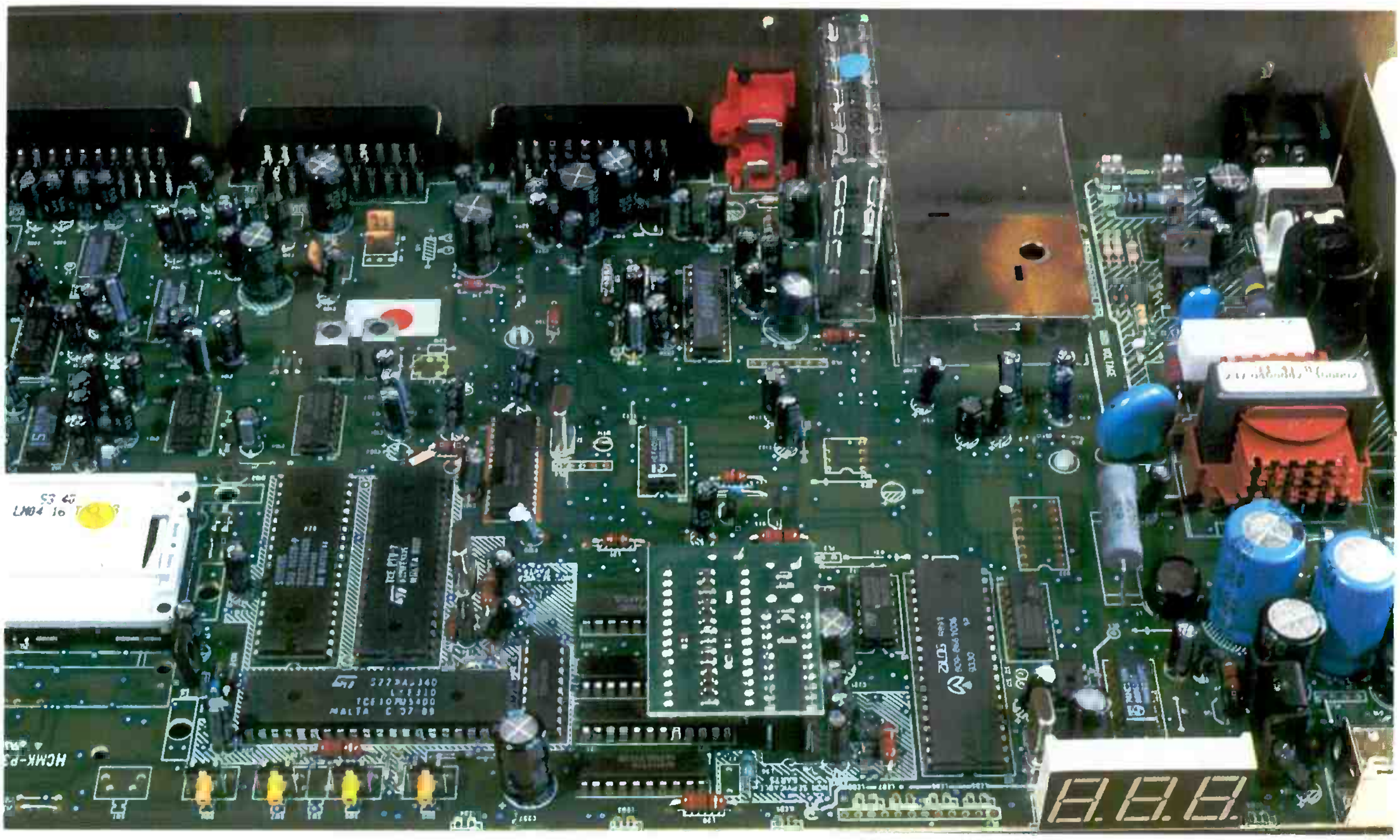
FEBRUARY 1994 £2.20

TELEVISION

SERVICING·VIDEO·SATELLITE·DEVELOPMENTS

FREE TV STANDARDS GUIDE



The Pace PRD800 Satellite Receiver

Introduction to Teletext Circuitry

The Dolby Surround Sound System

Notes on the Bush 2521T · DX-TV

Screen Entertainment 2000 Report

VCR Clinic · TV Fault Finding

A REED BUSINESS PUBLICATION

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TELEVISION

February 1994

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BC107	8p
BC108	8p
BC109	8p
BC109C	10p
BC140	20p
BC141	20p
BC142	20p
BC143	20p
BC147	8p
BC148	8p
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OC72	50p
OC200	180p

R2008B	100p
R2010B	100p
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VN10KM	60p
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ZTX303	24p
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2N1711	24p
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2N6241	500p
2N5245	45p
2N5294	30p
2N5296	30p
2N5366	25p
2N5401	12p
2N5448	12p
2N5496	80p
2N6107	40p
2N6292	40p

2N6385	120p
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
BY296	20p
BY298	23p
BY299	22p
BYX10	15p
BYX55/350	30p
BYX65/600	25p
BYX70/500	32p
OA47	10p
OA90	10p
OA91	10p
OA200	10p
OA202	10p
IN.914	2p
IN.4001	3p
IN.4002	3p
IN.4003	3p
IN.4004	3p
IN.4005	3p
IN.4006	3p
IN.4007	4p
IN.4148	2p
IN.5400	9p
IN.5401	8p
IN.5402	8p
IN.5403	8p
IN.5404	8p
IN.5405	11p
IN.5406	12p
IN.5407	12p
IN.5408	12p
RGP15	15p
RGP30	16p
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	
7805	25p
7806	25p
7808	25p
7812	25p
7815	25p
7818	25p
7824	25p
7905	25p
7906	30p
7908	30p
7912	30p
7915	30p
7918	30p
7924	30p
78L05	24p
78L08	24p
78L12	24p
78L15	24p
78L18	24p
78L24	24p
79L05	35p
79L08	35p
79L12	35p
79L15	35p
7818KC	100p
7824KC	100p
LM309K	100p
LM317K	200p
LM317T	100p
LM323K	350p
LM723	35p
78H08KC	800p
78H12KC	700p
79HGKC	800p
VALVES	
DAF96	100p
DY87	80p
EB91	50p
EBF80	60p
EBF89	60p
ECC84	80p
ECH83	100p
ECH84	90p
ECL80	65p
ECL82	80p
ECL84	100p
ECL85	80p
EF85	80p
EF183	75p
EF184	85p
EL34	300p
EL95	85p
EL500	100p

EY86	70p
EY87	70p
EY88	80p
PC97	100p
PCC85	60p
PCF80	100p
PCF801	110p
PCF802	80p
PCF806	115p
PCH200	100p
PCL81	65p
PCL82	80p
PCL84	60p
PCL85	80p
PCL805	80p
PFL200	110p
PL36	120p
PL83	60p
PL84	80p
PL95	180p
PL504	120p
PL508	200p
PL519	430p
PY81	100p
PY88	100p
PY500A	190p
LED's	
3mm	
RED	5p
YELLOW	8p
GREEN	8p
5mm	
RED	5p
YELLOW	8p
GREEN	8p
RECTANG. LED's	
5mm × 2.5mm	
RED	5p
YELLOW	8p
GREEN	8p
LINEAR IC's	
AN203	210p
AN210	165p
AN214Q	170p
AN228	280p
AN240P	130p
AN252	150p
AN259	250p
AN262	140p
AN271	230p
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AN304	360p
AN315	210p
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AN360	100p
AN362	140p
AN366	150p
AN610	160p
AN612	160p
AN3312	350p
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AN3331K	900p
AN3792	400p
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AN3795	500p
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AN3822K	700p
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AN3991K	400p
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AN5011	400p
AN5015	350p
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AN6811	130p
AN6884	240p
AN7105	210p
AN7110	130p
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AN7115	150p
AN7116	90p
AN7120	130p
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AN7140	450p

AN7145	195p
AN7146	210p
AN7154	180p
AN7156	240p
AN7168	260p
AN7178	270p
AN7222	180p
AN7254	150p
AN7256	250p
AN7310	90p
AN7311	90p
AN7410	250p
AY3-1015	290p
AY3-1270	800p
AY3-1350	450p
AY3-8910	360p
AY3-8912	400p
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BA311	80p
BA313	60p
BA333	100p
BA340	150p
BA401	60p
BA402	60p
BA511	160p
BA514	160p
BA516	150p
BA521	160p
BA524	240p
BA526	180p
BA527	95p
BA532	140p
BA534	290p
BA536	180p
BA546	180p
BA612	160p
BA656	150p
BA658	380p
BA684	400p
BA685	400p
BA1310	160p
BA1320	110p
BA1330	160p
BA1360	160p
BA4403	220p
BA5101	400p
BA5102	220p
BA5204	200p
BA5402	180p
BA5406	180p
BA5408	180p
BA6104	250p
BA6208	250p
BA6209	260p
BA6304	120p
BA6305	140p
BA6410	220p
BA6411	250p
BA6993	150p
BA7001	150p
BA7004	200p
BA7007	200p
BA7021	180p
BA7022	350p
BA7751LS	150p
BA7752	250p
BA7755	150p
BA7767AS	200p
CX108	950p
CX134A	950p
CX136	600p
CX139	1450p
CX139A	750p
CX141	750p
CX143	800p
CX143A	1250p
CX145	725p
CX150B	325p
CX158	825p
CX175	325p
CX186	750p
CX187	825p
CX804A	775p
CX832	825p
CX867	575p
CX868	525p
CX877	300p
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HA1197	150p
HA1199	145p
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HA1339A	350p
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HA1389	210p
HA1392	200p
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KA2412	350p
KA2912	125p
KA2914A	300p
LA1130	240p
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LA1185	150p
LA1201	75p
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LA1222	80p
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LA2000	150p
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LA4422	130p
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LA4440	230p
LA4445	200p
LA4460	130p
LA4461	130p
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LINEAR ICs — Cont.	
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JAPANESE TRANSISTORS	
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2SC3854	250p
2SC3855	280p
2SC3857	500p
2SC3858	550p
2SC3870	200p
2SC3883	280p
2SC3890	150p
2SC3895	400p
2SC3897	650p
2SC3907	420p
2SC3909	450p
2SC3927	550p
2SC3946	120p
2SC3950	120p
2SC3953	120p
2SC3954	150p
2SC3973	275p
2SC3976	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
2SD199	280p
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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	20p
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	30p
2SD602	60p
2SD612	50p
2SD613	70p
2SD636	10p
2SD637	40p
2SD638	40p
2SD639	60p
2SD640	350p
2SD642	50p
2SD665	50p
2SD661	60p
2SD666	70p
2SD667	60p
2SD668	120p
2SD669	40p
2SD673	350p
2SD676	250p
2SD716	80p
2SD717	180p
2SD718	200p
2SD722	240p
2SD725	270p
2SD734	60p
2SD-741	120p
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2SD-756	200p
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2SD-762	140p
2SD-763	140p
2SD-768	180p
2SD-772	200p
2SD-773	40p
2SD-774	60p
2SD-777	80p
2SD-784	650p

2SD-786	100p
2SD-787	80p
2SD-788	100p
2SD-789	80p
2SD-792	400p
2SD-794	170p
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-882	80p
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2SD-894	120p
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2SD-905	450p
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2SD-1308	140p
2SD-1309	140p
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2SD-1392	150p
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2SD-1911	400p
2SD-1913	50p
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2SD-1959	280p
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
2SJ-74	60p
2SJ-75	280p
2SJ-76	220p
2SJ-77	350p
2SJ-79	225p
2SJ-103	75p
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2SJ-162	680p
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2SK-55	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
2SK-511	450p
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2SK-617	200p
2SK-531	350p
2SK-534	700p
2SK-537	300p
2SK-538	450p
2SK-539	1100p
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2SK-872	950p
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2SK-51	100p
2SK-59	100p
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-129	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	160p
8255	160p
8256	700p
8257	220p
8271	3400p
8279	270p
8283	400p
8284	440p
8287	260p
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	
256K × 9-80	1100p
256K × 9-70	1200p
1MB × 9-80	3100p
1MB × 9-70	3200p

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

BRIDGE RECTIFIERS

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/500V	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

TRIACS	
TIC206D 4A/400V	60p
TIC225D 8A/400V	69p
TIC226D 8A/400V	68p
TIC236D 12A/400V	85p
TIC246D 16A/400V	105p
TIC253D 20A/400V	190p
TIC263D 25A/400V	205p
TI2800D 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
17088	200p
17089	200p
17127	200p
15/80H	230p
15/85R	230p
SG264	800p
SG613	800p

SERVICE AIDS

SERVISOL PRODUCTS	
VIDEO HEAD CLEANER	140p
SWITCH CLEANER	150p
SILICONE GREASE	170p
FREEZE IT	170p
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AEROKLEANE	140p
AERO DUSTER	170p
PLASTICSEAL	160p
GLASS CLEANER	160p
COLDKLENE	160p

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- TR4995 £33.00

GRUNDIG
- VS410/440/450/460/500/505/510/520/521/530 £17.00
- BARCELONA/MVS400/440/500/600/SE5100/6100/TVR4500/VS400/440/500/505/510/518/600/610 £18.00
- MADRID/SE5140/VS540/VS5480 £35.00
- MVS550/620/630/640 £38.00
- VS120 £25.00

HINARI
- VXL2/VXL3/VXL4/VXL20/VXL25/VXL35 £11.50
- 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/VTL30/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/VR3948/6948 £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
- 3292/8903/89008901/8902/8903/8606/8922/8923/3VO1/3V06/3V22 £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
- 8944/8949/3V42/3V44/3V45/3V46/3V47/3V52/3V54/3V55/3V56/3V57/8950/8951/3V64/FB10/FV11/3V65/FV20/FV21/FV22/FV26 £15.50
- 3V48 £17.00
- 3V43/3V53 £24.50
- 8930/8940/3V29/3V30 £31.50
- 8945 £7.50
- 3V00 £24.00
- FV31 £10.00
- FV37 £22.00
- £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/HS318/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
- V1306 £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/ £12.50
- VR1000/VR1100/VR1200/VR1600 £14.00
- VR3300X/VR3600X/VR3650/VR3800 £15.00
- VR3200/VR3500 £15.00
- VR2000/VR3300/VR3600 £15.00

SALORA
- 6600/6600 £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/V1520/616/621/626/900/710/VX617/619/629/710/712/VX720/730/970/971/972 £19.00
- VB770/V1730/770/VK8220/VX750/770/8225 £21.00

SANYO
- VTC5400/VTC5400/VTC6000/VTC6600/VRP5000/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/VC700/772/7810/782/7822/783/8481 £13.00
- VC6000/VC6200/VC6300/VC7300/VC7700/VC7750/VC8000/VC8300 £20.00
- VC793 £36.00
- VC473/785/786 £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/SLF1E) 2 PIN SLC24PS/SLC33E/SLC44PS/SLF30PF/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/V80/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) £4.50

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, 8061, 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) £4.50
- 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, GHVP1295, GHPV1296, VCP4100, GHV51, 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, HSB10, HSB20, HSB30, 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, VR2490, VRS2498, VR6462, VR6463, VR6464, VR6560, VR6660, VR6860, VR6861, VR6862, VR6863 £2.50

Pressure Roller Assembly
- DV186, DV190, DV286, SV486, DV471, DV582, DV571, DV761, VR6180, VR6182, VR6185, VR6285, VR6290, VR6291, VR6293, VR6362, VR6367, VR6390, VR6391, VR6393, VR6467, VR6468, VR6470, VR6561, VR6570, VR6581, BR6670, VR6676, VR6760, VR6761, VR6762, VR6870, VR6970, VR6975, VR86B1, 62SB7, 68SB4, 71SB4, 72SB8, 92SB31 £4.50

SANYO
- VHR1100, VHR1300, VHR1500, VHR2300, VHR1150, VHR1200, VHR2100, VHR2500, VHR2700 £2.50
- VTC5000, VTC5150, VTC5500, 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, VC800, VC682, VC684, VC693, VC699, VC700, VC772, VC7810, VC782, VC7822, VC7282MK2, VC783, VC793, 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, SC8520, 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 £2.50
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) £4.50

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, 8940 £0.90
3V31, 3V32, 8941, 8942 £0.85
3V35, 3V36, 3V38, 3V39, 3V49, 8943, 8944 £0.70
3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 57, 8945, 8947, 8948 £0.65
3V58, 3V59, 3V64, 3V65, 8950, 8961, FV10, FV11, FV12, FV13, FV14, FV20, FV21, FV22, FV26, FV30, FV32, FV33 £1.05

FIDELITY
H1S200, 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
VBR339, 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, VCR6800, VCR680 £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 £0.80
GHV1290, GHV1291, GHV1295, GHV1296, VCP4200, VCP4300, VCP4301, VCP4305, VCP4306, VCP4310, VCP4311, VCP4315, VCP4320, VCP4321, VCP4325, VCP4326, VCP4000 £1.20
GHV1247, GHV8200 £1.50

GRUNDIG
MVS400, MVS440, VS400, VS410, VS440, VS450, VS460 £0.55

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, VT130 £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
VR3963 £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, VR6975, VR72SB8, VR68SB4, VR86SB1, VR92SB3 £0.85
VR5442, VR6542, VR6843, VR6943, VR44SB9 £0.70

SAISHO
VR2000 £0.90
VR3800 £0.75

SALORA
SV9500 £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, VC793, VC800, VC7810, VC7822, VC6V3, VCA100, VCA102, 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
VCR 7000 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

BLAUNPUNKT
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 56371V 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, 8961, 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
5578154 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, VR3846, VR3948, VR3076, VR3997, VR6948
VR3912 CAPSTON MOTOR £21.00
VR3912 DRUM MOTOR £19.50
VR3605, VR3905 CAPSTON MOTOR £19.50
VR3935, VR3954, VR3385
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
288PO3401 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, VH704, VH708, VH712, VH770, VH774, VH780, VH820, VH844, VH900, VH974, VH1000, VH1204, VH200, VH2004, VH2204, VH3030, VH3050, VH3060, VH4008, VHF2A, VP200, VR2948, VR2949, VR2956, VR2957

ORION Cont.
NVHL, 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, VH883, 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, VC540, 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, VK305, VK308, VK3301

TOSHIBA
V55, V57 CAPSTON MOTOR £19.50
V51, V63 LOADING MOTOR £8.00
V71, V73, V74 REEL MOTOR £10.50
V75, V81, V83, V85, V86, V93, V94, V300, V500, V700, OV90
V71, V73, V74 CAPSTON MOTOR £9.50
V75, V81, V83, V85, V700
V96, V93, V94 CAPSTON MOTOR £15.00

CASSETTE HOUSING

GRANADA
VHSDP1 CASSETTE LIFT ASSEMBLY £15.00
VHSVJ2 £26.00

FERGUSON & JVC
3V38, 3V39, 8943, 8944, 8951, 3V35, 3V36, 3V49, HRD110, HRD111, HRD120, HRD121, HRD225 £26.00
3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V57, 8945, 8947, 8948, HRD140, HRD141, HRD150, HRD157, HRD158, HRD160, HRD250, HRD257, HRD455, HRD565, HRD566, HRD725, HRD755 £26.00
8948, 8950, FV10B, FV12L, FV13H, FV14T, FV20B, FV21R, FV22L, FV26, FV305, HRD230, HRD430, HRD530 £26.00
3V58, 3V59, 3V64, 3V65, FV11R, 8950, 8951, HRD170, HRD180, HRD370 £26.00

