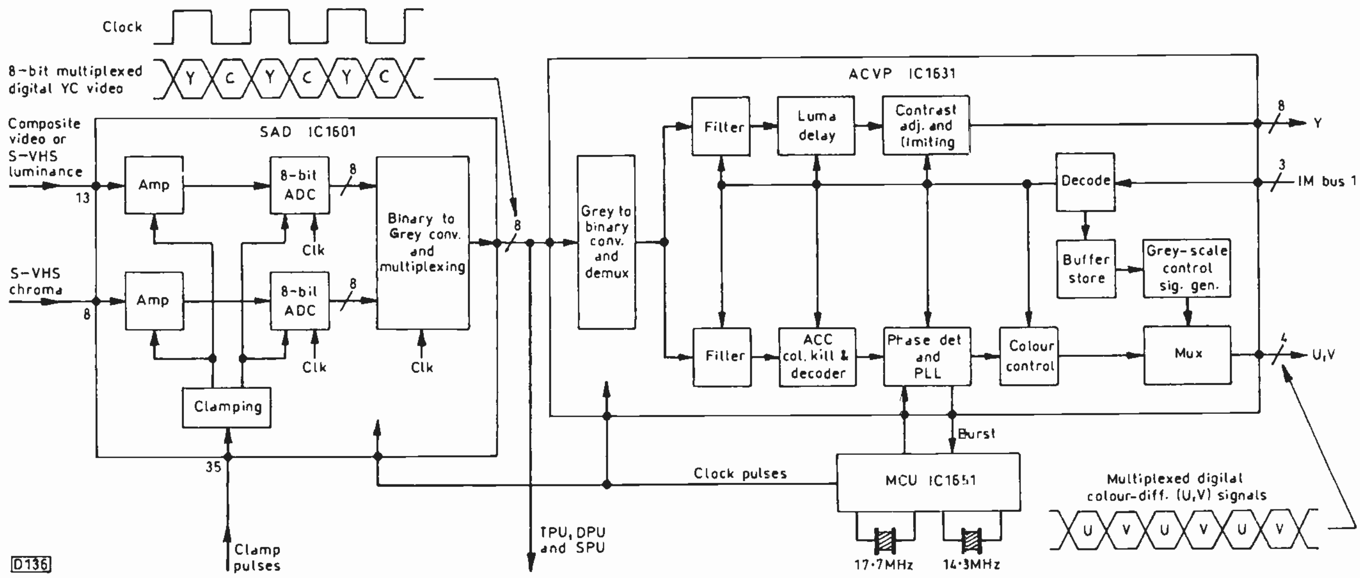


Fig. 5: Block diagram of the first part of the digital video processing chain.

without compromising on the quality of the colour-difference signals.

The Secam processor in Continental models is fitted in parallel with the ACVP chip, processing the Secam chroma separately for reinsertion after the ACVP.

After leaving the ACVP chip the digital luminance and chrominance signals enter the DTI chip, see Fig. 6. As Digital Transient Improvement is also built into the DFU (Digital Features Unit) chip, the DTI chip is used simply as a delay line to compensate for the processing delays in the DFU. It has one other main purpose: the nibble demultiplexer converts the 4-bit colour-difference signals back to 8-bit form.

Next comes the DFU chip, which carries out the picture processing functions LTI (Luminance Transient Improvement), CTI (Chroma Transient Improvement) and Scene Control (or 'artificial intelligence'). Unfortunately little information is available on this Matsushita chip. We can assume however that the LTI function is conventional in that the luminance signal is sharpened by being delayed during level changes, from black to white for example. This has the effect of crispening the transients without recourse to peaking circuits. Adjustment of the picture sharpness control varies the symmetry of the luminance transient improvement, thereby altering the visual effect obtained.

Colour transient improvement is carried out by processing the chroma signal and delaying the luminance signal to match. Scene control on the other hand works by numerical analysis of the luminance signal, as described in my introductory article on the chassis in the July issue (see page 654). Black-level expansion, where necessary, and gamma correction are then applied, the output being passed to the VDU (Video Display Unit) chip.