ITT
VR3605, VR3905 £26.00
VR3916, VR3926, VR2946, VR3948, VR3976, VR3986, VR3995, VR3997, VR6948 £26.00

NATIONAL
NV730 £43.00

NEC
N830EG, N831EG, N832, N833EG £26.00
N895 £26.00

PHILIPS
CASSETTE LIFT ASSEMBLY
6I120366 £11.00
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 £11.00

TELEFUNKEN
VR2970 £26.00

THOMSON
V320, V321, V323, V326, V4200, V4300 £26.00
V342, V343, V352, V353, V360, V364, V368, V4210, V4230, V4260, V4400, V5500, V6000, V8540 £26.00

TOSHIBA
V55, V57 £26.00
V65, V66 £26.00

PANASONIC MODE SWITCHES

NV2000, 2010, 7000, 7200, 7800 (VSS0048) £4.00
NV230, 280, 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, C8540, 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: VLO2)
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: VLO6)
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: VLO7)
GRANADA (VHSAY3), SHARP (VC200, 381, 384, 385, 386, 388, 390, 393, 9300, 9500, 9700) £0.70
(CASSETTE LAMP 5V 115mA CODE NO: VLO8)

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 6609B £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
1-439-216-00	KV-2002E, 2010E, 2200E, 2015, 1820E, 2010SE, KV-2012ME, 2016ME, 2015ME, 2010ME	£14.00
1-439-256-11	KV-2704EC, 2704UB, 2704ET, 2704E(A), 2704E	£35.00
1-439-286-21	KV-2215UB, 2217UB, 2215EI, 2215FE, 2212EX, 2215ET	£30.50
1-439-289-21	KV-2705F, 2705FE, 2705UB, 2705E, 2706UB, 2720EC	£40.00
1-439-303-00	KV-2064EC, 20PS1, 2082ME7, 2056EC, 2080SA, KV-2062E(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	£38.00
1-439-333-00	KV-1882EC, 1882UB, 1882F, 1882CH, 1882AEB, 1882AM, KV-1882ME3, 1882HK, 1882AS, 16TR1, 882EC(PS), 1770R	£20.00
1-439-363-21	KV-19HT1A, 19FX1MT, 18G2, 1602M7, 1602GE, ADM-16B, KV-2092UB, 2096UB	£22.00

FLYBACK TRANSFORMERS

FERGUSON		
00D-4208-001	TX9	£14.00
00D 4 208-002	TX9	£14.00
00D-4-235-002-01G	TX90	£14.00
00D-4-247-001	TX90	£14.00
00D-4-247-001 HT1	TX90	£14.00
06D-3-093-001	TX100	£14.00
(110)06D-3-087-001	TX100	£14.00
(110) 06D-3-084-001	TX100	£14.00
06D 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	£14.00
	CPT 2178	
OUTPUT TV MODULE	HM6251 (REF 2370551)	£5.50
	HM6232	£8.00

IDLERS & PULLEYS REPLACEMENT

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, 59, 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, 118, 205, 220			
VP7100, VS9300	T-UP IDLER	PU47752	£4.50
VS9500, VS9800			
VP7100, VS9300	UNLOADING	PU46381	£4.00
VS9500, VS9800	IDLER		
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, 58			
VS23, 35, 37, 53, 55	CLUTCH	ML373043	£13.00
VS66, 75, VSA77			
VS9700	FF IDLER	BV321761	£3.20
VS9700	REW IDLER	W321762	£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			£3.00
FERGUSON			
3V00, 3V01, 3V16	T-UP IDLER	PU47752	£4.50
3V22, 3292, 8900, 8901, 8904, 9806			
3V16, 3V22	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
3V43, 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	PU43608	£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
FVHP662, 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
FVHP999, 5000, 5005			
FVHP5050, 5075, 5100			
FVHD40, 55, 140	REEL DRIVE ROLER		£6.00
FVHP1, 10, 20			
FVHP975, 980, 990	GEAR		£3.00
FVHP975, 980, 990	CLUTCH	F12430510404200	£9.50
FVHP420, 520, 530	IDLER		£2.80
FVHP420, 520, 530	TAKE UP IDLER		£3.60
FVHP990	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	435038A	£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, VT16S			
VT120-220, 100, 110	CLUTCH ASSY	6886824	£7.50
111, 113, 115, 118, 200		6886972	
125, 128, 130, 135, 138, 145, 150, 175, 225, 250,			
255, 258, 260, VTL30			
VT8000-8300, 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	6861482	£3.20
VT680, 6800, 9700		6861481	
VT 9900			
VT9300-9500, 9700	IDLER	681505	£3.00
VT9900, 6500, 680, 6800	IDLER	687043	£3.80
VT11-33, VT63-64	FF-REW IDLER	6886971	£1.50
VT14, 16S, 17, 19, 34, VT35, 38, 39, 52, 61, 62			
VT65, 85, 86, 88, 330, 640			
VT1000, 110, 111, 113	FF-REW ARM	6886792	£2.75
VT115, 118, 119, 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
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, 576, 580, 585			
VT588, VTM625, 626, 630, 635, 636, 640, 645, 646, VTS80, 85			
VT400, 405, 410, 413	CLUTCH BASE	6896951	£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, 576, 580, 585			
VT588, 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 MUDULE HM 6251			£5.50
OUTPUT MODULE HM 6232			£8
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, HPR50			
MATSUI			
VX730, 735, 750, 755,	CLUTCH	850A00005	£6.50
VX810, 820, 850, 880, 990			
VX730, 735, 750, 755	LIMITED POST LEVER		£1.30
VX770, 800, 810, 880	ASSY		
VX990			
VX800A, VX300	IDLER REEL		£1.50
VX800A, VX820	REEL UNIT CLUTCH		£3.50
VX850, VX900	ASSY IDLER		£3.50
MITSUBISHI			
HS306, 307, 318, 319,	GEAR ASSY	522B00201	£6.25
HS400, 410, 710			
HS337, 338, 347, 349	IDLER	552B01701	£3.50
HS411, 412, 421, HSB10, HSB20, HSB30, HSE10, HSE20, HSE20, HSE30, HSE70			
HS306, 307, 318, 319	IDLER	641C34301	£2.00
HS400, 410, 710			
HS347, 349, 412	IDLER	522902002	£3.00
HSB10, HSB20, HSB30, HSE10, HSE20, HSE30, HSE70			
MITSUBISHI Cont.			
HS337, 338, 411, 421	IDLER	552B01801	£3.50
HS200	TAKE UP IDLER (LARGE)		£4.50
HS200	UNLOADING IDLER		£4.00
HS200	REWIND IDLER		£6.00
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	522C06301	£3.00
HS337, 338, 411, 421	REEL DISK	522P00601	£5.00
HS300, 301, 302, 310	PULLEY	522C05201	£2.25
HS306, 307, 318, 319	GEAR WHEEL	641D71101	£1.50
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		£6.00
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
NV280, NV370, NV380, NV430, NV450, NV460, NV465, NV470, NV480			
NV630, NV650, NV730, NV780, NV810, NV830, NV850, NV870			
NVG7, NVG9, NVG10, NVG11, NVG12, NVG 14, 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, 7800	CLUTCH	VXP0343	£4.00
NV8150, 8200, 8300,	IDLER UNIT	VXP0245	£0.90
NV8400, 8600, 8610, 8620			
NV8200, 8400, 8600	PLAY IDLER	VXP0243	£0.90
NV8610, 8620			
NV8620	CLUTCH	VXP0343	£4.00
NV332, NV600, NV688	IDLER	VXPO488	£3.50
NVG20, NVG21, NGV25	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	VXP0691	£1.50
NVG14, NVG15, NVG18, NVG30, NVG120, NVG130, NVG400, NVH70			
NV2000, 2010, 3000	LOADING GEAR	VDG0035	£0.60
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			
NGV130, NVG400, NVH70, AG1000			
NV230, NV250, NV260	CLUTCH GEAR		£2.50
NV280, NV430, NV450, NV730, NV770, NV810, NV870, NV890			
NVG7, NVG10, NVG11, NVG12, NVG14, NVG15, NVG18, NVG30			
NCG120, NVG130, NVG400, NVH70, AG1000			
NV230, NV250, NV260	LIMITER ROLLER		£1.50
NV280, 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, NVG18, 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		£0.60
VH1, VH2A	INTERMEDIATE GEAR		£0.65
VC150, VC180, VH200	IDLER		£1.50
VH201, VH205, VH212, VH250, VH254, VH288, VH300, CH303, 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			
VTC9100, VTC9300	IDLER	143-0-551T-01400	£1.20
VTC9300	FF ROLLER ASSY	143-0-547T-00200	£2.20
VTCM10, M11, M20, M21	REEL DRIVE PULLEY	143-0-662T-10350	£5.00
VTCM30, M31, M50			
VHR2100, 2300, 2500	IDLER	6130374899	£5.00
VHR2700			
VTC5000, 5150, 6000	PULLEY	143-0-662T-01201	£5.20
VTC6500			
VTCM10, M11, M20, M21	PULLEY	143-0-662T-10350	£5.50
VTCM30, M31, M50			
VHR3100, 3300, 3310	REEL DRIVE	143-0-662T-15621	£4.25
VHR3400, 3700, 3800	ROLLER		
VHRD500, VHRD700			
VPR5800, VTC5300	LOADING ROLLER	143-0-661T-03800	£1.00
VTC5400			
VTC3000	FWD LIMITER		£3.50
VTC3000	IDLER		£5.00
SHARP			
	IDLER ASSY	NIDL0005GEZZ	£1.50
	IDLER	NIDL0006GEZZ	£1.50
VC600, 661, 681, 682	IDLER ASSY	NPLYV0107GEZZ	£6.15
VC684, 685, 693, 699, 700, 783, VC6FR, VC6V3			
VC7300, VC7700, 7750	PLAY IDLER KIT	NPLYV0041 + NDA1V1007	£7.50

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REMOTE CONTROLS

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TP160E	1050P
TP200, TP300	1000P
TP400	850P
TP590-600	1050P
TP390, TP610	1050P
TP621	1050P
TP630, TP650	1000P
TP660	1050P
TP661	1050P
HITACHI	
CLE800-CLE830	900P
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
FS4	850P
RG305	900P
RG306	900P
FS9/1-10/1	900P
VS5 RUK	900P
VS4-1	900P
MULTICONTROL (17C20)	1000P
KORTING	
18279, 18396, 18460, 18521 SE	1000P
40540 VTS	1000P
LOEWE	
DC11	1000P
MATSUI	
010270601	1000P
VX770	1000P
METZ	
JAVA COLOR (6890)	1000P
COLOR (7156)	1000P
JAVA (7180)	1000P
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939P/03607, 939P/03609	900P
NOKIA	
SATELLITE	1000P
NORDMENDE	
TC2336	1050P
CMC1, TC3519	1050P
OCEANIC	
390C9500	1000P
ORION	
RC53	1000P
PANASONIC	
EUR51200	900P
TC2200	900P
VSQ0357/NV730	1050P
TNQ1621	1000P
PHILCO	
CARVEL, CONCORDE, MERCURY	1000P
TELESTAR	
TC10	1000P
PHILIPS	
RC5002, 5154	900P
KT3 NON TEXT	900P
69117032	1050P
69117194	1050P
RC5991 UNIV	850P
RC3B	900P
KT3 TEXT	900P
RC5352	900P
RC5375	900P
RC5 STANDARD	900P
RC5901	900P
RC5903	900P
SABA	
T6772	1000P
TC319-320	1050P
TC356	1050P
TC358	1050P
TC360	1000P
TC365	1000P
SALORA	
SERIES L	1000P
86173	1000P
SANYO	
RC218, RC222, RC228, RC238	900P
JXGE	1000P
JXDE	1000P
VHR2300	1000P
RC628	1000P
SHARP	
G0121CESA, 123CESA, 204, 251	900P
SIEMENS	
FC616	1000P
FC631	1000P
FC742	1000P
SONY	
RM604, RM605, RM606	900P
32 CHANNEL	900P
RM613	900P
RM632, RM636	900P
TATUNG	
FXA	1000P
RC70	900P
FX70 FASTTEXT	850P
TELEFUNKEN	
FB632	1000P
FB639	1000P
THORN/FERGUSON	
3V35-42	900P
3V31-32	900P
3V57-58	1050P
TX10 TEXT	850P
TX10 STEREO TEXT	850P
TX9-90-100	850P
3V55, FV11	1050P
TX100 FASTTEXT	900P
TX100 STEREO FASTTEXT	900P
PROFESSIONAL	850P
TOSHIBA	
CT937	1000P
CT9117	1000P
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138-10229. 2.4V – 90mAh 240P

REPLACEMENT FERGUSON NI-CAD BACKUP BATTERIES
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Used on: TX10 150P
Replaces Ferguson Part No's: 00E6-066-001. 2.4V
Used on: 3V35, 3V56, 3V58, 3V65 280P

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Description	Price	Order Code
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ORION 3714002	1500P	LOT02
FIDELITY ZX300	1500P	LOT03
FE TX100 90 DEG	1500P	LOT04
SABA 490007182	1500P	LOT05
FE TX90 WHITE	1650P	LOT06
ITT D307/37 EQ	1600P	LOT07
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
HITACHI 2434141 CP	1450P	LOT33
FE TX100 110 D	1700P	LOT34
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315mA	FUSE03	75P	FUSE19	60P
400mA	FUSE04	75P	FUSE20	60P
500mA	FUSE05	75P	FUSE21	60P
630mA	FUSE06	75P	FUSE22	60P
800mA	FUSE07	60P	FUSE23	60P
1A	FUSE08	60P	FUSE24	60P
1.25A	FUSE09	60P	FUSE25	60P
1.6A	FUSE10	60P	FUSE26	60P
2A	FUSE11	50P	FUSE27	60P
2.5A	FUSE12	50P	FUSE28	60P
3.15A	FUSE13	55P	FUSE29	50P
4A	FUSE14	55P	FUSE30	50P
5A	FUSE15	60P	FUSE31	50P
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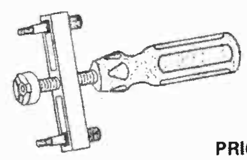

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JUST ARRIVED

VIDEO HEADS

AKAI
VSF600, VSF650 3800P
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VS20, VS22, VS24, VS25, VS26, VS27, VS422, VS425, VS426, VS427, VSF10, VSP8, VSP9 1700P
VS240, VSP82, VS202 1500P
VS33 2600P
VSR9 1700P

AMSTRAD
VCR8800, VCR8804, VCR9340 2400P
DD8900, DD8904, TVR4, VCR6200, VCR8600, VCR8602, VR8700 1300P
VCR8603, VCR8604, VCR8704, VCR8714 1350P

BAIRD
VC14L 3000P
VHS82 7000P

BLAUPUNKT
CR1000, CR1200, CR1500 4650P
CR1800 4100P
RTV321, RTV322 1700P
RTV330 2300P
RTV333 1000P
RTV33B 2800P
RTV348 2700P
RTV404, RTV414 3000P
RTV635 3000P
RTV640 3000P
RTV750, RTV800, RTV900 3500P
RTV810 4400P
RTV910 4500P

JVC
HRD330, HRD337, HRD440, HRD637, HRD641, HRD660, HRFC100 2200P

JVC AND FERGUSON
8902/8903/8909/8912/8922 1000P
8923/8925/8929/8935 650P
8931/8933 750P
FV43H, HRD860 3800P
VC141L, HRD190, HRD610 3050P
FV44L 2200P
BR1600, HRD142, HRD156, HRD152 1550P
BR6200 720P
HRD154, HRD217, HRD321, HRD350, HRD521, HRD522, HRD525, HRD527, HRD550 1700P
HRD580, HRD620, HRD650 2900P

FIDELITY
VR900, VR910 1600P

FISHER
FVHD140, FVHD40, FVHP1, FVHP10, FVHP20 FVHP40, FVHS10 1600P
FVHP200, FVHP210, FVHP300, FVHP310 2100P
FVHP500, FVHP5100, FVHP730, FVHP830 1200P
FVHP980 2500P

FUNAI
E1100, VIP5000 1200P
VCR5840, VCR8007, VIP2500A, VIP3000A, VIP6000, VIP150 2200P
VCR4530, VCR6000, VCR6100 1600P
VCR8103, VCR600, VCR6100 1600P
VCR8103, VCR8107 2200P
VIP300A MKII 1900P

GEC
V4005H 2000P

GOLDSTAR
GHV1232, 1233, 1241, 1242, 1243, 1244, 1290, 1291, 1295, 1296, 1891, VCP4130, 4300, 4301, 4305, 4306, 4310, 4311, 4315, 4316, 4320, 4321, 4326 1650P

GRUNDIG
VS456 1700P
SE6110, SE9100, TVR4510, TVR5510, VS500, VS510, VS5180, VS6190, VS700, VS900 1800P
VS790, VS930, VS940 3800P
MVS660, SE6160, VERONA, VS660, VS6690 3500P
MVS710, MVS720, MVS910, SE9120, VS800, VSB10, VS910, VS920, SE7120, VS710, VS720 1800P
VS160, VS740 4400P
VS170 4600P
VS680 4600P

HINARI
VCR34H, VTV200, VXL90 1850P

HITACHI
VT15, VTP10, VTP30 1100P
VT16B, VT260, VT498 2700P
VT570, VT575, VT576, VT580, VT585, VT588 3400P
VT5600 1200P
VT60 1500P
VT660E 2600P
VT6700, VT6800 1200P
VTL30 2100P
VT522, VTM620, VTM622, VTM720, VTM722, VTM822 2000P
VTM725, VTM726, VTM72B 1600P

ITT
VR3520, VR3701, VR3719, VR3720, VR3721, VR3759, VR9720 2000P
VR3730, VR3731, VR3749, 2700P
VR3907, VR3908 1600P
VR3918, VR3919, VR3938 1800P
VR396B 7000P
VR3984 2300P
VR3958, VR4993 650P
VR4913, VRP3833 650P

LUXOR
9245, 9251, 9254 1225P
9255, 9256 2150P
9270, 9271, 9273 1800P
9272, 928217 2700P
9252 2500P
928017, 928077, 928097, 929107, 929117 1700P
9253 2500P
9281 2700P
9284, 9295, VR3701, VR3721, VR3731, VR3761 2100P

MATSUI
VX600 1100P
VX750 1500P
VX990 1600P

MITSUBISHI
HSE12, HSE22, MX1 2400P
HS411EZ, HS411GZ 2900P
HS273 1700P
HSB10, HSB20, HSE10, HSE20, HSE21, HSE41 2200P
HSB11, HSB21 2200P
HSB30 2400P
HSE31, HSB31, HSE32 2800P
HSE50 3300P

NATIONAL
NV8050, NV8051 2800P
AG1000, AG1050, NV260 1650P
AG6010, AG6015 2500P
AG6840 2400P
NV200 850P
NVD80 5000P
NVF65, NVH75 3400P
NVF51 4200P
NVG19 2300P
NVJ33, NVL21, NVJ30 1800P
NVJ35 3000P
NVM1, NVM3, NVM5 4200P
AG2100, AG2200 700P
NVF65 3200P

N.E.C.
DX2000 3400P
DS6000 3500P
DX1000, DX1600, N9040, N9053, N9055 2000P
DX4000, N9610, DX3000 3200P
N9052, N9530 3400P
N9110, N9120, N914C 2700p
VCP1 1700p
PVC2300, PVC240, PVC740, PVC744, PVC760, PVC764 1600P

SAMSUNG
VM1560, VN1561 2200P

SANYO
VHR7900 3600P

SHARP
VC585, VC685 2300P
VC90ET 3900P
VFH815 2800P

SONY
SLV373UB 3000P

TOSHIBA
V660 2350P
V880MS 2600P
V700G 3700P
V500G, V509G 2500P
V9680 2900P
V300G, V301, V305, V309G 2550P
V61, V63 1700P
V110, V120, V130, V140, V210, V220 1800P

TELEVISION ON/OFF MAINS SWITCHES

Baur, Normende, Nova, Pioneer, Quelle, Saba, Salora, TEC, Thomson & Vega 375P

VIDEO MOTORS

HITACHI
VT11, VT14, VT15, VT16, VT17, VT19, VT35, VT39, VT57, VT88 (capstan motor) 3100P

BANG & OLUFSEN
VHS65, VHS90 (capstan motor) 3100P

LOADING MOTOR UNITS

ITT
VR3605, VR3905, VR3955, VR3985 1100P
VP2826, VR3906, V43926, VR3976 1250P
VP3946, VR3906, VR3948, VR3986, VR3995, VR6948 1500P

JVC
HRD110, HRD111, HRD120, HRD121, HRD225 1100P
HRD140, HRD150, HRD157M, HRD158MS, HRD160, HRD250, HRD257MS, HRD566, HRP50 1250P
HRD455, HRD725, N895 1500P

SABA
VR6005, VR6014, VR7004, VR7011, VR8011, VR8014 1100P
VR6006, VR6007, VR608, VR6009, VR6018, VR7007, VR7018, VR9006 1250P
VR6016, VR6038, VR7016 1500P

TELEFUNKEN
VR1925, VR1930, VR1940, VR1950, VR925, VR930, VR940, VR950 1100P
A920, VR2920, VR12970, VR7921, VR7926, VR7931, VR7971, VR975 1250P
VR1970, VR1980, VR7970, VR7980, VR970, VR980 1500P

THOMSON
V320, V321, V323, V326, V4200, V4300 1100P
V342, V343, V352, V353, V360, V4210, V4230, V4260 1250P
V364, V368, V4400, V6000 1500P

THORN-FERGUSON
3V35, 3V36, 3V38, 3V39, 3V49, 8943, 8944 1100P
3V44, 3V45, 3V48, 3V54, 3V55, 3V57, 8947, 8947B, 8948 1250p
3V43, 9845 1500P

TOSHIBA
V55, V57 1100P
V65, V66, V67 1250P
V61, V63 1500P

CASSETTE HOUSING

AKAI
VS35, VS53, VS55, VS66, VS75 2600P

FERGUSON
FV31R 4300P

JVC & FERGUSON
HRD515, HRD520, HRD527, HRD540, HRD550, HRD580, HRD600, HRD610, HRD620, HRD660, HRD670, HRD830, HRD840, HRD850, HRD860, HRD4050, HRD6600 & FV37H 2400P

IC TRANSISTORS

M491BB1 500P
SAA5243PE 800P
TIP112H 50P
UPC1488H 150P
STR4090A 650P

IC AND TRANSISTORS

BU506DF 120P
BUZ11 200P
BUZ80 200P
M494B1 700P
SAA5231 300P
SAA1293 550P
S2000A3 175P
S2000AF 175P
S2055A 175P
S2000AF 200P
S2530A 100P
TEA201BA 200P
UC3844 100P
UPC1185H2 400P

REMOTE CONTROLS

AKAI
RC-V10A 1000P
RCV37B 1000P
V25A 1000P

BUSH
2020T, 2114T, 2321T, 2514T 1000P
2020, 2114, 2321, 2514 1000P

DECCA
RC70 850P

FISHER
RC905B 1000P

GRANADA/REDIFFUSION
UNIVERSAL, 79500C, 986700 850P
SATELLITE 1000P
MK4 TEXT, 70115G, 70133G, 70357E 850P
MK4A TEXT, 70375C 850P
95288E 1000P
94490D 1000P

VIDEO SERVICE KITS

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VCR700
Contents
BELT SET. PINCH ROLLER. REEL IDLER. VIDEO LAMP
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FERGUSON & JVC
3V42/43
HRD455/HRD725

Contents	*Economy Kit Contents*
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Order Code: SK37 £17.50	**Order Code: SK38** £9.50

3V58/59/64/65
HRD170/180/210/230/300/320/370/400/430/530/700/750
HRS5000
Contents
BELT SET. PINCH ROLLER. IDELR ARM. TENSION BAND
Order Code: SK44 £8.50

3V29/3V30
HR7200/7300/7350
Contents
BELT SET. PINCH ROLLER. TENSION BAND. IDLER TYRES
Order Code: SK05 £6.00

3V35/36.38/39/49
HRD110/111/120/225
Contents
BELT SET. PINCH ROLLER. TENSION BAND. IDLER TYRES
Order Code: SK04 £5.50

3V31/3V42
HR7600/7610/7650/7655

Contents	*Economy Kit Contents*
BELT SET. T/U REEL TABLE TYRE. PINCH ROLLER. REEL IDERL. T/U CLUTCH. T/U IDLER. TENSION BAND. VIDEO LAMP	BELT SET. T/U REEL TABLE TYRE. PINCH ROLLER. REEL IDLER TYRE. T.U IDERL TYRE. T/U CLUTCH
Order Code: SK33 £12.00	**Order Code: SK34** £5.50

3V35/36/38/39/49
HRD110/111/120/121/225

Contents	*Economy Kit Contents*
BELT SET. T/U REEL TABLE TYRE. SUPPLY REEL TABLE TYRE. PINCH ROLLER. T/U CLUTCH. T/U IDLER. REEL IDLER. TENSION BAND	BELT SET. T/U REEL TABLE TYRE. SUPPLY REEL TABLE TYRE. PINCH ROLLER. T/U CLUTCH. T/U IDLER TYRE. REEL IDLER TYRE
Order Code: SK35 £10.50	**Order Code: SK36** £6.50

3V29/3V30
HR7200/7300/7350

Contents	*Economy Kit Contents*
BELT SET. T/U REEL TABLE TYRE. SUPPLY REEL TABLE TYRE. PINCH ROLLER. REEL IDLER. T/U CLUTCH. T/U IDLER. TENSION BAND. VIDEO LAMP	BELT SET. T/U REEL IDLER TYRE. SUPPLY REEL TABLE TYRE. PINCH ROLLER. REEL IDLE TYRE. T/U IDLER TYRE. T/U CLUTCH
Order Code: SK31 £11.50	**Order Code: SK32** £5.60

3V44/45/48/53/54/55/57
HRP50/HRD140/150/158/160
HRD250/257/565/566/755

Contents	*Economy Kit Contents*
BELT SET. PINCH ROLLER. CLUTCH MECHANISM. TENSION BAND	BELT SET. PINCH ROLLER
Order Code: SK39 £15.00	**Order Code: SK40** £9.50

FISHER
FVHP905/906/907/908/910/911/916/918

Contents	*Economy Kit Contents*
BELT SET. PINCH ROLLER. IDLER. GEAR IDLER UNIT. TENSION BAND	BELT SET. PINCH ROLLER. IDLER TYRE
Order Code: SK57 £13.00	**Order Code: SK58** £5.00

FVHP615/618/620/622/710/711/715/716/720/721/722/725/730/830/840

Contents	*Economy Kit Contents*
BELT SET. PINCH ROLLER. IDLER. GEAR IDLER UNIT. TENSION BAND	BELT SET. PINCH ROLLER. IDLER TYRE
Order Code: SK68 £12.50	**Order Code: SK69** £3.60

HITACHI
VT11/VT33
Contents
BELT SET. PINCH ROLLER. TENSION BAND. IDLER TYRES
Order Code: SK08 £6.00

VT11/VT33

Contents	*Economy Kit Contents*
BELT SET. T/UP REEL TABLE TYRE. SUPPLY REEL TABLE TYRE. PINCH ROLLER. FF/REW IDLER. CLUTCH PLATE. TENSION BAND	BELT SET. PINCH ROLLER. FF/REW IDLER TYRE. T/UP REEL TABLE TYRE. SUPPLY REEL TABLE TYRE
Order Code: SK45 £15.00	**Order Code: SK46** £4.50

VIDEO SERVICE KITS *(Cont.)*

HITACHI
VT52/61/62/63/64/65/85/86/640

Contents	*Economy Kit Contents*
BELT SET. PINCH ROLLER. FF/REW ARM. CLUTCH PLATE. TENSION BAND	BELT SET. PINCH ROLLER. FF/REW IDLER
Order Code: SK49 £14.00	**Order Code: SK50** £3.25

VT400/405/410/13/14/15/18/420/25/26/28/430/31/35/48/450/498/510/520/25/26/530/35/36/540/545/46/48/570/75/576/580/85/88
Contents
TIMING BELT. PINCH ROLLER. FF/REW ARM. CLUTCH BASE. TENSION BAND
Order Code: SK52 £11.50

VT100/110/111/113/115/118/120/125/128/130/135/138/145/150/175/220/225/250/255/258/260/VTL30
Contents
BELT SET. PINCH ROLLER. FF/REW ARM. CLUTCH PLATE. TENSION BAND
Order Code: SK51 £15.00

PANASONIC

NV2000/NV2010	NV7000/NV7200/NV7800
Contents	*Contents*
BELT SET. PINCH ROLLER. TENSION BAND. IDLER TYRES	BELT SET. PINCH ROLLER. TENSION BAND. IDLER TYRES
Order Code: SK03 £6.25	**Order Code: SK02** £5.50

NV300/NV330/NV333/NV340/NV366
Contents
BELT SET. PINCH ROLLER. TENSION BAND. IDLER TYRE
Order Code: SK01 £5.50

NV2000/NV2010

Contents	*Economy Kit Contents*
BELT SET. PINCH ROLLER. FF IDLER. PLAY IDLER. TENSION BAND. VIDEO LAMP	BELT SET. PINCH ROLLER. IDLER TYRE. PULLEY TYRE
Order Code: SK13 £9.50	**Order Code: SK14** £4.50

NV7000/NV7200/NV7800

Contents	*Economy Kit Contents*
BELT SET. PINCH ROLLER. IDLER UNIT. PLAY IDLER. TENSION BAND	BELT SET. PINCH ROLLER. IDLER TYRE. CLUTCH TYRE
Order Code: SK11 £10.00	**Order Code: SK12** £4.20

NV300/NV330/NV333/NV340/NV366

Contents	*Economy Kit Contents*
BELT SET. PINCH ROLLER. IDLER UNIT. PLAY IDLER. TENSION BAND	BELT SET. PINCH ROLLER. IDLER TYRE. PLAY IDLER TYRE
Order Code: SK15 £8.00	**Order Code: SK16** £4.00

NVG7/NVG9/NVG10/NVG11/NVG12/NVG14/NVG15/NVG16/NVG18/NVG30/NVG120/NVG130/NVG400/NVH65 (PX/ACY/AG1810 (P/K)

Contents	*Economy Kit Contents*
LOADING BELT. CAPSTAN BELT. PINCH ROLLER. IDLER. TENSION BAND	LOADING BELT. CAPSTAN BELT. PINCH ROLLER. IDLER TYRE
Order Code: SK27 £9.50	**Order Code: SK28** £4.50

NV332

Contents	*Economy Kit Contents*
BELT SET. PINCH ROLLER. PLAY IDLER. FF/REW IDLER. TENSION BAND. FF/REW TYRE	BELT SET. PINCH ROLLER. PLAY IDLER TYRE. FF/REW IDLER TYRE
Order Code: SK29 £13.00	**Order Code: SK30** £5.10

NV230/250/260/280/430/450/460/470/650/810/890/AG1200PK/AG1500PK

Contents	*Economy Kit Contents*
BELT SET. PINCH ROLLER. IDLER. TENSION BAND	BELT SET. PINCH ROLLER. IDLER TYRE
Order Code: SK23 £7.00	**Order Code: SK24** £3.50

NV600/NV688

Contents	*Economy Kit Contents*
BELT SET. PINCH ROLLER. PLAY IDLER. FF/REW IDLER. TENSION BAND	BELT SET. PINCH ROLLER. PLAY IDLER TYRE. FF/REW IDLER TYRE
Order Code: SK25 £13.00	**Order Code: SK26** £6.50

NV730/NV770

Contents	*Economy Kit Contents*
SLOT IN BELT. LOADING BELT. PINCH ROLLER. IDLER UNIT. TENSION BAND	SLOT IN BELT. LOADING BELT. PINCH ROLLER. IDLER TYRE
Order Code: SK19 £7.00	**Order Code: SK20** £4.30

NV370/NV380/480/630/780/830/850/AG2100PK/AG2200PK

Contents	*Economy Kit Contents*
BELT SET. PINCH ROLLER. IDLER. TENSION BAND	BELT SET. PINCH ROLLER. IDLER TYRE
Order Code: SK21 £7.00	**Order Code: SK22** £3.50

NV777/NV788

Contents	*Economy Kit Contents*
BELT SET. PINCH ROLLER. IDLER UNIT. TENSION BAND	BELT SET. PINCH ROLLER. IDLER TYRE
Order Code: SK17 £7.50	**Order Code: SK18** £4.00

VIDEO SERVICE KITS *(Cont.)*

SHARP
VC381

Contents	*Economy Kit Contents*
BELT SET. PINCH ROLLER. REEL IDLER. TENSION BAND. VIDEO LAMP	BELT SET. PINCH ROLLER. REEL IDLER TYRE
Order Code: SK47 £9.00	**Order Code: SK48** £5.00

VC500/VC571/VC581/VC582/VC583/VC584/VC5F3

Contents	*Economy Kit Contents*
BELT SET. PINCH ROLLER. REEL IDLER. TENSION BAND	BELT SET. PINCH ROLLER. REEL IDLER
Order Code: SK60 £9.50	**Order Code: SK61** £6.50

VC781/VC7810/VC7822/VC785/VC786/VC793/VC800/VCA100/VCA102/VCA104/VCA202

Contents	*Economy Kit Contents*
BELT SET. PINCH ROLLER. REEL DRIVE UNIT. TENSION BAND	BELT SET. PINCH ROLLER. REEL DRIVE UNIT TYRE
Order Code: SK64 £13.50	**Order Code: SK65** £6.25

VC681/VC682/VC684/VC685/VC693/VC699/VC6F3/VC700

Contents	*Economy Kit Contents*
BELT SET. PINCH ROLLER. REEL DRIVE UNIT. TENSION BAND	BELT SET. PINCH ROLLER. REEL DRIVE UNIT TYRE
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ICPF15	ICPN10
ICPF20	ICPN15
ICPF25	ICPN20
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ICPF50	ICPN38
ICPF75	ICPN50
	ICPN75

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COVER PHOTO
This month's cover photograph shows an internal view of the Pace PRD800 satellite receiver. See article on pages 248-251.

REED
BUSINESS
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TELEVISION

Japanese Sandman

The Japanese economy is in a mess. Consider one or two facts. The recession has now lasted for over 32 months, the longest period of economic decline since World War II, and shows no signs of any improvement. With production falling, employment is decreasing and consumers are reluctant to spend. Even if they felt confident enough to borrow, the fact that there is at present a credit squeeze would block this possible means of improving the performance of the economy. There's a credit squeeze not for the usual reason, high interest rates because of economic overheating, but because Japan's banking system is suffering as a result of massive bad debts. There are times in economic life when nothing seems to go right. We've experienced this sort of thing often enough in the UK, though generally for rather different reasons. The Japanese economic boom of the Eighties led to asset overvaluation of a type that can be likened only to the Wall Street bubble of the late Twenties. In the Eighties Japanese share prices rose to astronomic levels that had little to do with the comparative economic performance of firms, the only realistic way of valuing them. This was observed in the West, but we tended to assume that the Japanese had their own ways of doing things and that somehow these gross overvaluations were acceptable. They weren't, of course: reality will intrude sooner or later. But the problem was that Japanese banks had over-invested in securities as prices rose. So had the firms to which they lent: during the boom years some major firms were making greater profits from share dealing than from their core activities. To make matters a great deal worse there was, again like the USA in the Twenties, a simultaneous property boom which the banks fuelled by lending to speculators.

The bubble bursts when an excessive rise in asset values is no longer sustainable and when confidence, which is all that underpins an asset-value boom, for one reason or another declines. Several scandals helped to start the collapse. And once a collapse starts you get the domino effect. The banks have been left with a mass of bad debts, hence the present credit squeeze. Unfortunately the bad debts are still building up faster than the banks are able to write them off. There are reputed to be something like £300bn of bad debts amongst the leading banks, and it's expected that this will affect their performance for the next five-ten years.

Under normal circumstances you can reverse a recession by lowering interest rates. But Japanese interest rates are already negligible – the official discount rate is 1·75 per cent. It's ironical that Japan's trade surplus continues unabated. Because of this the value of the yen can't be lowered to stimulate industry and interest rates can't be lowered – even if there was room for this. There are indeed times in economic affairs when it's difficult to know which way to turn. Generally one has to wait for economic conditions to sort themselves out naturally, which can be a painfully slow process.
Who would have imagined all this in the Seventies and Eighties, when the Japanese economy was forging ahead and taking over the role of the engine of world trade? There was talk of the 21st century being the century of Japanese world domination – that, anyhow, was how the chairmen of Sony and Matsushita saw things. For the West it was a worrying prospect. But at least the Japanese realised that they couldn't monopolise production, which in consequence was spread abroad. In a way it's reassuring to know that Japan is subject to the same economic laws as the rest of us. Now the worry is that the Japanese economy could tip from recession to a full-blown depression because of waning demand, over capacity and excessive stocks. Though their profitability has fallen dramatically, the major Japanese firms seem to be secure enough for the present: the pressure is being felt by the smaller firms and subcontractors, which are losing work as the major firms rely more on their own off-shore plants.

There's no solace to be gained from Japan's economic woes. But at least the threat of Japanese economic hegemony has been removed, for the present at any rate. It is now up to Western manufacturers to make the most of their opportunities. Unfortunately the problem of mature markets and a lack of new developments affects us all. Will the much-vaunted multimedia revolution and increasing opportunities in the service sector provide a way out?

Teletopics

EUROPEAN TV PRODUCTION EXPANDS

Several recent moves suggest that Europe is about to become an increasingly important base for the production of TV receivers. First Gooding Consumer Electronics (GCE), a Welsh firm, has acquired Grundig's factory at Creutzwald in north east France. GCE intends to increase production from the present capacity of 500,000 sets a year to a million within three years. As part of the agreement the factory will continue to produce sets for Grundig until the end of 1994. GCE will then switch to the production of 14, 20 and 21in. sets of its own design for the volume market. The company starts with the advantages of a high-quality, recently modernised factory and a trained workforce. At present, most smaller-screen sets sold in Europe are imported from east Asia. Alfred Gooding, joint owner of GCE with Koen van Driel, a former managing director of Grundig UK, says that with modern, sophisticated production equipment and a well-managed labour force it should be possible to compete with east Asia, which has the disadvantage of having to ship sets half way round the world. GCE has also bought the Minerva brand name from Grundig and the Continental Edison brand name from Thomson of France.