This chip is the final device in the chain, being the one that converts the signals back to analogue form so that the tube can be driven. It also controls the beam current and carries out conventional RGB matrixing. In addition to the digital video signal inputs this chip receives RGB plus blanking signals from the text processor chip, and the external RGB inputs. We'll return to these next time.

Because the VDU chip isn't connected to the CCU's IM bus, it's controlled via the ACVP chip. This is done by storing the IM bus commands in a buffer and then transferring them, during the field blanking period, to the VDU chip via two of the digital chroma signal lines.

Possible Problems

Finally this time a few comments about the video processing system and some possible problems. For

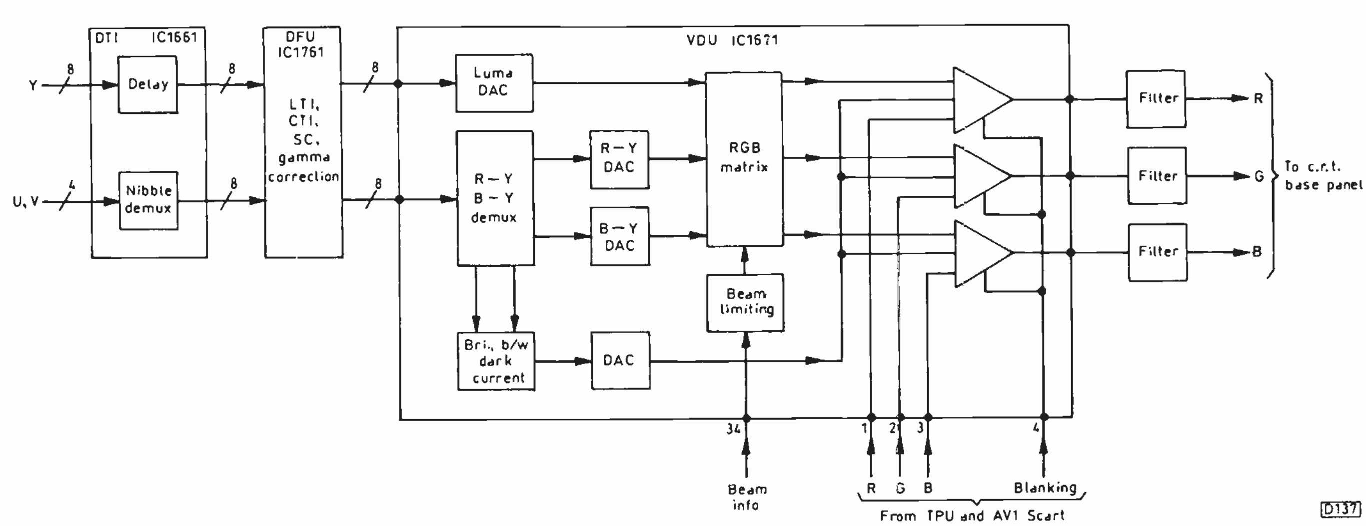


Fig. 6: The transient improvement, DA conversion and matrixing part of the video signal chain.

analogue-to-digital conversion to be carried out correctly by the SAD chip its video input signal must be clamped at the correct levels. The chip has only a 2V window for signal slicing, so 5V line-frequency clamp pulses are fed in at pin 35. This ensures that the video signal at the input pin 13 sits between 5V and 7V. If the clamp pulses aren't present the video d.c. level will increase and the result will be a grey or white picture.

Missing video data signals can cause a resolution loss that's best described as 'pixelisation' of the image. Take for example the 8-bit video bus link between the SAD and ACVP chips. Loss of the least significant bit (V0, SAD pin 32) may not be noticeable, as the resolution reduction is small. Loss of the next least significant bit (V1, SAD pin 33) would be noticeable as pixelisation. At the other end of the scale loss of the most significant bit (V7, SAD pin 40) would result in loss of the picture as the sync pulses would disappear.

The ACVP chip requires, at pin 1, a burst gating signal from the DPU chip. If this is missing the colour is lost and the contrast is reduced. Pin 19 is a voltage reference input. No voltage here means that the picture will slowly darken, as the grey-scale level drifts. If the luminance signal is lost within the ACVP chip the screen image looks as if 'solarisation' effects have been added.

To Follow

In following instalments we'll deal with audio processing, teletext decoding, the digital deflection processor and the other remaining bits of the chassis.

Help Wanted

Wanted: A 6in. 16DB22 colour tube for the Saisho CTR6 CTV/radio receiver. Peter J. Lane, Frost Industrial Estate, Bidewell Close, Drayton, Norwich NR8 6AP. Tel. 0603 867 264.

Wanted: Circuit diagram for the Cascade TV510 14in. portable. Or can anyone identify R418 (value, function) which is just a charred lump on the board? A.A. Duxbury, 169 Warbank Crescent, New Addington, Croydon CR0 0AZ.

Wanted: A PC1130B motherboard and c.r.t. for a Ferguson TX90 chassis 14in. portable. Ken Partington, 14 Napier Road, Monton, Eccles, Salford M30 8AG. Tel. 061 789 2088.

Wanted: The following issues of *Television*. Sept. 1984; Feb. and May 1986; May and Sept. 1988; Jan. 1990 and Jan. 1991. I've a complete Vol. 42 available if anyone is interested. Chris J. Davies, 52 The Close, Johnston, Haverfordwest, Dyfed SA62 3QQ. Tel. 0437 890 561.

Wanted: Ferguson TX98 chassis PCB (Model 51P7). J. Taylor, Cheriton, Chilworth Road, Southampton. Tel. 0703 769 876 or fax 0703 769 875.

Wanted: Philips VR6460 upper drum (rotary transformer only); LOPT for a National Model TC2201; Salora 1F3 RC conversion (boards/circuit); Advent Videobeam projection TV circuit/manual; rec/play heads for a Revox A77. Also *Radio and Television Servicing* books 1975/6, 1976/7, 1979/80, 1981/2. Parts are wanted for repair of OAP's equipment. Malcolm Lambert, 1 Dundale Farm Cottages, Dundle Lane, Bells Yew Green, Tunbridge Wells, Kent. Tel. 0892 824 657.

Wanted: Scan coils for the Mitsubishi 2607 or equivalent; Philips G11 IR sets/20in. sets for scrap parts. I have a Grundig 6632 (complete) and a Rediffusion Mk 4 chassis (cabinet and c.r.t. only) free for collection (both tubes good). M.J. Levy, 19 Totternhoe Close, Kenton, Harrow, Middx HA3 0HS. Tel. 081 907 3620.

Wanted: Service manual for the Sanyo VTC9300 VCR; 12-pin lead for the Ferguson 3V06D camera; lacing wire cable for the Philips 2021 VCR. Desmond Casey, Cloonloo, via Boyle, Co. Sligo, Ireland.

Wanted: Working power supply PCB (no. S75-94V-0 CK20101-A01) for the JVC AV20 me, or unmodified board for it or any information on modifications – the original PCB has lots of print missing. D. Granger, Whitelodge, Sheephatch Lane, Tilford, Surrey GU10 2AQ. Tel. 0252 782 692.

Wanted: TDA1104/6 or NP1105/6 field timebase chip for the Panasonic U2 chassis. Arthur Hopkinson, 6 Swan Close, Dunholme, Lincoln LN2 3SB. Tel. 0673 860 990.

Wanted: Circuits for a Cantabrian basketball scoreboard Model C578C, including PCBs Y2585A, Y2586A, Y2587A, Y2589C, Y2590A and Y2592A. Sandy Hewat, 30 Fullarton Drive, Troon, Ayrshire KA10 6LE. Tel. 0292 314 190.

Wanted: Working Toshiba 17in. Fastext Model 175T9B. M. Heran, 28 Island Road, Handsworth, Birmingham B21 8NP. Tel. 021 554 0660 (evenings).

Wanted: Details of transformer secondary windings for the Heathkit-Daystrom Model C-3U RC bridge – secondary voltages, circuit diagram. Transformer (type 54/506) gladly purchased. Ron Dark, 14 Northdene, Bideford, Devon EX39 3NZ. Tel. 0237 471 042.