Alfred Gooding has other electronics interests, based in south Wales: Gooding Sanken, a jointly owned company that manufactures power supply units, and Race Electronics, a contract manufacturer that is at present manufacturing, amongst other things, 10,000 satellite TV receivers a week – customers include Dixons and Comet. The satellite receiver activity is significant since it will enable GCE to put together satellite/TV set packages. The group expects to achieve a turnover of £130m this year.

Meanwhile Daewoo has taken an interest in a TV plant at Pruszkow, near Warsaw, Poland. Production of Daewoo TV sets at a rate of 250,000 a year is due to start next month. Further investment over the next few years could boost output to 600,000 sets a year, eighty per cent of which would be exported, mainly to western Europe.

And as part of Samsung's plans to expand production in Europe the company has recently acquired an east German manufacturer of glass for colour TV tubes.

DEVELOPMENTS

Intel and General Instrument have jointly developed equipment to link personal computers to cable TV networks. The technology enables data to be transmitted a thousand times faster than using standard telephone lines. Two leading US cable TV operators are to field test the equipment later this year.

British Telecom is to carry out a field/commercial trial of its video-on-demand system later this year. It will involve some 2,500 houses in the Colchester, Essex area. BT has already demonstrated the transmission of good-quality TV pictures via ordinary telephone lines while these are also in use for ordinary telephone conversations. The aim is to offer subscribers a wide range of entertainment and information services from a central data base for a fee. In the USA Bell Atlantic plans to have a similar service in operation by the end of the year, covering a million households. The aim is to extend this to eight million households by the year 2000.

NTL and Pace Micro Technology Ltd. have formed a partnership to work together on digital TV reception equipment. NTL will be supplying the video compression technology and Pace the design, manufacturing and distribution. Initial production units should be available later this year. Satellite broadcasters plan to start direct-to-home digital services next year.

AT&T Microelectronics, LSI Logic and SGS-Thomson Microelectronics have all announced details of chip sets for MPEG-2 video decoders.

FIRST W-VHS VCR

JVC recently launched the world's first W-VHS VCR. The W-VHS format is designed to handle Japanese HiVision HDTV signals, using metal powder instead of the conventional ferric oxide tape. Model HR-W1 has several recording modes however. The HD mode is used for recording HiVision transmissions when connected to a HiVision TV receiver – the JVC HV-32Z3 TV set has an AV Compulink system for timer recordings. The SD mode is used for recording NTSC signals and is claimed to offer improved picture quality in comparison with a conventional VCR system. The HR-W1 can also record and playback in the S-VHS and VHS modes. It has newly-developed, five-layer Sendust heads and the hi-fi VHS audio system. Dimensions are 445 x 182 x 463mm, power consumption 84W and the price in Japan the equivalent of about £3,875. A three-hour W-VHS tape costs £37, a two-hour version £30. There are no plans at present for a European launch of the system.

DISC SYSTEMS

Kodak has developed an 80cm version of its Photo CD disc. The new disc holds up to 36 photographic images and is intended for use with notebook and laptop computers and personal digital assistants – the standard 120cm disc holds 100 images. The 80cm discs are compatible with CD-ROM, Photo CD and CD-i players, most of which have a disc tray slot for smaller discs. A plastic ring adaptor enables the miniature discs to be used with older machines. The new discs are expected to be available by the end of the year.

The Philips digital video cartridges that enable CD-i decks to play full-motion video titles are at present in short supply.

CONGRATULATIONS RICHARD!

Richard Flowerday, who contributes to our fault finding pages, has been named Sony European Video Technician of the Year. Richard runs Harborne TV Services, Birmingham which he set up after being made redundant in 1986. The award was won in Amsterdam after answering questions on video engineering and tracing three video faults in thirty seven minutes.

IN BRIEF

Philips' Voice Commander, a voice-operated remote control unit, has gone on sale in the UK at £99. . . A new conference entitled 'Television Distribution Technology' will run alongside the Cable and Satellite '94 Exhibition which is being held at Olympia on April 11-13th. . . Mauritron Technical Services, 47A High Street, Chinnor, Oxfordshire OX9 4DJ (0844 351 694) has issued a new technical publications catalogue (edition 18). It's full of items that should be of interest to readers.

VCR Clinic

Reports from Eugene Trundle, Terry Lamoon, Brian Storm, Gerald Smith, Chris Watton, Michael Dranfield, Nick Beer, Simon Bodgett, J.K. Potts, Fauz Ahmed Sumar, John Edwards, John Hopkins and Bob McClenning

Mitsubishi HSB21

The same deck is used in a wide range of Mutsubishi HSB models, so the following problem could probably happen with any of them. When the machine was set to play it would lace up then produce a broken-up still picture (tape stationary) before shutting down again. Sometimes the tape would struggle forwards, producing a very mistracked picture with no sound and no tape-counter action. It didn't touch the capstan or the audio-control head. The cause of all this was that the half-loading arm (C033 in the exploded diagram of the deck) didn't retract fully at eject, so that it was unable to catch and pull the tape when a cassette was next loaded. It was caught behind the take-up tension regulator arm (C031) which moved too far to the left because its brake pad had come adrift, allowing the metal shoe to bear on the rim of the take-up turntable. **E.T.**

Hitachi VTM820

A long search for the cause of a very intermittent squealing noise from this machine's deck, accompanied by a rippled picture, led us to the shaft of the white plastic impedance roller just upstream from the entry tape guide. Giving it a clean, a polish and a single tiny drop of light oil cured the problem. **E.T.**

JVC HRD520

This machine produced off-tape pictures that were marred by multiple thin mistracking bars spaced progressively closer towards the top of the screen. The cause was failure of the entry guide to go fully home – its base jammed in the plastic guide rails that had become distorted or warped. Some careful paring with a file or a very sharp knife gets things moving again. **E.T.**

Samsung SI/SX7220

It took us weeks to find the cause of this machine's very intermittent fault: the tape would run at very high speed to give a search-forward effect, with the sound still present – fast and high-pitched. A dry-joint in the capstan FG feedback line on the 'deck-joint' PCB which sits behind the capstan motor was responsible. It wasn't obvious to the eye: re-make the joints between the board and motor connector CN213. **E.T.**

Hitachi VT63/64

Two other firms had attempted to repair this old-timer, which would sometimes fail to play or record when asked. Between them they had replaced all the belts, the reel idler, the capstan motor drive chip and the thermistor that feeds power to this chip. The real culprit was the capstan motor, which when put on test drew over 1A from a 4V supply! **E.T.**

Panasonic K Deck

The first machine fitted with this new deck came into the workshop recently. It was damaging tapes. When we opened it up and watched the loading we saw that the loading arm pulled the tape up to the control head but didn't lock into place fully. On careful examination it could be seen that the arm was slightly bent over. Realigning it provided a complete cure. It wouldn't surprise us if this became a regular problem with the deck, especially if users try to retrieve tapes from semi-loaded machines as some do. The construction of this arm (P5) is not rigid. **T.L.**

JVC HRD860

The problem with this machine was no E-E sound while the recorded sound buzzed. I checked the sound along to IC6 where it disappeared. Further checks showed that the supply here was low at only 2V. Following this back I found that the full voltage appeared at the connector to the panel. The plug was covered with a gluey substance, presumably to stop it moving. When this had been cleaned off the fault was no longer present. What amazes me is how the machine could work for months before the substance decided to foul up the sound completely. Funny business! **T.L.**

Panasonic NVL20

There was a very poor picture in the review mode while, more seriously, the machine would sometimes throw out tape into the mechanism, much to the detriment of the tape. A careful check on the tape's progress along its path failed to reveal any obstructions or resistance: all the brakes and soft brakes were working faultlessly. The culprit was eventually found to be the head drum entry guide, which had seized. As the guide didn't rotate, the tape's progress was somewhat unstable as it stuck and jumped randomly over the guide. A replacement guide, part no. VXP0863, restored correct operation. **B.S.**

Panasonic NVJ40

This machine intermittently powered down when a tape was inserted. Preliminary checks showed that the head drum didn't start as the tape was loaded – in this machine the tape is fully loaded round the head in the stop mode. Inserting the tape a couple of times would get the machine to work.

As the condition and alignment of the mode switches seemed to be o.k. suspicion fell on the systems and servo control, in particular the microcontroller chip IC6001, but again the verdict was not guilty. I still felt that there had to be a problem with the mode switches. A look at the carriage mode switch, which I'd already replaced, showed that it seemed to be less securely mounted than usual. Holding it securely with my finger as I loaded a tape proved the point: the machine worked faultlessly. A replacement right side cassette housing, part no, VXA4468, cured the problem. The cause of the trouble was the excessive play in the mode switch mounting. **B.S.**

GoldStar GHV1244

This machine wouldn't accept tapes and kept going into the standby mode. An examination showed that the shaft-connect cog on the right-hand side of the lift had a broken pin and spring. A replacement cog and spring assembly and alignment of the lift cogs cured the problem. **G.S.**

Nokia 3722/42

There were no functions and the machine wouldn't accept a tape or power up. The clock display showed four small zeros. A check showed that the back-up 5V supply was low. D7001 was found to be open-circuit while the back-up capacitor C7001 was gradually discharging and not being recharged via D7001. Replacing D7001 cured the problem. You get the same fault when C7001 is leaky. **G.S.**

JVC HRD400

There was no play, fast forward, rewind or eject, the machine going to standby after a few seconds. We found that the reel brakes were jammed on hard and the idler was jammed on the brake mechanism. The clutch spring, which is used along with the 'windmill' to release the reel brakes, was broken and when the mechanism had been stripped down I found that the main cam was also damaged. The slide encoder, the main cam and the clutch spring were replaced and after realignment of the mechanism everything worked correctly. **G.S.**

Nokia 3722/42

A fault we've had with a number of these machines is loops of tape left hanging out when the cassette is ejected. There are two common causes. First a stiff capstan motor. As a result there's no take-up on eject. The cure is to replace the capstan motor. The second cause is a faulty mode switch. This switch can also be responsible for erratic functions, failure to accept tapes and failure to eject them. **G.S.**

Sanyo VHR3100

The cassette would go in only about a quarter of an inch then come out again. On investigation we found that the capstan to idler belt had become very soggy: it had glued itself to the capstan pulley which couldn't turn. A good clean up and some new belts made the machine as good as new. **C.W.**

Ferguson 3V44/JVC HRD140/NordMende V1001

This machine was brought to us because of loss of colour. A tap on the top panel would restore it temporarily, but even after a mass soldering operation the colour was still tap-sensitive. So methodical checks had to be carried out. This brought me to filter BP301, which must have had a poor internal contact. Anyway a replacement restored reliable colour. **C.W.**

Sanyo VHR1100

For tracking errors check both the supply and take-up guide rollers which tend to become loose at the pole base. In the past we've tried to glue them back but this is not a good idea. Replacement of the pole base assemblies gives a reliable cure. **M.Dr.**

Akai VS967

If the capstan motor works in the fast forward and rewind modes but won't turn in the play mode check the fusible resistor FR4 in the power supply. It will almost certainly be open-circuit. **M.Dr.**

Saisho VR3600/Matsui VX755

When this machine had been running for about an hour the capstan motor would momentarily stop for about a second then start to turn, repeating the sequence about every six revolutions to give a play/pause symptom. We've had this fault on many occasions, also with Sharp/Philips machines that use the same (M51782ASP) capstan motor drive chip. Cooling the chip will cure the fault for a while, but beware: on the first occasion we spent some £18 on a new chip only to find that the replacement didn't provide a cure – despite the fact that cooling it restored normal operation. We now replace the motor, which is not much dearer than the chip. **M.Dr.**

Samsung VI910

Field roll was the complaint with this playback-only machine. The cause was insufficient back tension because of sticky grease on the back-tension post bearing. Cleaning and relubrication provides a cure – the cleaning needs to be thorough. **N.B.**

Panasonic NVJ35B

This machine came in dead. That there was no operation on the primary side of the power supply was indicated by absence of the squeal at switch on. We found that diode D1104 (type AP01C) in the snubber network was short-circuit. **N.B.**

Sony SLC30

These machines now suffer from a common affliction that's often not mentioned by the customer. When the machine is repowered after being unplugged the E-E and playback vision are sometimes marred by severe diagonal patterning, at both r.f. and baseband, the latter usually being better. The cause is C319 (22μF, 16V) in the power supply. It goes low in value or open-circuit. **N.B.**

Philips VR6180/Pye DV186

There was no playback f.m., just noise. The cause of this was the fact that the lower drum earthing bracket's securing screw was very loose. When this was tightened there was a nice clean picture but no colour. Recordings were fine when played back on another machine. I found that the f.m. from the head amplifier was about fifty per cent down and rather noisy: this was triggering the colour killer, though the luminance seemed to be perfectly all right. After much searching around I found the cause of the problem. Someone had soldered the leads from pins 1 and 2 of L6 to the print side of the PCB. Fitting them to the connector itself restored the colour. Perhaps a previous attempt to cure the loss of f.m. had gone awry? **N.B.**

Toshiba V209

There was no mechanical action. Checks showed that the 9V output from the power supply was very low. Disconnecting this supply restored the voltage, but there was no excessive load. A replacement STK7253 multiregulator chip cured the fault. **N.B.**

Panasonic NVJ40/42/45/47

In this range of machines a drum motor that appears to be lazy or is mechanically noisy is rarely due to the drum itself. The cause of the fault usually lies in the drive circuit on the small PCB behind the mechanism. You will probably find that one of the three electrolytic capacitors C204/5/6 (0·1µF, 50V) is faulty. **N.B.**

JVC HRD820

This machine suffered from an intermittent loading fault: it would also stop dead in play for no obvious reason. We suspected the syscon sensors but it was the microcontroller chip itself that was faulty. **S.B.**

Panasonic NVJ40

This machine came in with a tape stuck inside. The cause of the trouble turned out to be the capstan motor. Tape loading was o.k., driven by the capstan motor, but once loading was complete and play commenced the motor wouldn't run at the slower speed. **S.B.**

Panasonic NVL25HQ

If there is no output from this machine's power supply it's as well to go straight to C9 (1µF, 350V). It's positioned between two high-wattage resistors that cook it gently, drying it out. **J.K.P.**

Hitachi VT410

There was sound but only a blank white raster. I inserted our colour-bar test tape and checked at the video output socket with a scope. Only a chroma signal was present. This was strange, as one would have expected to see flickering colour on the monitor's screen. The scope was next used to check the luminance signal path. The signal was present at pin 7 of the HT4848B chip IC202 but didn't emerge at pin 1. After confirming that its supply was present we replaced the chip. This restored normal operation. **F.A.S.**

Hitachi VT9500

Fast forward and rewind were o.k. but when play was selected the tape loaded to the heads then unloaded as there was no drum rotation. A check on the supply at pin 4 of the drum chip IC503 produced a reading of 0V instead of 9V. The cause of the fault was the STK5720 regulator chip IC901 on the syscon PCB. **F.A.S.**

JVC HRD211

There was a fast forward/rewind fault with this machine. These modes could be selected and worked, but when stop was selected the tape would thread to the drum and no tape end was sensed - the loading motor would start to screech, then the machine would switch off. The cure was to replace the M50731-626SP mechacon chip. **F.A.S.**

Ferguson FV12L/JVC HRD230

In the E-E and playback modes a single, large hum bar travelled from the bottom to the top of the display on the monitor's screen. A check on the switched 5V line showed that a distorted 500mV, 50Hz squarewave was present. We initially suspected C14 which decouples the switched 5V output at pin 3 of the STK5481 chip IC1. It was o.k. however, the cause of the fault being the chip itself. **J.E.**

Panasonic NV830B

There were snowy E-E and loop-through pictures. This time the cause wasn't the r.f. booster module itself but absence of the 12V supply at its ANT BS input because the RD13EB3 zener diode D1110 was short-circuit. Note that there are two 12V supplies to the module, the always 12V supply and the ANT BS supply which is switched – this is why the fault didn't affect tape playback. **J.E.**

Sanyo VHR3100

The fault with this machine was no rewind. I tackled it the hard way. First I checked the idler assembly and all the parts around it, then I ordered the service manual. This isn't exactly comprehensive, so it took quite a lot of observation to discover what was wrong.

On the underside of the mechanism there's an assembly that consists of a main slide on top of which (with the unit upside down) there's a sub-slide. This has an elongated hole and is held in place by a pin, washer and plastic retaining clip. In the fault condition the sub-slide rode over the pin because the space between the washer and the sub-slide was too great. I carried out a temporary repair by fitting a compression spring between the washer and the plate to hold the sub-slide tighter against the main slide. This worked very well.

I then sent a fax to Sanyo to ask what I should have done. A short time later I received a phone call from Sanyo's Technical Department to tell me that the fault was not an unusual one and that all that was necessary was to push the retaining pin back against the sub-slide and fit a circlip on the other side of the deck to hold it in place. Many thanks Sanyo for a prompt, efficient and polite service. **J.H.**

Mitsubishi HS337

The customer's complaint was that while the sound was o.k. the picture had slowly "evaporated". There was no E-E or playback output though there was a signal at the scart connector. So we knew that the signal was there but wasn't getting to the modulator. The cause of the fault was C2E5 (100µF, 25V). Being close to a power transistor it had slowly and surely baked dry! **B.McC.**

Ferguson 3V48/JVC HRD565

The following fault caused us some sleepless nights. The machine came in with a damaged timer door and PCB. Putting this right was quite easy but when we tested the machine we found that while instant and normal recording worked fine all we got with a timer recording was garbage. The mechanism sprang into action correctly, and checks showed that all the record voltages were the same as with an instant or normal recording. A clue was that when coming out of the timer record mode the E-E display had swirling interference on it: this cleared when the machine was set for another function.

We eventually traced the cause of the fault to C10 which is connected to the switched 5V rail. It allowed parasitic oscillation to get into the f.m. modulator with a timed recording only, destroying any chance of a successful recording. The display gave the impression that there were the remnants of a picture behind the scrambled garbage. **B.McC.**

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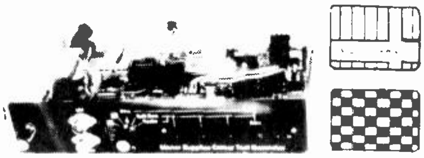

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The Pace PRD800 Satellite Receiver

J. LeJeune

Over the years many TV receiver chassis have been described in these pages. We have not to date undertaken a similar exercise with a satellite receiver. The one selected as an introduction to satellite receiver technology is the Pace PRD800, an integrated receiver-decoder with true Wegener Panda-1 sound processing, 120-programme capability, three scart sockets, a tunable u.h.f. modulator, full satellite radio coverage, parental lock, a four-event 14-day VCR timer and remote control with a sophisticated menu-led system. It has been included in the ranges of several well-known setmakers. For the purposes of this article we examined a Ferguson SRD5.

The complete circuit diagram is quite daunting at first sight, so the general overview shown in Fig. 1 may help you to get a grip on things. Pace use the letter U for their i.c. circuit reference numbers and, in common with many other manufacturers, Q for transistors. Where to start? What better place than the usual one, the power supply circuit.

Chopper Power Supply

The power supply circuit is shown in Fig. 2. It's a conventional chopper arrangement that operates at about 26kHz and provides mains isolation. This is an important point with satellite receivers because of possible access to the outdoor unit and the desirability of having a direct video feed to the main TV set via a scart lead. The circuit operates with a.c. inputs over the range 198-264V, the receiver's maximum power consumption being 35W.