Wanted: Working battery back-up board for the Hitachi VT17E VCR. D.R. Webster, 37 Eemins Place, Bishopmill, Elgin, Moray, Grampian IV30 2PA. Tel. 0343 550 932.

Wanted: Serviceable A56-615X and A56-120X (two of these required) 22in. tubes for economical repair of OAP sets. A.F. Sheen, 132 Heol Llanishen Fach, Rhiwbina,

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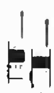

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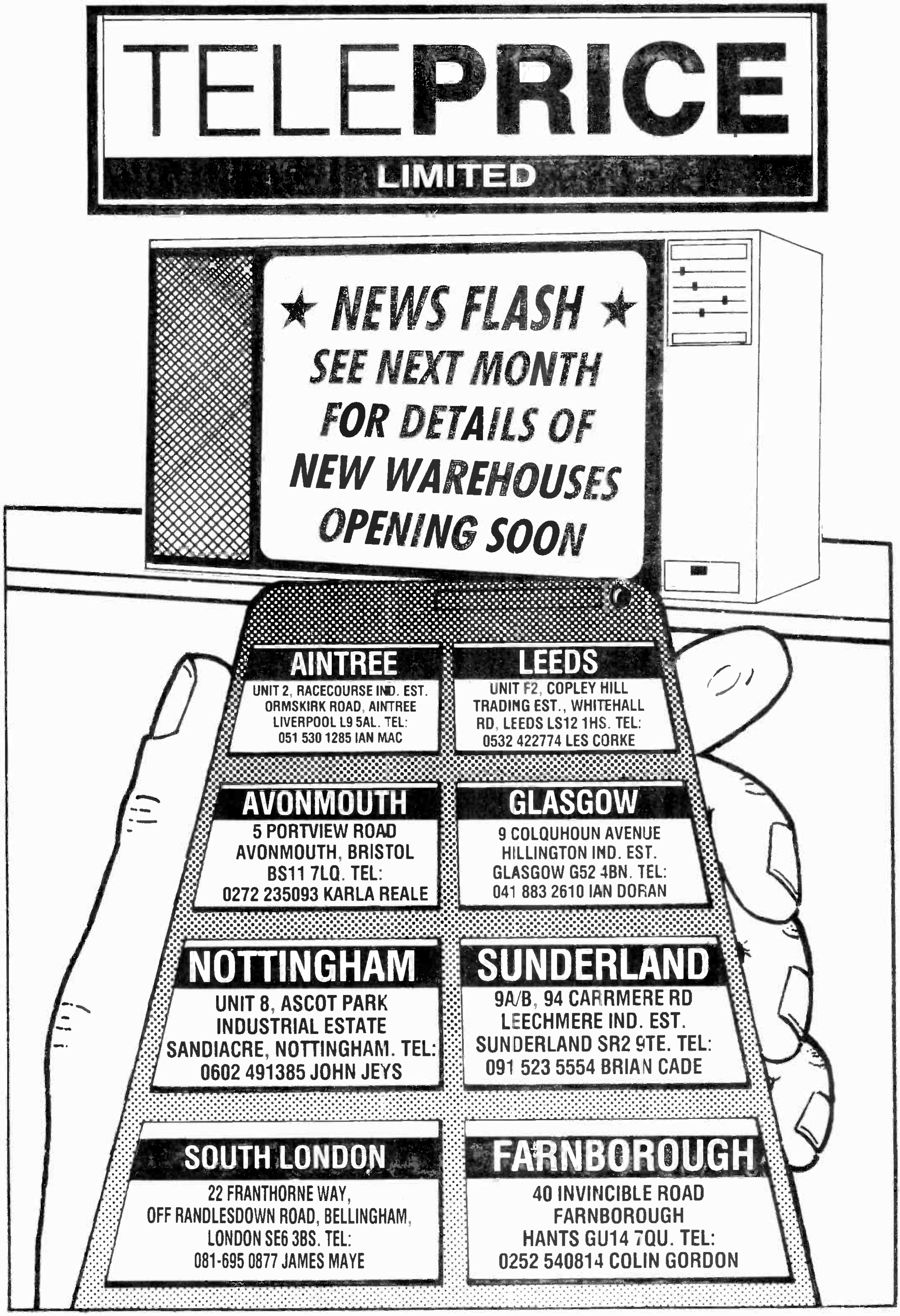
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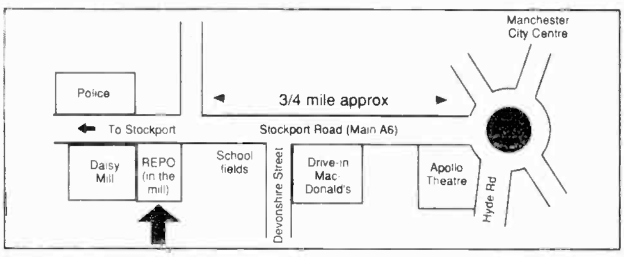