T1 and C1 form a filter to prevent hash from the power supply being fed back into the mains. Diodes D1-4 form the usual bridge rectifier, charging the reservoir capacitor C2 to

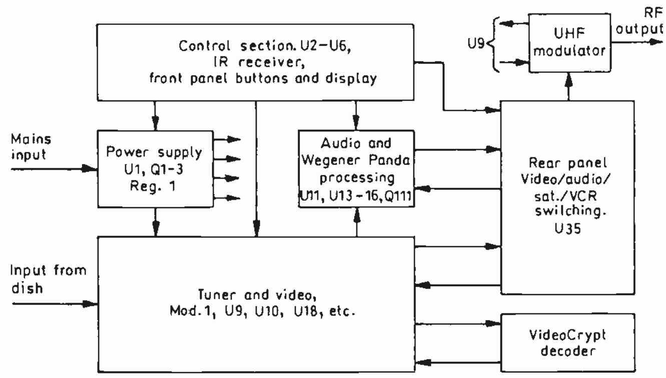

Fig. 1: Simple overview of the Pace PRD800 satellite receiver.

approximately 330V. R1 provides switch-on surge limiting. This mains rectified supply provides a feed for the chopper transformer T2's primary winding (pins 7-13) and a start-up feed via R2.

At switch on R2 charges C6 to establish a supply for the TEA2018 chopper control chip U1. This is fed to pin 6. As the voltage at pin 6 rises, U1 begins to supply drive pulses to

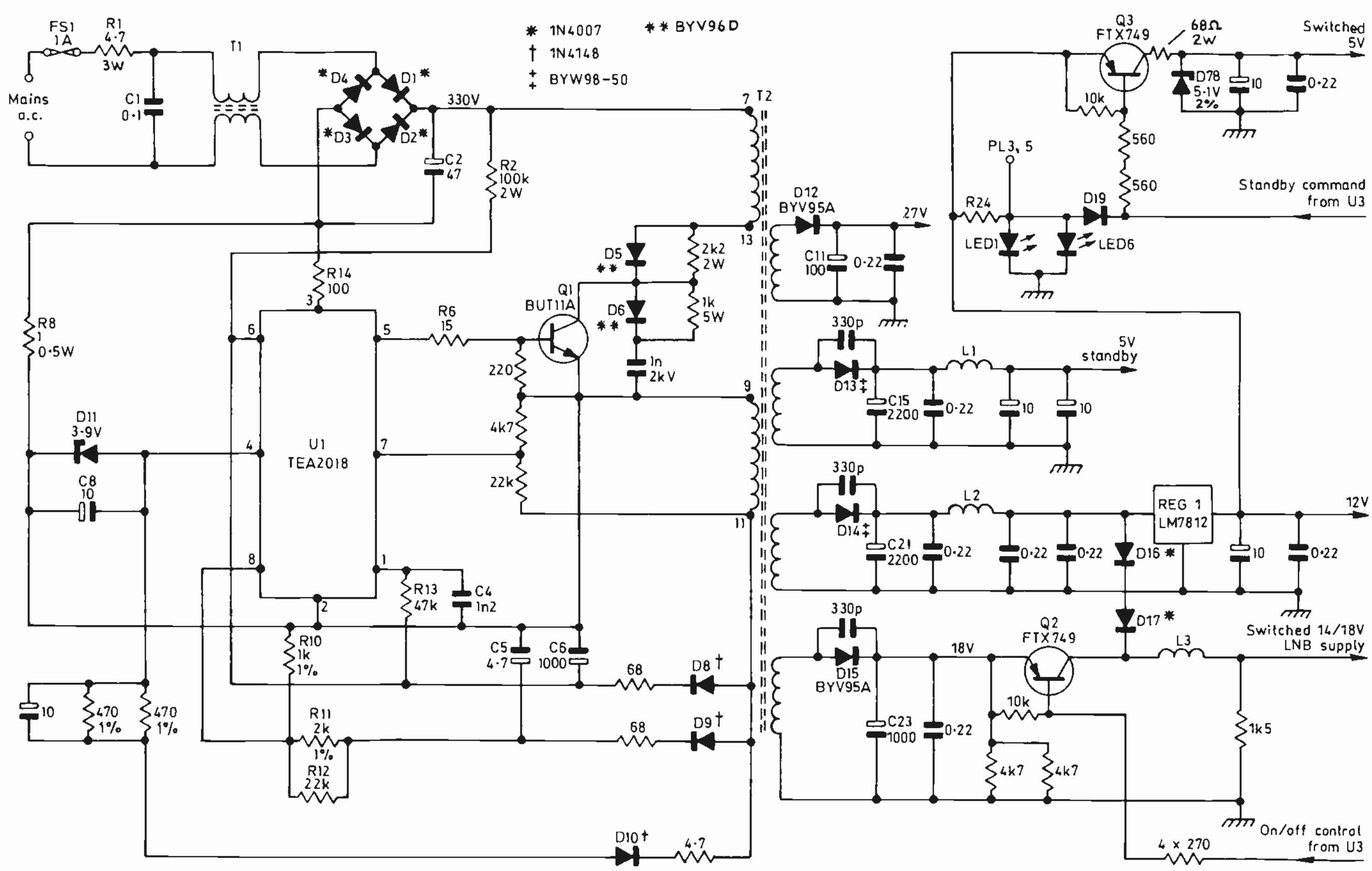

Fig. 2: The chopper power supply circuit.

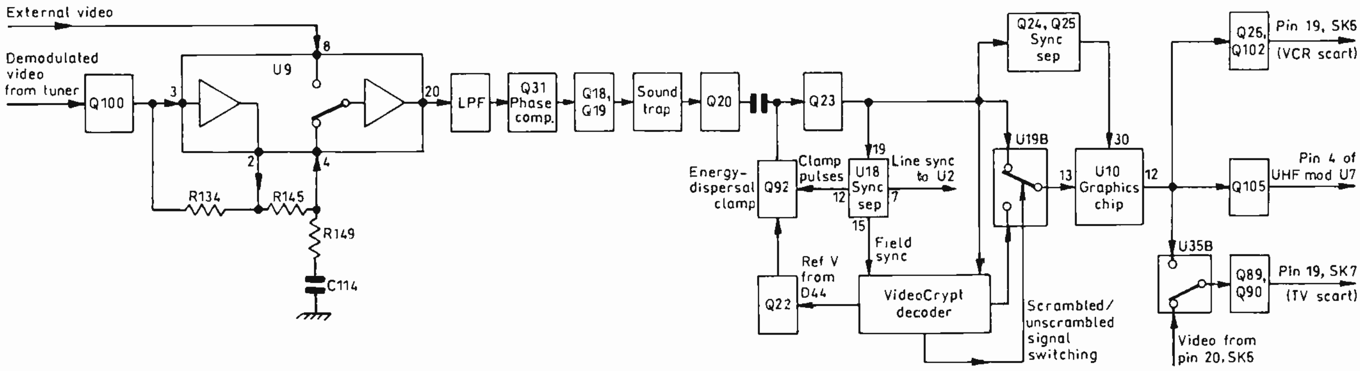

Fig. 3: Block diagram showing the post-demodulator video signal path.

the base of the BUT11A chopper transistor Q1. The capacitance value of C6 is sufficient to provide U1's current demand until the chopper circuit gets going, when D8 comes into operation to maintain the supply across C6 by rectifying the output from winding 9-11 on the transformer. The values of R13 and C4 determine the supply's basic operating frequency.

Two other rectifiers are connected to pin 11 of the transformer. D9 charges C5 which supplies pin 8 of U1 via the potential divider network R10/11/12. This is the voltage sensing pin for supply regulation. When the supply is running normally at full power the voltage at pin 8 is approximately 2·4V.

The chopper transistor Q1 is very effectively switched off by the negative voltage generated by D10 and C8, regulated by the 3·9V zener diode D11. This voltage is fed to pin 4 of the chip. Q1's base is driven from pin 5 via R6.

The low-value (1Ω) resistor R8 connected in series with Q1 generates a voltage proportional to Q1's current. This is fed via R14 to pin 3 of the chip to provide current limiting. The operating principle of this circuit is similar to that of a beam-current limiter. In the event of excess current flowing via R8, Q1 and the primary winding of T2, the rising negative voltage at pin 3 of U1 reduces the mark-space ratio of Q1's drive waveform so that Q1 conducts for a shorter time during each on/off cycle.

There are four rectifiers on the secondary side of the circuit, D12-D15. D13 produces a standby 5V supply across C15. D14 and C21 provide an input for the 12V regulator REG1. Q3 provides a switched 5V supply for the modulator. In the standby mode pin 15 of U3 in the control circuit goes high. This voltage is connected to the base of Q3 which, being a pnp device, switches off. As D19 is also switched off the supply to LED1 and LED6 is no longer shorted out and these diodes light to give the standby indication – note that the indicator circuit is present in some models and not others, including the PRD800. During full-power operation, when Q3 is conductive, zener diode D78 stabilises its collector voltage at 5V.

The 14/18V switched supply for the LNB comes via either D16/17 or Q2 depending on whether Q2 is switched on or off. Q2 is controlled by pin 16 of U3. When Q2 is switched on the LNB receives 18V from the rectifier circuit D15/C23, D16/17 then being biased off.

There are no adjustments, the operation of the circuit being preset by R10/11/12.

Control Circuit

The heart of the control circuit is the microcomputer chip U2 which is a Z8 family device. It runs at a clock frequency of 4MHz, controlled by crystal X1. There are four other chips in this section of the circuit. U3 and U4 are buffers that limit the current drain on U2, U5 is a multiplexer for the front-panel character display while U6 is an EEPROM which stores the information set by the on-screen menus. There are also two transistors, Q96 and Q98, that act as inverters. Pin 6 is U2's reset pin, D20 and C31 giving the reset action. C31 is rapidly discharged by D20 at switch-off, charging slowly at power-up so that pin 6 is held low for a few milliseconds to reset U2.

Video Path

Frequency-synthesis tuning is used. The detected video passes from the tuner-demodulator block via the emitter-follower buffer transistor Q100 to pin 3 of U9, see Fig. 3. A video preamplifier within this chip raises the signal level, the amplified output emerging at pin 2. Video gain is set by the feedback resistor R134 while R145, R149 and C114 provide de-emphasis. The signal returns to U9 at pin 4, after which an internal switch selects either external or internal video. Further amplification is then provided, the video signal finally leaving U9 at pin 20. The following low-pass filter (L10/11, C103/4/5/6) has a 5·5MHz cut-off frequency. Correction for the group-delay effects (phase shift varying with frequency) introduced by this filter is provided by the circuitry around Q31. The circuitry associated with Q18/19 filters out the sound subcarriers.

Up to this point the video signal still has imposed on it the triangular 'energy-dispersal' signal that's added before transmission to prevent interference with other microwave services. If the 25Hz energy-dispersal waveform was not removed the picture would suffer from intolerable flicker – and VideoCrypt decoding would be impossible. Very tight video signal clamping to a stable d.c. level is carried out, line-by-line, by field-effect transistor Q92 in Q23's base circuit – Q23 is an emitter-follower buffer transistor. Fig. 4 illustrates the action of this clamp.

Clamping is done at the start of every line, during the back porch that carries the colour burst. A pulse from pin 12 of U18 switches Q92 on, setting Q23's base voltage at a d.c. level which is determined by D44 and Q22 – D44 is a 2·4V zener diode that's within the VideoCrypt decoder. The f.e.t. Q92 has a low on and a very high off resistance, so that once Q23's base voltage has been set Q92 will not leak away the clamp charge on the video coupling capacitors C132/C313. This circuit provides the accurate clamping required for the VideoCrypt decoder to produce noise-free, unscrambled pictures.

After clamping the video signal goes four ways. One path is to pin 19 of U18, which provides the gating pulses for the energy-dispersal clamp at pin 12, field sync pulses for the VideoCrypt decoder at pin 15, and at pin 7 line sync pulses for pin 39 of U2 which uses them to identify the presence of a station for muting purposes. A second feed goes to Q24/5 which form a sync separator circuit that feeds composite sync

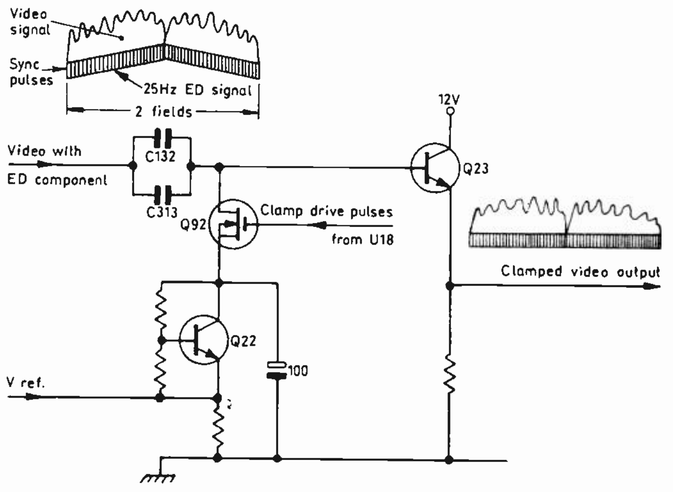

Fig. 4: Action of the clamp that removes the 25Hz energy-dispersal signal.

to pin 30 of U10, the graphics generator. The third and fourth feeds both end up at the switch in U19B, one feed going there directly while the other one goes via the VideoCrypt decoder. The output from U19B goes to pin 13 of the graphics generator chip U10 where the colour graphics are inserted into the picture or replace it. U10's output, at pin 12, is fed to pin 19 of the VCR scart socket SK6 via Q26 and Q103, to pin 4 of the modulator chip U7 via Q105, and to switch element U35B: this feed ends up, via Q90 and Q89, at pin 19 of the TV scart socket SK7.

The Modulator

The modulator module includes the r.f. bypass circuit for off-air signals passing through the receiver and the r.f. combiner circuit which adds the modulator's output to the off-air spectrum. A two-stage, broad-band circuit with a gain of about 3dB amplifies the off-air signals: this low gain is provided simply to compensate for the losses incurred in the combining process.

The modulator itself is within U7. Fig. 5 shows a block diagram of this chip and the tuning system. Varicap diode D21 and its associated components tune the video carrier oscillator. D21's cathode is biased by a 0-24V supply from pin 14 of U9 via Q9/Q97. Prescaler U8 takes an output from video carrier oscillator, producing a divided-down output in the range 7-14MHz. This is fed to the phase-locked loop tuning system in U9. The 4MHz clock signal from pin 29 of the microcomputer chip U2 provides the reference for the PLL system. Control of the PLL in U9 is from U2 via the I2C bus. The audio section is tuned and frequency modulated by varicap diode D79 and its associated components.

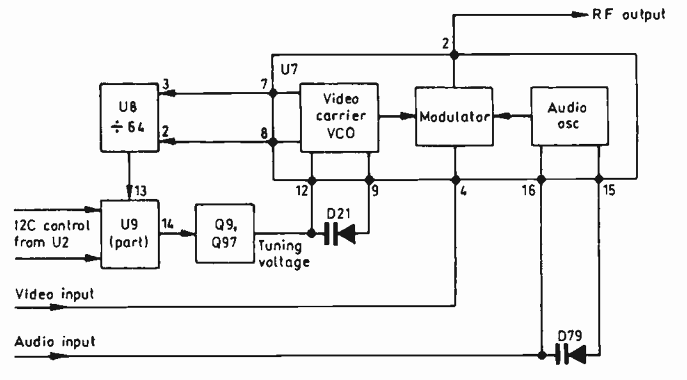

Fig. 5: Block diagram of the u.h.f. modulator and its tuning system.

Colour Graphics

The colour graphics chip U10 is controlled by the microcomputer chip U2 via the I2C bus. Fig. 6 shows the circuitry in this area. The 17·734MHz crystal X2 is resonant at four times the colour subcarrier frequency. It uses a PLL to lock to the received colour burst. L12, C119 and C120 tune the character generator readout clock oscillator.

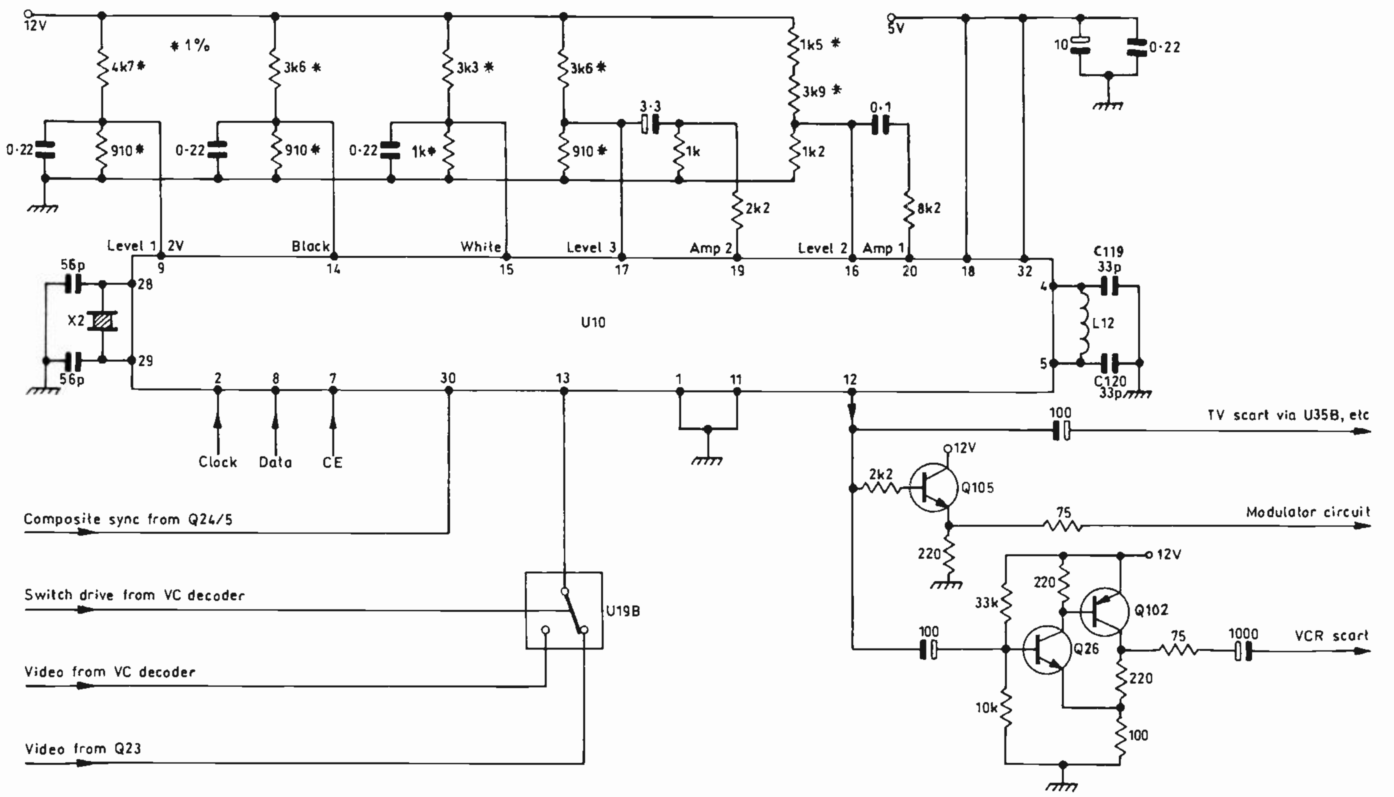

Fig. 6: The colour graphics chip circuitry.

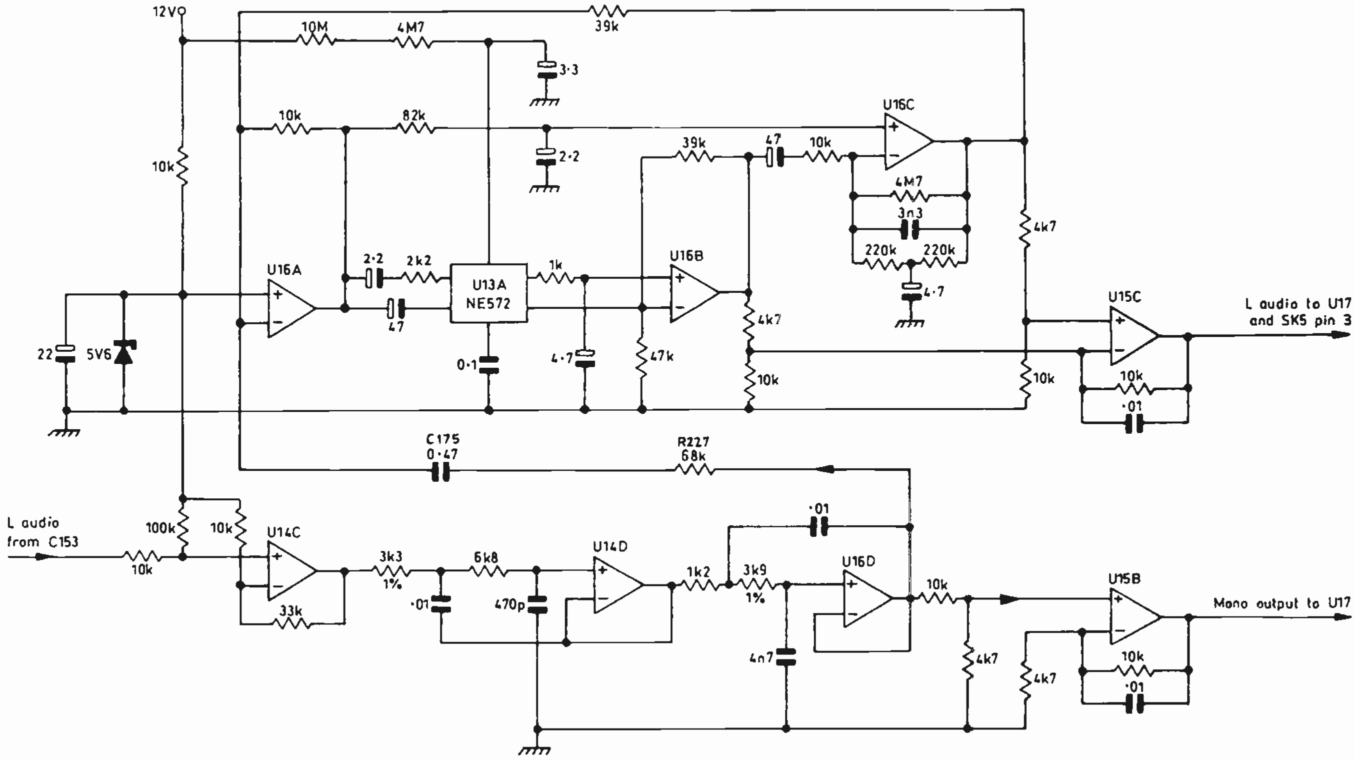

Fig. 7: The left-hand audio channel signal-processing circuitry.

The presence of scrambled video is detected by the decoder which produces an output to control the video source select switch U19B. When a clear transmission is detected this switch passes the direct video feed from Q23 to pin 13 of U10. When there is no video signal U2 detects the absence of line sync pulses and tells U10 to insert a blue background for the white characters. The video/graphics output at pin 12 is passed to the modulator via emitter-follower Q105. There are also feeds to the TV and VCR scart sockets as shown.

The sync tip, signal black and peak white levels and other parameters for the graphics are set by the networks connected to pins 9, 14, 15, 16, 17, 19 and 20 of U10.

VideoCrypt

Because of the confidential nature of VideoCrypt decoding the circuitry used is not divulged.

Audio

The demodulator's output contains a spectrum of signals from 50Hz to nearly 8MHz. Video occupies the spectrum up to 5·5MHz, the audio subcarriers beginning at 6·5MHz. They are frequency modulated and consist of single mono carriers and pairs of stereo carriers grouped in the standard way: the main mono subcarrier is at 6·5MHz, the first stereo pair at 7·02MHz and 7·20MHz and the second pair at 7·38MHz and 7·56MHz.

U11 performs audio selection by up-conversion of the audio subcarriers to 10·52MHz and 10·70MHz. The switching is controlled by software, the left-hand channel only being selected for mono operation. U11 also carries out limiting and demodulation.

Many satellite broadcasters use Wegener Panda stereo. This is catered for by a Dolby-like expander and sliding high-pass filter, the latter depending on the audio signal's h.f. content. In addition a noise-cancelling system which uses filtering and inversion improves the signal-to-noise ratio before signal de-emphasis. This filters off the noise, inverts it and adds it to the unfiltered audio to cancel the noise content – a similar process is used in VCRs. Fig. 7 shows the left-hand audio processing circuitry.

U14C, U14D and U16D provide a 24dB per octave roll-off above 15kHz. The mono signal is taken from U16D and passed via U15B to the audio switching circuits. The left-hand stereo signal goes via R227 and C175 to U16A which has a gain of around 17dB. U13A contains a variable-gain amplifier which is controlled by bias from an internal rectifier circuit: the larger the output from the rectifier, the greater the amplifier's gain. This brings about the volume range expansion. U16C is an active variable low-pass filter that's driven by U16B. U15C receives the filtered and full-bandwidth signals, cancelling the noise and carrying out audio de-emphasis.

In Conclusion

This concludes our look at some of the circuitry used in the Pace PRD800 and its clones. We've found that the unit is very reliable in operation, with few problems. Possibly the biggest problem was radiation that affected low-end u.h.f. channels up to about Channel 42: later production units are markedly better in this respect and we can get around the few problems we do encounter by using high-quality r.f. leads and carefully positioning the unit. Replacement lead sets for use with earlier receivers are available to bona fide dealers/service companies free of charge from Pace Micro Technology Ltd., Victoria Road, Shipley, W. Yorkshire BD18 3LF (0274 532 000, fax 0274 532 010). Blown chopper transistors were apparently a problem with early models, and because of this the value of R8 was changed from 0·75Ω to 1Ω, but we've never experienced any failures in this part of the receiver. Because the coaxial connectors for the terrestrial TV aerial and the r.f. output lead are soldered directly to the PCB you may encounter dry-joints should frequent disconnections and reconnections be made. The electronic failures we've encountered have been too few to mention. In fact it's an excellent unit all round.

For a short review of the PRD800, see the December 1992 issue of *Television*.

What a Life!

Donald Bullock

Les Lawry-Johns' death was a great loss to us all. In a practical sense he was a technical wizard of his time. But the reason for his great popularity amongst readers – I suspect that most long-term readers turned to his article first when the latest magazine arrived – went deeper than this. He was one of us, a fellow sufferer at the hands of Joe Public. We knew those who caused him such trouble: thinly disguised, they circulate amongst us all. Like the rest of us, Les knew exactly what they were up to. Yet he continued to suffer because his tormentors – our tormentors – have no code of honour. Like us all he constantly resolved to harden, to make the most of his experience so that he would come off best in future. But he seldom did, and nor do we. It isn't in our stars. We're born losers.

Les's troubles were ours. But he was a bit more honest, a bit more vulnerable and a great deal more decent than most of us. His writing left us all richer. I, for one, am grateful to him.

Grundig Troubles

Kevin Bentun brought his Grundig colour set in the other day – a CUC2401 type. "It's gone mental" he announced. "All right at first, then the sound and picture fade, leaving the screen bright. After a while the picture comes back and flutters at me. Enough to get a chap's dander up, I can tell you." And off he minced.

Hoping to resolder a few dry-joints and make some quick money I got cracking. There would, I figured, probably be a line output transformer derived supply playing up. An hour later I'd got nowhere, so I decided to stop and try to think about it. Well, it could be the line output transformer. We had one like it in stock, so I fitted it. This made no difference. I next connected a voltmeter to the tuner's 12V supply. When the fault returned, the voltage swung about. On opening the tuner I saw several suspect joints, but resoldering them didn't help. As the supply remained stable when it was connected to a dummy load I carried out a more detailed examination of the tuner and soon found a 220µF, 10V electrolytic that had dried up. A replacement cured the trouble.

Then, surprise, surprise, Mr. Fussie fidgeted in with another Grundig set that was just the same.

"It's never been right since you mended our wireless" he bickered. "I took it to Snoddies and they fitted some parts and charged me £40, but it's still the same."

"Why don't you take it back to them?"

"They recommended you."

As the fault was identical to the pervious one I mended it in no time. He returned shortly after I'd phoned him with the news.

"What was it?" he moaned, looking at me as though I was a bad drain.

"A condenser" I said. "Twenty five pounds."

"How much was the part?" he asked.

"Tuppence" I replied.

"That's sixty five pounds in all" he whined, "Snoddies said you might be expensive. Can you guarantee that another part won't go? Could this have damaged anything else in the house?"

I gave him a deranged look and he departed, leaving me wondering why, all those years ago, my people put me in this trade when the local paper beckoned me. The extra pound a week I suppose. Oh to start again!

Video Problems

Mrs. Tubby rolled in from the Forest of Dean with something in a plastic bin liner. "How much to mend this?" she asked, eyeing me as though I was a sneak thief.

"What is it?" I asked.

"Wonky" she said.

After a delay she extracted the item from its bag. It was a Philips/Pye DV286 VCR that was matted with greasy dust and had strands of tape hanging from its mouth.

"Help" I muttered as I waved her out. Then I called Steven in from the van. "Your job" I said.

"What's up with it?" he asked.

"Wonky" I replied. He gave me an odd look and took it over to his bench.

Having unloaded that one I pulled a Ferguson 3V47 portable VCR on to the bench. "Picture was intermittent, now gone. Sound o.k." said the card. The machine was full of dust and tape debris. So I gave it a thorough service and tried it again. It was no better. I took the video heads out and found that the leads hadn't taken to the solder when the machine was produced. They were held only by the resin. After resoldering them I tried the machine again. The results were excellent. As I was boxing it up I looked over at Steven. He'd finished the Philips video and was doing the bill.

"What was it?" I asked.

"A jammed Chinese cassette and a missing spring which should have held the back-tension arm by the tail. I found it in the works. It's o.k. now. What shall I charge?"

"Up to you" I said. "But you won't win. If you charge enough you'll be a rogue. If you make a small charge it was easy and you shouldn't have charged anything at all. And God help you if it goes wrong again or another of her Happy Friend tapes jams. And don't phone her yet, because that will mean that there couldn't have been anything much wrong with it."

"I wouldn't mind a cup of tea" said Steven. I got the message. Never mind. Who sits on pride after a forty year battering?

Miscellaneous Faults

As I set about making the tea Steven pulled a Panasonic TX5500 (U5 chassis) on to the bench. The card said "no brightness". He stood there pondering.

"IC601" I said.

"You see what?" he asked.

"It won't be a no brightness fault" I said. "Almost certainly it'll be no luminance because the TDA3562A chip IC601 on the upright panel to the right of the main chassis has failed. Don't forget the A" I added as he looked in the i.c. drawer. "You'll get nowhere if you fit one that doesn't have the A suffix."

So that's what he fitted, curing the trouble.

Then he pulled a Neff 6007 microwave oven on to his bench. When he operated it the counter worked but the rest didn't.

"What do you think's up with this?" he asked.

"Dunno" I said, "and when you find out, shield me from the answer."

A short while later he had it working. The switch at the top of the door had burnt out. Whilst at it he replaced them all.

As I was washing up he got busy with an Hitachi VT8300 that wouldn't accept a tape. It didn't take him long to discover that the loading motor wasn't working. "There's 6V on the pink supply lead" he said "and only 0·4V on the white. I'll check around IC905 and 906."

"Check R081 while you're doing that" I said. It was open-circuit, a replacement restoring normal operation.

Visitors

Just then the door flew open and an RAF chappie from the nearby estate breezed in. He was carrying a cardboard box that contained a dismantled television set.

"Ah!" he said. "They tell me you're good with a screwdriver! I got this set for nothing in Germany. When I brought it back the sound needed twiddling. So I had a go and swapped some of those things with legs. Some smoke came out of there, where it's gone black. I don't mind letting you do it, but I don't want to spend. . ."

I opened the door and jerked my head. Off he went. I felt the need for some air and wandered out to have a word with Brian who does a bit of gardening for us. He always looks well and smart and as usual had a cigar wedged in his mouth. He was clipping at some bushes. A van spluttered up and out leapt this all-in wrestler with a Ferguson 3V00 video, also dismantled.

"Where's Mr. Bullock, mate?" he asked me thickly. Then he saw Brian and shot over to him.

"Ah Mr. Bullock. This thing's got a volt gone wrong. It isn't much and won't take long. Don't wanna spend much, see. . ."

I sauntered off and Steven appeared. Later I came in at the back of the workshop and found him putting it together. "What do you think of this trade?" I asked him.

"It's good fun" he replied.

That's what I used to think. What's gone wrong with me?

Test Case 374

In the early Eighties the Ferguson TX range of TV sets was all the rage: Sage still has a TX tie that was presented to him by a sales rep. or a TLO in those far-off days. It's a tribute to the design of these sets that many of them are still going strong. One, now well into its second decade of operation, found its way on to Dylan's bench the other day. It was a TX9 of the later sort, with a chopper power supply and PC1044 main panel.

The complaint was about 'green faces'. Sure enough Anne Diamond, who was on at the time, looked as though she had just crossed the North Sea in a force ten gale. Everyone else on the show had the same bilious look. This meant a lack of red in the set's display. As a check the output from a colour-bar generator was fed to the set. The red bar was very muted, and some of the other colours looked a bit strange: blue and green were bright and clear however, despite the fact that the tube was probably a bit tired.

Dylan thought that the tube was likely to be responsible for the lack of red in the display. Out came the wonderful tube tester and, after some rooting about in the box, a base to match the tube. On test the emission of all three guns was found to be a little low, but the red gun was the second best one. All three were brought up to scratch by using the tester/reactivator's 'clean-and balance' facility. When the set was tested the picture was a degree brighter but the low-red fault remained the same. A reasonable monochrome picture was present with the colour control turned to minimum but, as TV Ted said, red is the colour you miss least with a monochrome display.

Dylan switched on his scope and pulled his multimeter across the bench. The first check he made was at the tube's red cathode, where the voltage was rather higher than the 125V specified in the manual. He felt the red output transistor's collector load resistor R132 and found that it was cooler than those in the blue and green output stages. Dylan decided to check the resistor's value, which was correct at 12kΩ, so he went on to twiddle the red gain and background controls RV136 and RV138. The red in the colour-bar display changed a bit as these controls were wound from one end to the other, but at no point was it correct. Dylan began to suspect the BF460 red output transistor itself, TR56. As a check he swapped it over with the corresponding transistor in the blue channel, TR55. This made no difference at all, the transplanted transistor working perfectly well in its new position.

A scope check on the red output signal at pin 12 of the TDA3560 colour decoder chip IC52 was then carried out. For comparison purposes the green and blue output signals at pins 14 and 16 were also looked at. There was certainly something wrong with the red output: its amplitude was low, and the d.c. level was below the specified 3·8V. Could something external to the chip be loading down the red output? R113 and R107 in the feed to TR56 were checked and found to be o.k., as were all the components in the transistor's emitter circuit including the frequency-selective decoupler C95. What else was there to suspect other than the chip itself?

Dylan trotted off to the component store and came back with a pristine TDA3560. When he'd finished installing it he had no doubt in his mind that he'd cured the fault: the diagnosis had been thorough, and every other possible culprit had been eliminated, hadn't it? With a flourish he flung the old chip in the bin and switched the set on. There was Father Christmas on the screen, in a pale, luminous green coat. The fault was still there! Dylan hastily retrieved the TDA3560 chip, which was still warm, from the bin. If you can't work out what was the cause of the fault, turn to page 281.

Dolby Surround Sound

Ian Martin

Several TV models equipped with Dolby Surround sound have been introduced during the last couple of years. This feature had previously been available only with professional cinema and audio products, such as the Pioneer AV amplifier reviewed in the August 1991 issue of *Television*. Widescreen video releases, Laserdiscs and large-screen TV sets have all stimulated interest in 'home cinema'. Toshiba and Hitachi at present have models with Dolby Surround and the more sophisticated Dolby Pro Logic Surround sound: other setmakers will doubtless follow

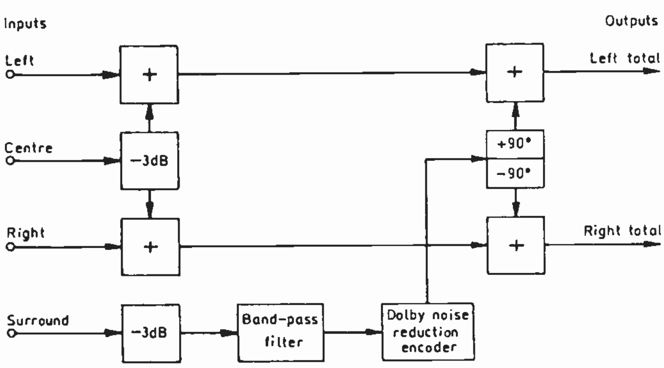

Fig. 1: Dolby Stereo Surround sound encoder block diagram.

suit. In addition Pace has a satellite receiver with VideoCrypt and Pro Logic decoders, aimed at the subscription movie channel market. And why not? What better way for viewers to get maximum value for money from their premium movie subscriptions?

It's not only consumer awareness that has led to the sale of the almost nine million Dolby Surround sound systems now in use worldwide (Dolby's figures). Advancing chip technology has also played a part. Just two years ago a simple passive decoder such as that used in the Toshiba Models 2505DB and 2805DB needed several different chips for signal processing, noise reduction, memory and the control logic. Because active Pro Logic decoders require even more sophisticated electronics, their introduction in cost-efficient TV designs was held back pending the arrival of custom Dolby chips. Such devices are now available from several manufacturers, including Analogue Devices and Mitsubishi.

The situation has changed again over the past year or so as Digital Sound Processor chips (DSPs) have become more widely available. Initially they offered only acoustic and pre-programmed effects, but it was only a matter of time before a Dolby Pro Logic algorithm was incorporated and approved. Such devices, licensed by Dolby, are now available from Motorola and Yamaha amongst others. They can be easier and cheaper to produce than a bipolar ASIC (application specific integrated circuit) chip, as the Dolby processing is controlled by a program that's within the device.

Before we consider a typical decoder design we'll outline how the surround system works.