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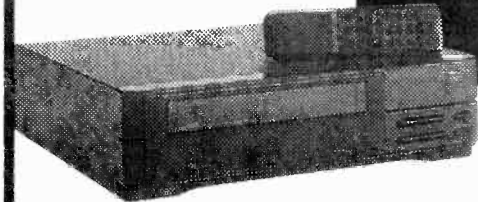

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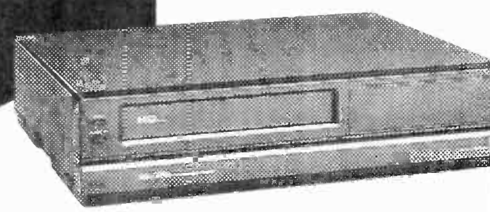

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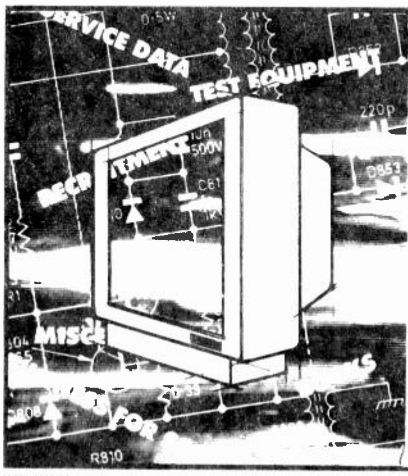

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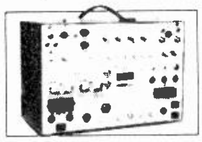

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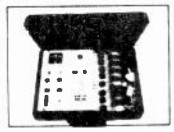

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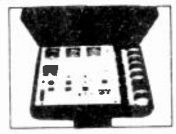

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STK5471	£3.00
STR58041	£5.00
TA7122	£1.15
TAA320A	50p
TAA470	£1.50
TAA570	75p
TAA611B	£1.00
TAA621	£2.00
TA7108P	£1.00
TA7117	50p
TA7120P	50p
TA7315AP	50p
TA7137P	50p
TA7193AP	£3.00
TA7240AP	£3.00
TA7265	£3.00
TA7227P	£1.00
TA7265AP	£3.00
TA7608AP	£3.75
TA7680AP	£3.00
TA7750P	30p
TBA120A	40p
TBA120AS	40p
TBA120SA	40p
TBA120B	40p
TBA120SB	40p
TBA120T	50p
TBA120SQ	£1.00
TBA120U	75p
TBA120Q	30p
TBA120C	40p
TBA1440	£1.00
TBA1441	£2.00
TBA231	75p
TBA395Q	50p
TBA396Q	£1.00
TBA396	75p
TBA440P	£1.00

TV CRYSTALS

4MHz	
4.433-619	
6MHz	
8.867238	
11.059 000	
Large or small	50p each
Antistatic Isolators	
Disc Type Black	10p
Filters	
CSA 3.97M	15p
6MEGtCDA	25p
6MHztSFE	25p
SFE 5.5MHz	20p
CDA5.5	25p
SFD460B	15p
CSB455A	15p
TA8662	£2.00
CCU3000	£1.00
AN5836	£3.00
BA6219	£2.00

HITACHI

U/V Video Hand Set	£14

TBA1440C	£1.00
TBA480Q	£1.00
TBA520	£2.00
TBA530	£2.00
TBA540	£1.00
TBA560CQ	£1.00
TBA570	£1.50
TBA625	50p
TBA651	£2.00
TBA673	£1.00
TBA750Q	£2.50
TBA780	£1.50
TBA800	50p
TBA810AP	60p
TBA810S	60p
TBA820	60p
TBA820M	25p
TBA920	£1.50
TBA920Q	£1.50
TBA990Q	£1.00
TMS1000NL	£2.00
TMS1943 N2L (clockchip)	£1.00
TMS9980	£4.00
TMS9901	£1.00
TMS2708JG45	45p
TMS2716JL	£1.00
TMS3529	£1.00
TMS3720ANS	£3.00
TMS4014	70p
TX-012	£1.00
TMS9902	£1.20
ULN2004P	£1.50
ULN2216	75p
UPC566H	£1.00
UPC585C	£1.00
UPC1009C	£2.00
UPC1031H	£2.00
UPC1353C	£1.00
UPC1363C	£2.75
UPC1364C	£2.00
UPX1365C	£2.00
UPC1366C	£1.00
UPC1378H	£2.00
UPC1514C	£3.00
UPC2002	35p
UPD1943G	£2.00
UPD8049HC	£2.00
SN29848	50p
SN29770BN	£2.00
SN29771BN	£2.00
SN29772BN	£2.00
SN76001	£1.00
SN76013ND	£2.00
SN76018	£1.00
SN76110N	£1.00
SN76115AN	50p
SN76131	50p
SN76141N	£1.00
SN76226	£1.00
SN76227N	£1.00
SN76228N	£1.00
SN76270	£1.00
SN76532N	£1.00
SN76545N	£3.00
SN76546	£3.00
SN76550	30p
SN76552	30p
SN76570	£1.00
SN76620	50p
SN76660N	40p
SN76620AN	50p
SN76666	£1.00
SN76705N	£1.00
SN76707N	75p
SN76708AN	75p
SN76720	£1.00
SN76709N	£2.00
UA783P3C	40p
BT100A/02	40p
BT138/10A	70p
BT146	30p
TBA540Q	£1.50
TCA270	£1.00
TCA270Q	£1.00
TCA270S	£1.00
TCA270SQ	£1.00
TCA800	£1.50
TCE120CQ	£1.00
TCE520	30p
TD6306P	£3.00
TDEA440Q	50p
TDA1003A	£1.00
TDA1010	£1.00
TDA1013	£1.00
TDA1012	£1.00
TDA1013A	£1.00
TDA1060A	£1.50
TDA1035SB	£1.00
TDA1072	£1.00
TDA1150	50p
TDA1151	30p
TDA1154	50p
TDA1170S	£1.00
TDA1180	£2.00
TDA1190	£1.00
TDA1200	75p
TDA1270	£1.50
TDA1327A	69p
TDA1365	£3.00
TDA1512	£2.00
TDA1540P	£3.00
TDA1670A	£2.00
TDA1908A	£1.00
TDA2002	£1.00
TDA2003	25p
TDA2004	£2.00
TDA2006	£1
TDA2008	£2.00
TDA2010	£1.00
TDA2020	£1.00
TDA2030	£2.00
TDA2140	£3.50
TDA2160	£1.00
TDA2320	50p
TDA2545A	£1.00
TDA2600	£3.00
TDA2640	£2.00
TDA2522	£5.00
TDA2530	£1.50
TDA2532	£1.00
TDA2540	80p
TDA2541	£1.00
TDA2542	£1.00
TDA2545	£2.00
TDA2546	£2.00
TDA2556	£1.00
TDA2560	75p