Dolby Stereo

The system stems from cinema requirements. In a cinema, traditional stereo sound is effective only for viewers sitting near the centre axis of the screen. For those seated off axis the output from one loudspeaker or the other will predominate, giving an unbalanced stereo image. The stereo sound 'sweet spot', i.e. the area in which a realistic, balanced effect is obtained, is in fact quite small. It was found that if a centre channel was added, primarily for dialogue, driving a loudspeaker mounted behind the screen speech was effectively fixed within the picture. This gave acceptable results even for viewers sat near the edges of the theatre. In other words the 'sweet spot' became much larger. The addition of a rear surround channel boosted the effect further by giving the sound a three-dimensional quality. Several surround speakers could be used for this purpose.

Although some film formats enable four or more sound channels to be used, for 35mm films with optical stereo-sound tracks it was necessary to devise a system that encoded four channels as two. The system that came into use was called Dolby Stereo. Fig. 1 shows a block diagram of the encoder. The left and right sound channel signals pass straight through, the centre and surround channel signals being added to them, the latter as phase-shifted signals. As the left and right channels produce the

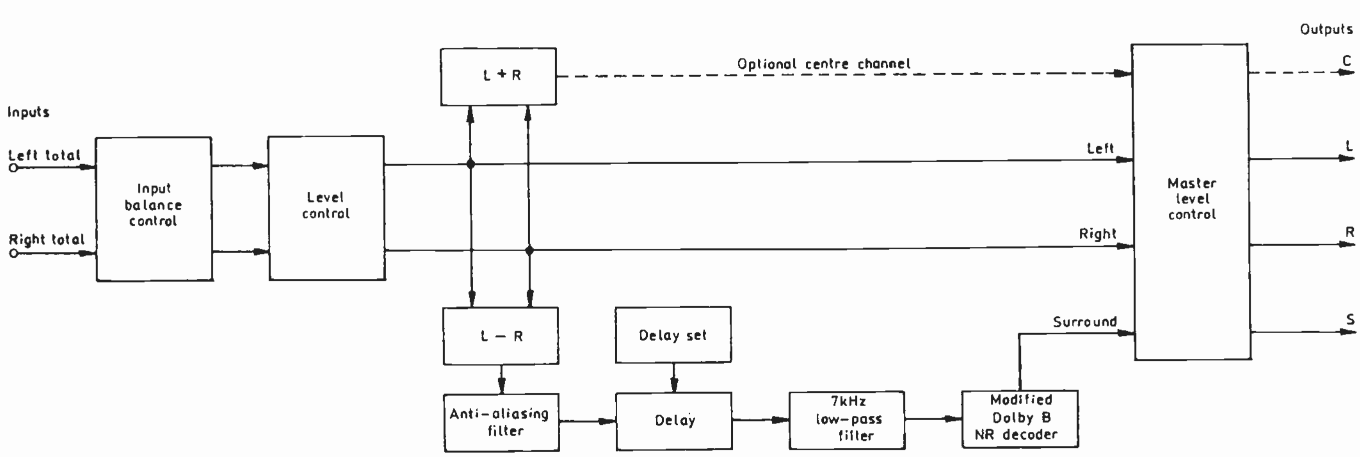

Fig. 2: Passive Surround sound decoder block diagram.

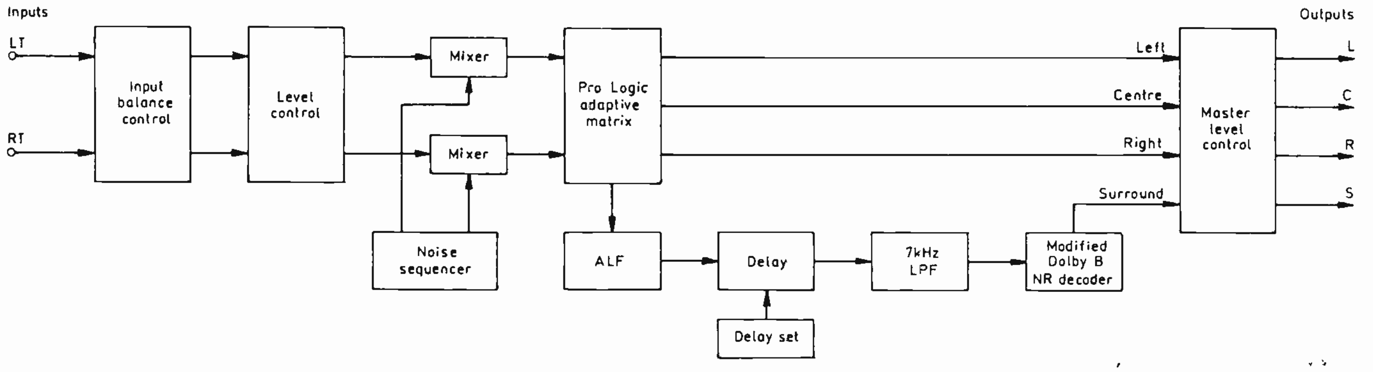

Fig. 3: Pro Logic decoder block diagram.

left total and right total outputs there's no reduction in the basic stereo channel separation.

Dolby Surround

In the decoder, see Fig. 2, the centre and surround channels are recovered by addition and subtraction. Provided the left total and right total signals remain balanced, crosstalk is kept at a minimum. Because the left total and right total channels also carry the centre channel information, for domestic use the centre channel was considered to be optional – the left and right speakers together create a 'phantom' centre channel. The enlarged 'sweet-spot' effect is reduced, but this is not as significant in the home as in an auditorium. This is the system that was used in the first Toshiba Dolby Surround TV models.

To reduce unwanted effects – sibilants could for example be decoded as surround information – filtering is used in the surround channel. For similar reasons a modified Dolby B noise-reduction circuit is used: this reduces hiss, which might otherwise be enhanced. An audio delay is also available. This introduces an artificial lag in the surround channel to give, in accordance with the Hass effect principle, the impression of a larger listening room. Dolby Laboratories recommend various delay times for differently sized rooms. For the average UK living room the delay is in the range 15-25msec.

Because this system uses a simple difference signal to produce the surround channel it's described as a 'passive' surround system.

Dolby Pro Logic

Dolby Pro Logic Surround is a second-generation system that employs additional circuitry to enhance the spatial positioning of sound effects. This is done by continuously monitoring the encoded sound track and evaluating the direction and intensity of dominant sound effects, which are then enhanced in the same direction in proportion to the sound's dominance. To do this a 'signal dominance vector' that tells the decoder in which direction the current effect is positioned has to be generated.

Fig. 3 shows a block diagram of a Pro Logic decoder while Fig. 4 shows some of the elements of the adaptive matrix, which is the heart of Pro Logic processing. The relative intensities of the left, right, centre and surround signals are assessed in the adaptive matrix by first full-wave rectifying them then feeding the outputs to log difference amplifiers which compare these to provide left-right and centre-surround difference signals. Representations of the left-right and centre-surround axes are thus obtained. When a signal appears front left, the left-right and centre-surround difference signals both become positive. A vector is in this way be produced, indicating the sound effect's direction and intensity. When an effect exceeds a certain intensity threshold the decoder switches to 'fast mode', in which polarity splitters convert the two dominance signals to four control voltages, EL, ER, EC and ES, that represent each of the primary directions. These drive four voltage-controlled amplifiers in each of the left and right channels. These eight VCA components and the two left and right components are then weighted and combined in a network. The result is an enhanced effect that remains directionally accurate. As the adaptive matrix contains active operational circuitry, Pro Logic is referred to as an 'active' surround system.

The rest of the Pro Logic decoder is similar to the

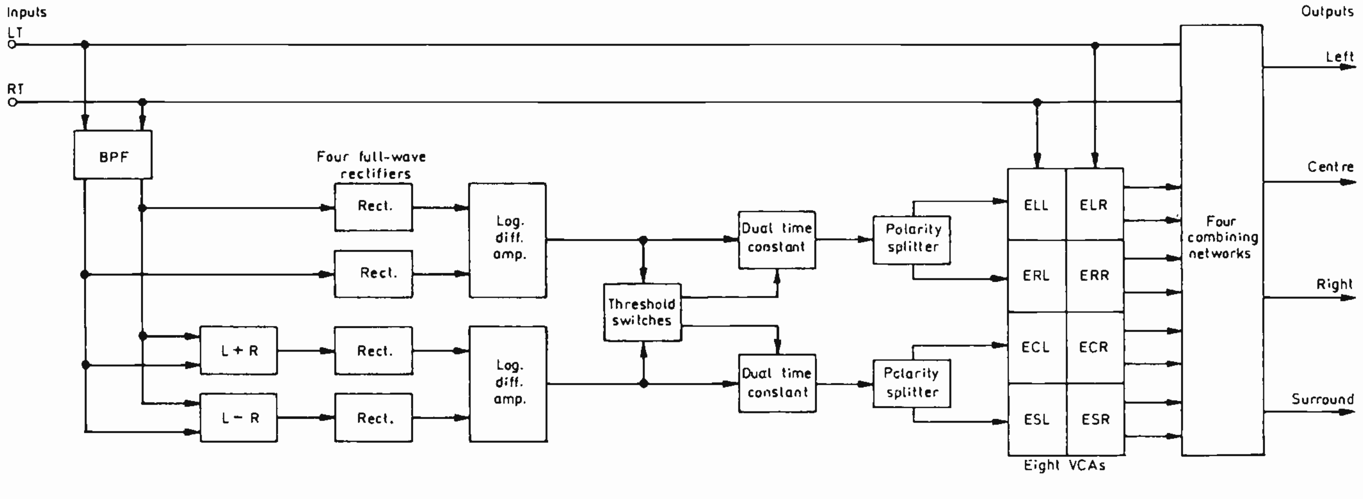

Fig. 4: Pro Logic adaptive matrix block diagram.

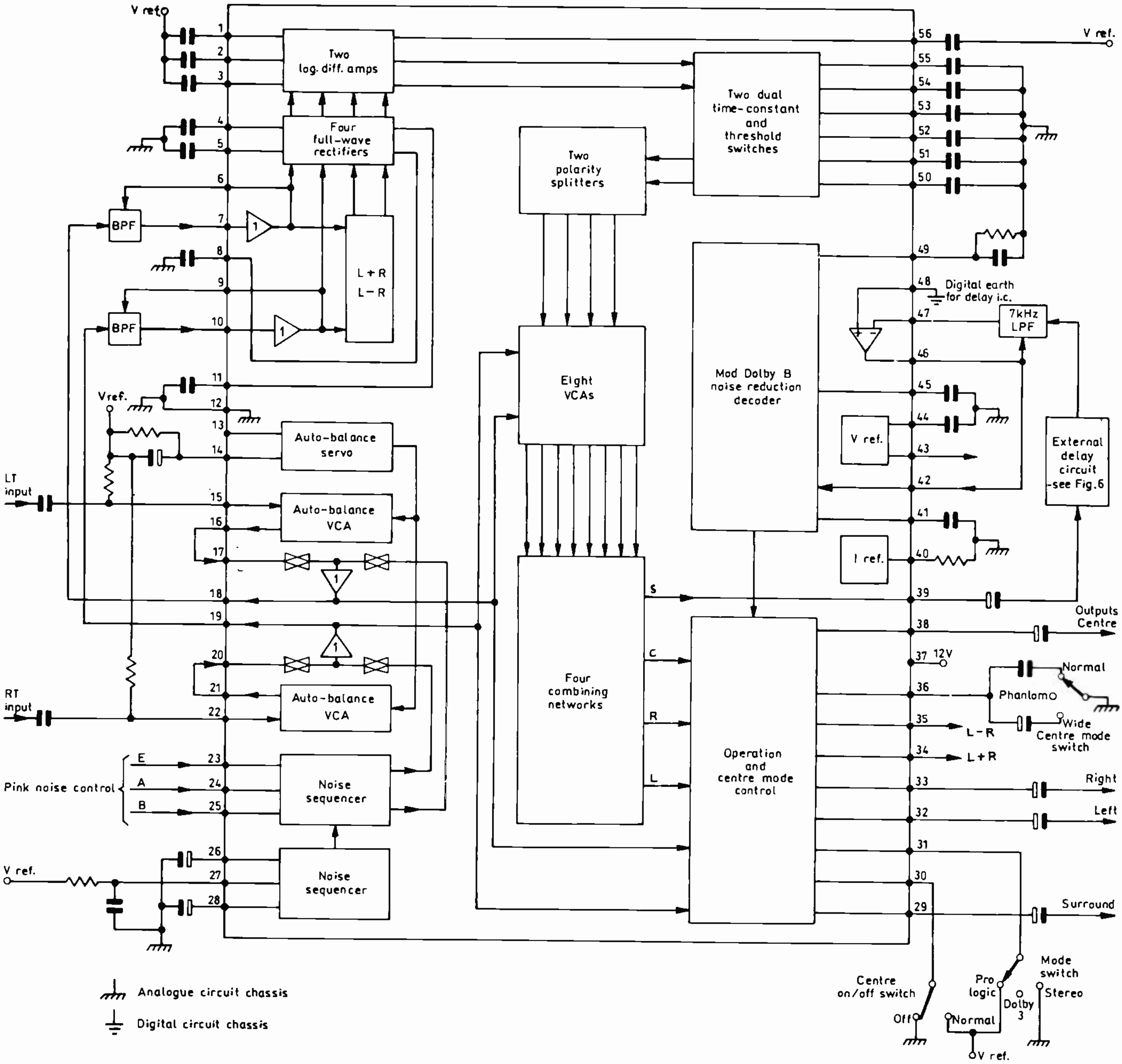

Fig. 5: Operation of the M69032P Dolby Pro Logic Surround processor.

simple passive type except that a noise sequencer is provided. This, when activated, sends pink noise sequentially to each of the channels so that the user can set up his system's balance controls. Pro Logic systems usually have automatic input balance circuits as well.

Centre and Surround Modes

A few options are available when a Dolby Surround sound system is being designed or set up. Most depend on loudspeaker availability.

A 'phantom' centre speaker arrangement was mentioned earlier. Best results will be achieved however if a separate centre speaker is used. As this channel carries mainly speech information, with a limited bandwidth, a low-cost speaker will suffice. Another centre channel mode, called 'wide', is provided for use with a high-quality, full-range centre speaker: this ensures that the high- and low-frequency signals are distributed across the left, right and centre channels.

The positioning of the centre speaker is one of the biggest problems a TV receiver manufacturer faces when Dolby Surround sound is to be incorporated. Though a small, low-cost unit may suffice it will have to be mounted close to the screen, so magnetic shielding or cancellation must be provided. For this reason many models use the 'phantom' centre speaker arrangement, though provision may be made for the customer to connect an external centre speaker.

The Dolby 3 Stereo system is quite popular in North America. This has left, right and centre channel speakers installed in the receiver but no surround speakers. It gives the benefit, in comparison with normal stereo, that speech is always fixed close to the screen. Optional rear channel speakers can be added later and the set switched to surround operation.

A Practical Pro Logic Decoder

Designers of consumer electronics products have the choice previously mentioned: to use either a custom chip (ASIC) or a DSP. Digital sound processors are becoming cheaper but are most suitable for use where the signals are already in digital form, e.g. from a CD, Laserdisc or a D2-MAC source. In most cases the DSP will also require a microcontroller chip and external memory. Thus as a stand-alone solution the simplest approach, which we'll describe here, is to use a custom chip.

One such device is the Mitsubishi M69032P, a custom Pro Logic decoder chip that, apart from the anti-alias filter and the delay, contains all the circuit blocks required in a single package. A separate CMOS chip that incorporates a 16Kbit static RAM, the Mitsubishi M65830P, provides the filter and delay features.

Figs. 5 and 6 show the system: the blocks can be compared with Figs. 3 and 4. Note that the M69032P provides L + R and L − R as well as L, R, C and S outputs: these are not necessary for the Pro Logic application but may be useful for other purposes. The recommended supply voltage for the M69032P is 12V, the chip generating a 4V reference voltage internally. Depending on function, many of the external components are connected to the reference voltage rather than chassis. In the interests of avoiding digital noise it's important to have separate analogue and digital chassis connections, linking them together at a single point.

The decoder options are set by connecting various control pins to the reference voltage or chassis. For example when pin 31 is connected to chassis the 'ordinary' stereo mode is obtained, when it's connected to the reference voltage the Surround mode is selected while leaving it open-circuit gives the Dolby 3 Stereo mode. Likewise pin 30 selects centre channel on/off while pin 36 selects the normal, phantom or wide centre channel mode.

Left total and right total inputs from a VCR, Nicam decoder etc. are fed to pins 15 and 22 respectively. After automatic balancing they are fed to unity-gain amplifiers where they are mixed with the signals from the noise sequencer (when this is selected). They next pass to the Pro Logic adaptive matrix. Here part of the signal goes to the voltage-controlled amplifier (VCA) and combining network blocks while another part is fed to the bandpass filters. These consist of external filter components and internal unity-gain amplifiers, connected at pins 7 and 10. The rest of the adaptive matrix blocks are all internal.

The left, right and centre outputs from the combining network block go to the operation and centre mode control block before leaving the chip at pins 32, 33 and 38 respectively. The surround sound output from the combining block goes straight to pin 39 for application to an optional delay circuit to which we'll return in a moment. After passing through a 7kHz low-pass filter the surround sound signal re-enters the chip at pin 47, emerging again at pin 46 then returning at pin 42 to go to the modified Dolby B type noise reduction block. After this it passes to the operation and control section, finally leaving the chip at pin 29.

Delay Chip

The M65830P digital delay chip contains an input analogue-to-digital converter (ADC), a memory, delay control and an output digital-to-analogue converter (DAC). There's a serial port for delay adjustment – it's not used in this application. One-bit adaptive delta modulation (ADM) gives simple single-bit encoding. A 2MHz resonator connected to pins 2 and 3 provides the master clock frequency – ADM coding requires a much higher frequency than that of the analogue input signal.

The input to this chip enters at pin 23, with low-pass filtering via pin 22. The signal is then passed to the control block, where analogue-to-digital conversion takes place. Leaving pins 4, 5 and 6 open-circuit and earthing pin 7 sets the delay time. After digital-to-analogue conversion the delayed signal emerges from the control block and returns to the decoder chip via pin 13, with low-pass filtering via pin 14.

If delay is not required pins 39 and 42 of the decoder chip can be connected together, with the digital chip omitted.

With the delay chip included, the number of external components required with the M69032P decoder chip is approximately eighty. Most of these are small capacitors and resistors. Probably the most expensive items are the electrolytic capacitors that provide the coupling for the inputs and outputs.