TDA3565	£3.00
TDA2575A	£1.00
TDA2577A	£2.00
TDA2578A	£2.00
TDA2579A	£2.00
TDA2581	£2.00
TDA2591	£1.00
TDA2593	£3.00
TDA2560	50p
TDA2556	£1.50
TDA2600	£3.00
TDA2611A	£1.00
TDA2611AO	£1.00
TDA3651A	£1.00
TDA2653	£4.00
TDA2640	£2.00
TDA2593	£1.00
TDA3047	£1.00
TDA3048	£3.00
TDA3083	£2.00
TDA3190	£1.00
TDA3300B	£5.00
TDA3301	£3.00
TDA3505	£3.00
TDA3506	£3.00
TDA3561	£3.00
TDA3560	£4.00
TDA3561A	£3.00
TDA3566	£3.50
TDA3564	£4.00
TDA3565	£3.00
TDA3571A	£2.75
TDA3581	£3.00
TDA3590	£3.00
TDA3591	£1.00
TDA3592A	£3.00
TDA3650	£7.00
TDA3651	£3.00
TDA3651AO	£3.50
TDA3652	£3.50
TDA3653AO	£2.00
TDA3654	£2.00
TDA3654O	£2.00
TDA3710	£3.50
TDA3800	£4.00
TDA3180	£2.00
TDA4260	50p
TDA4501	£3.00
TDA4505NE	£3.00
TDA4420	£2.00
TDA4439	£2.00
TDA4600	£3.00
TDA4601	£2.00
TDA8190	£3.00
TDA8703	£3.00
TDA8349	£3.00
TDA9403	£1.50
TDA9503	£3.00
TDB2033	£1.00
TDD1610S	50p
TD6306P	£2.00
TDA1060	£3.00
TEA1009	50p
TEA1039	£2.00
TEA1060	£2.00
TEA2017	£2.00
TEA2029C	£3
TEA5114	£1.00
TDA3300B	£6.00
SIL4516	50p
SN16861NG	50p
SN16862AN	£1.00
SN16964AN	50p
SN29764AN	£1.00
UA721	40p
UA7300	40p
MPS43A	25p
MJ13005	30p
MJE51T	25p
MJE340	28p
MJE660	25p
MJE661	25p
MJE3055	£1.00
MJE2801	30p
MJE2955	50p
MJE13005	50p

Transistors

A1222	25p	BF181	20p
A1223	25p	BF182	20p
A1233	25p	BF184	20p
AC106	25p	BF194	10p
AC121	25p	BF195	10p
AC124	25p	BF196	10p
AC128	25p	BF197	12p
AC137	25p	BF198	10p
AC151	25p	BF199	10p
AC131	25p	BF200	20p
AC138	25p	BF222	10p
AC152	25p	BF224	15p
AC153K	25p	BF238	20p
AC142K	25p	BF240	16p
AC169	25p	BF244	40p
AC176	25p	BF245b	20p
AC178K	25p	BF255	20p
AC179	25p	BF256	20p
AC186	25p	BF257	20p
AC188	25p	BF258	25p
ACY21	25p	BF262	15p
AD143	50p	BF263p	25p
AD149	50p	BF264	15p
AF17A	25p	BF271	10p
AF139	25p	BF273	10p
AF181	£1.00	BF274	10p
AF239	25p	BF324	25p
AF367	25p	BF337	50p
AL102	£1.75	BF355	30p
BLY49	50p	BF362	20p
BF115	20p	BF363	15p
BF121	20p	BF367	15p
BF127	20p	BF391	15p
BF137	20p	BF394	10p
BF157	20p	BF419	30p
BF160	20p	BF422	15p
BF161	20p	BF423	15p
BF164	60p	BF448	30p
BF179	30p	BF470	30p
BF180	20p	BF471	30p
		BF597T	10p
		BF694	10p

Thorn Transformers

DT2076/78	£10.00
90D3-035-003	£10.00
90D4-106-003	£1.00
90D3-038-001	£5.00
OT204130	£3.00

I.C.s

MA721PC	£1.00	UPD114LC-2	£1.00
M50430-8505P	£1.00	MN1250BJC	£1.00
TD6359P	£1.00	M50441-5505P	£1.00
M58657P	£1.00	M491BB1	£4.00
PCD8572	£1.00	HA513385	£1.00
HD74HC86P	£1.00	14DN 728A	£4.00