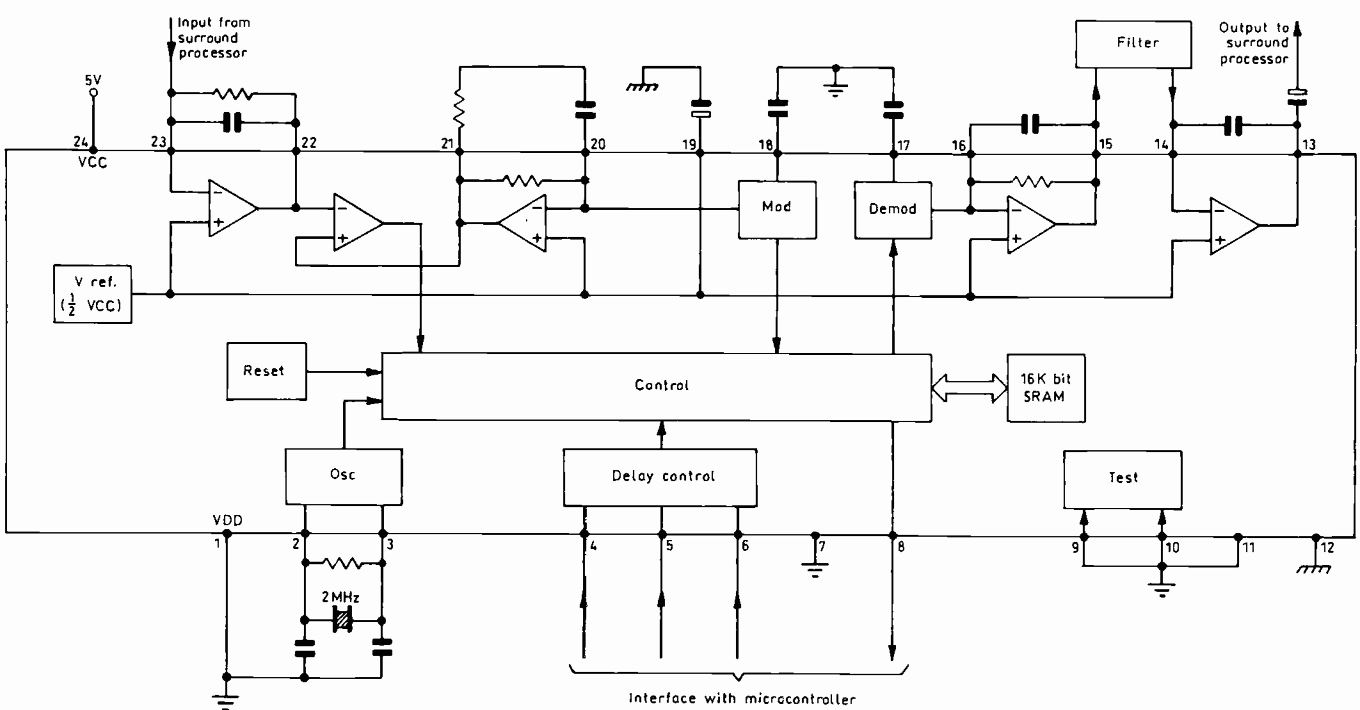

Fig. 6: Operation of the M65830P digital delay chip.

After testing an evaluation board that uses this circuit I must say that it works very well. The solutions offered by other chip makers differ in complexity or circuit configuration, but all must have the same basic functional blocks. This also applies with DSP systems, where the circuit operation is more difficult to see as it's achieved using software.

Surround Licensing

Dolby Laboratories protects its copyright by allowing the technology to be used only by companies that have signed a licence agreement. Even when a licence has been obtained all new products must be approved and their performance checked for adherence to the specifications before they can be marketed bearing the Dolby logo. A fee has to be paid for each use of the copyright mark on the product and, via the supplier, on the relevant components inside. This ensures that only licensed companies with approved designs can obtain the necessary parts. It also means that it is difficult to obtain parts for home construction or experimental purposes.

Acknowledgements

My thanks to Dolby Laboratories Inc., Wooton Bassett and Mitsubishi Electric U.K. Ltd., Hatfield for supplying help and information.

HELP WANTED

Wanted: 250-0-250V, 370-0-370V and 425-0-425V 80-250mA Electrovoice, Osmabet etc. h.t. transformers. May buy batches for cash. M.J. Evans, 7 Shap Drive, Warndon, Worcester WR4 9NY.

Wanted: Four Hitachi 8611A E3AF 14A607C1A chips for a Ford car power amplifier type 86AB-18T805 used with the ECU2 tuner/cassette deck. Geoff Davies, 13 Bowen Road, Rugby CV22 5LF. 0788 574 774.

Wanted: A TDA1104SP and an AN247P chip. L. Mawdsley, One Way TV, 82 Sandhurst Road, Rainhill, Prescot, Merseyside L35 8NQ. 051 426 4152.

Wanted: Aerial/i.f. amplifier in screening cans for a Grundig VS510GB VCR. Ian Burnell, 88 Weaverham Road, Norton, Stockton on Tees, Cleveland TS20 1QL. 0642 554 690.

Wanted: Remote/tuning panel (part no. 3113 108 67260) on which the back-up battery sits for a Philips 20CT4626 TV set (KT4 chassis). Sarah Burton, Circuit Services (Lincs), 31a High Street North, Ruskington, Lincs NG34 9DY. 0526 833 023.

Wanted: TMS3529 chip or programme tuning module part no. 29502-003-21 for the Grundig GSC200 chassis or intact, non-working chassis for parts. H. Ben, 6 Talbot Road, East Ham, London E6 2RZ. 081 471 6348.

Wanted: TDA2653 i.c. for the Grundig Model B7681 (CUC740 chassis). G. Orchard, Orchard's Electrical, Whitstone, Holsworthy, Devon EX22 6TZ. 0288 84 522 or 0836 317 092.

Wanted: TDA2655 (not TDA2655B) for a Saba colour set. Gay Hannon, Moylena, Tullamore, Co. Offaly, Eire. 010 353 506 21407.

Wanted: Decoder and RGB panels for the Philips K35 chassis and the chopper transformer for the Fidelity ZX3000 chassis. J. Levy, 19 Totternhoe Close, Kenton, Harrow, Middx HA3 0HS. 081 907 3620.

Wanted: UE30-B22 tuner for a Goodmans R1400 portable TV set sold by Comet. R. Thomas, Thomas TV Video Repairs, 4 Jolly Road, Garnant, Ammanford, Dyfed SA18 1NE. 0269 823 711.

Wanted: New or used complete front PCB for a Panasonic NVG40 VCR. Also service information for the Toshiba V73DC VCR bought in Hong Kong. K.J. Woolley, 35 Wenthill Close, High Ackworth, Pontefract, W. Yorks. 0977 708 408.

Wanted: Service manual for the Sanyo VTC-NX100 VCR. And can anyone help with a Marconi TF144H/4 standard a.m. signal generator. R. Baker, 17 Chapel Lane, Upwey, Weymouth, Dorset DT3 5NA. 0305 208 815.

Wanted: Operating manual or any other information for the Telequipment DM53A scope. Can anyone date a Bush T76C valve TV set? Thomas McGhee, 86 Haldane Terrace, Dundee DD3 0JF. 0382 810 072.

Wanted: Manual or photocopy of one for the Amstrad TVR3. Bill Pattison, Glenmore TV, 42 John Greekie Road, Durban, 4001, Natal, RSA.

Wanted: Manuals/circuits for the Advance OS1000A and Scopex 4S6 scopes. Nicholas Arnold, Flat 190/31 Griffin Close, Bristol Road South, Northfield, Birmingham B31 2UT.

Wanted: Service manual for the ITT VR3919 VCR. Copy would do. John R. Taylor, 14 Lastigar, Westray, Orkney KW17 2DJ. 085 77 235.

Wanted: Service manuals for the Technicolor/Funai 212E VCR, the Telefunken FK500 video camera (or JVC equivalent) and the Philips VP700 laser disc player. T. Martini, 6 Levant House, Mile End Road, London E1 4RB. 071 790 6807.

Wanted: Service manual (loan or photocopy) for the JVC GXN5E video camera. Geoff Darby, 69 Churchill Road, Earls Barton, Northampton. 0604 811 438 (evenings).

Wanted: Philips laser disc players, working or not, condition not important but must have working laser. R. Lewis, 59 Lawfield Avenue, West Kilbride, Ayrshire KA23 9DH. 0294 823 550.

Wanted: Working main PCB for the Sony KVM2121U. Barry Tuttiett, 28 Queen Street, Barwell, Leicester LE9 8EA. 0455 851 599.

Wanted: Secam/PAL transcoder, preferrably in-line type, modulator not required. R. Lawrence, 31 Goldstone Road, Hove BN3 3RN.

See also page 267.

Screen Entertainment 2000

George Cole

What will television be like in the next century? At the end of October around 300 delegates gathered in London at the Screen Entertainment 2000 conference to hear the views of people involved in the electronics, consumer, broadcast and telecommunications industries. The common theme was 'convergence', the way in which these various industries are forming closer links with one another: the factor that's bringing them together is digital electronic technology.

Multimedia

Part of the first day was devoted to consumer multimedia systems. Philips' director of interactive media systems John Hawkins announced that some 100,000 CDi decks have now been sold world wide. The figure was expected to double by the end of the year and sales of a million decks were forecast by the end of 1994. CDi should be available at over 13,000 retail outlets by the end of 1993. Over 850 companies are now involved in CDi development, publishing, studio production and hardware manufacture. More than a hundred titles are now available and a further 250 are in the course of production.

Philips sees the new Video CD standard as a boost to CDi. At the recent Japan Electronics Show nine companies showed dedicated Video CD players: three Korean companies have also demonstrated machines. The digital video upgrade cartridge that enables a base type CDi deck to play full-motion video titles costs £150 and has been released in the USA, the UK, Japan, France and the Benelux countries. It will be available throughout Europe in 1994. Ten studios around the world are encoding digital video, and real-time encoders are expected to be in use in early 1994. When this happens, the CDi encoding price will be comparable with that of putting video on tape.

Hal Josephson of the 3DO company said that software licences have been taken out by over 340 companies and that 106 titles are in the production stage. Unfortunately a technical failure prevented the demonstration of 3DO software. It's understood that Panasonic intends to launch 3DO equipment in the UK during 1994.

Interactive TV

Bill Andrews of Interactive Network Ltd. said that interactive TV will offer a variety of services including entertainment (movies on demand and computer games for example), education, commercial (such as home shopping) and information (data downloading). They will arrive at homes via a variety of paths – cable (coaxial and fibre-optic), off-air (satellite and terrestrial), telephone and cellular.

MPEG

A close look at digital technology took up the second day. Ed Thomson from Compression Labs began by describing the MPEG standard for digital video. MPEG is concerned with three main areas. First the data bit stream: for MPEG-1 the top rate is 1·5Mbits/sec while MPEG-2 offers 2-15Mbits/sec. Secondly audio: MPEG offers two or more near CD-quality sound channels. Thirdly broadcasting: MPEG is concerned with the integration of video and audio in a broadcast TV system, covering such things as synchronisation and multiplexing. MPEG does not however stipulate the type coding to be used, so companies can use their own compression algorithms. MPEG-1 has been optimised for storage media such as CD-ROMs while MPEG-2 is optimised for broadcasting – and is also 15 per cent more efficient than MPEG-1. Another group (MPEG-4) is looking at slower data rates for applications such as videophones. What about domestic MPEG encoding? Current MPEG encoders cost around £50,000-£100,000, but Dr. Alex Ballanski of C-Cube Microsystem thinks that the price will halve within a year and be as low as £10,000 in eighteen months. Home MPEG encoders won't be available for three-four years however.

Typical video system resolution figures, assuming the use of PAL, are 352 pixels x 288 lines for VHS, 480 pixels x 576 lines for TV display and 720 pixels x 576 lines for CCIR 601 studio quality. Examples of bit rates required are 10-64kbits/sec for a videophone, 1-2Mbits/sec for VHS movie quality, 3-8Mbits/sec for entertainment TV and 15-25Mbits/sec for HDTV. Ed Thomson suggested that the term 'compression ratio' is meaningless as the bit rate required depends on a number of factors including the resolution, whether the source is film or video (film is easier to compress) and programme content (a sports programme requires a faster rate than say a discussion programme). Compression Labs has developed a prototype MPEG decoder and is working on a number of digital TV projects with Thomson, Philips and Hughes – it's also part of the US digital HDTV project. The company thinks that DBS digital TV services will be available in the second quarter of 1994 (Hughes plans to launch its DirectTV satellite service in the USA during 1994, giving viewers hundreds of digital TV channels to choose from), that digital cable TV and video-on-demand (VOD) services will become available in late 1994, while digital HDTV services won't start before late 1996.

Digital Transmissions

Dr. John Forrest of NTL spoke on digital broadcasting. He began by pointing out that digital video compression isn't new – during the Seventies the IBA's engineering division (forerunner of NTL) had developed coders and decoders for inter-studio links and the satellite distribution of programmes in connection with the then only proposed fourth u.h.f. channel. The compression system was demonstrated at the 1980 IBC but wasn't adopted when Channel 4 started in 1982 as in those days satellite TV distribution was considered to be too risky.

Dr. Forrest then explained the principles of compression. A single PAL frame consists of around 700 x 570 pixels (400,000). This has to be tripled to include RGB information, giving a total of 1·2 million bits of information per frame. The image is compressed by breaking it into blocks of pixels, e.g. 8 x 8, and analysing these for regular patterns and colour and brightness levels. Because there is only one twenty-fifth of a second between each frame there is little difference between one frame and the next: a subtraction system is used to find the differences and only these are transmitted, greatly reducing the data rate required. Compression systems also take advantage of the fact that the human eye is less sensitive to fine detail and colour variations. Most companies at work in the compression business are aiming for a data rate of around 8Mbits/sec, which gives studio quality pictures: acceptable broadcast picture quality can be achieved with a data rate as low as 2Mbits/sec.

Although Dr. Forrest's talk was mainly concerned with broadcast systems he also mentioned a system for transmitting digital video images via ordinary telephone lines. Known as Asymmetric Digital Subscriber Line (ADSL), it involves the transmission of high-quality (140Mbits/sec) video images after compression at the local telephone switching centre to 1·5Mbits/sec. ADSL would offer domestic users a very limited VOD service but the technology looks as if it has potential. Companies such as Bell Atlantic are carrying out ADSL trials.

Satellites currently use a 36MHz bandwidth transponder to transmit a single analogue channel: digital compression will enable such a transponder to carry 4-16 channels (depending on picture quality). Likewise a 30-channel cable system could use digital compression to increase the number of channels to 120.

The terrestrial u.h.f. system used in the UK requires around 4,000 transmitters to broadcast four national services. This involves the use of some forty channels. Digital TV would allow each channel to carry four programmes. The simultaneous transmission of analogue and digital services is possible, which would allow the PAL system to be phased out in the same way that the 405-line system was brought to an end. NTL's SPECTRE digital compression system has been developed for u.h.f. transmissions, but it will be up to the ITC to decide how the new services will operate.

All digital TV systems will use MPEG compression, but different modulation systems will be required for satellite, cable and terrestrial services. Dr. Forrest doesn't think we will see a standard conditional access system. Thus decoders will need to have several card slots. But a common coding system will be necessary to identify programmes and services. Likewise viewers will want to have a user-friendly system for navigation through the hundreds of channels. Dr. Forrest thinks that the TV receiver of the future will take on the appearance of a computer/terminal, be modular and upgradable.

AT&T Trials

Ken Trojniar of AT&T described several trials that have provided viewers with pay-per-view (PPV) and vision-on-demand (VOD) services. PPV enables viewers to select programmes from a schedule and pay for what they watch: VOD is more flexible, giving viewers greater choice and control over what they see and pay for. AT&T's first trial, using a system called viewer-controlled cable TV (VCTV), was carried out in Denver in 1991. AT&T and Telecommunications and US West offered viewers PPV and movies-on-demand services. A recent trial in Chicago linked the homes of fifty employees to a computer server in New York: the server provided programmes and services such as games, consumer reports, interactive sports programmes, home shopping and electronic mail. Later this year AT&T will start the Castro Valley trial, which will put Viacom's two-way cable system in 1,000 homes. Users will be able to stop, pause, rewind and fast-forward TV programmes, will be able to browse through 'video catalogues', ordering products by using a remote control handset, and there will be full-motion video games.

There have been interesting results from the Chicago trial. It established that people like the idea of a 24-hour service that provides programmes on a PPV basis. Eighty per cent of the viewers used the service actively, with half the total group using the system to plan their viewing. Those with children tended to plan their viewing more than those without. It was also found that people prefer to use a remote control unit rather than having to call up programmes over the telephone. One result was that viewers spent less on other forms of entertainment, including video rental. Not surprisingly, films and games were the most popular items. Ken Trojniar admitted that it was early days for VOD, and that the system faces two big obstacles – the provision of broadband cable to a large enough number of homes, and whether consumers are prepared to pay for these extra services.

Astra

Marcus Bicknell of the Vision Consultancy Group surveyed the current Astra satellite plant. The present three satellites 1A, 1B and 1C at 19°E provide fifty transponders that are used for analogue channels (some are used for back-up purposes however). Astra 1D, to be launched in September 1994, will increase the number of transponders to 64: it could provide a mix of analogue and digital services. Astra currectly uses the 10·7-11·7GHz FSS band, but space in the 11·7-12·5GHz BSS band could be used for an extra forty digital transponders. Astra's owner SES plans to have six co-located satellites by 1996. Depending on picture quality, a sixteen-transponder satellite using digital technologuy could provide 80-160 channels. Marcus Bicknell suggested that there could be around 3,500 digital satellite channels by the year 2004, and that by then satellite and cable systems could be in 110 million European homes.

Reception of digital satellite TV services will require new equipment. At present an LNB with a 750MHz bandwidth can be used for Astra 1A/B/C: the bandwidth will need to be increased to 1GHz to receive 1D. For reception of both analogue and digital services a switchable LNB with a 1GHz bandwidth will be required. A 'universal' LNB is under development and should be ready by 1995.

Astra is likely to face stiff competition from other companies offering digital services, for example Eutelsat, regional services such as Telecom and Tele-TV and international operators such as Intelsat. Marcus Bicknell added that while agreement has been reached on setting a common European digital transmission standard (by the Digital Video Group, see the Berlin report in the December issue) there is no agreement on conditional access. Will there be a single box that accepts smart cards from a number of programme providers or will viewers have to have lots of different decoder boxes next to their sets? One hopes that there will be a one-box solution.

3-D Systems

Toshio Motoki of NHK's science and technical research laboratories described two 3-D systems. The first uses two HDTV cameras to record left- and right-eye images which are recorded by two HDTV VCRs: the images are projected on to a 110in. screen and polarisation glasses are required to see the 3-D effect. The second system doesn't require the use of glasses. The 'auto-stereoscopic' display system is based on lenticular stereoscopic photos, which produce a 3-D effect with still pictures. The 3-D TV version uses an LCD screen and works by projecting left and right images on to the screen as a series of vertical stripes. Light from the pixels is refracted by a series of small lenses: when this is viewed at an appropriate distance a 3-D effect is seen. NHK has developed a prototype system which uses a 50in. lenticular screen and four cameras. Sanyo, which developed the technique with NHK, plans to launch a system in Japan during 1994.

Video Storage

Dr. Tae Seok Park from Samsung's advanced institute of technology discussed storage systems for domestic video. Tape offers many advantages: as it is cheap to produce and has a high storage capacity it's likely to be the main medium for the coming generation of consumer digital video recorders, but it can't be used for interactive systems because it doesn't offer random access. Discs can offer random access, but there are problems. Today's CD-ROMs have a storage capacity of around 650Mbytes and use infra-red lasers to read them. The use of smaller pits in the disc would increase storage capacity but would require a shorter wavelength laser. Use of a red laser, with a 670nm wavelength compared with the 780-830nm of today's lasers, would increase the disc capacity by a factor of 1·5; a green laser (532nm) would give an increase of 2·5 times while a blue laser (415nm) would give an increase of four times. A 30mW red laser and a 20mW green laser for high-density recording have been developed, and a blue-green laser has also been produced, but these are all expensive. Dr. Park thinks that shorter-wavelength lasers for domestic machines will be available at around the turn of the century.

Other ways of increasing storage capacity include super-resolution technology: this increases the recording density beyond the limit set by the wavelength of the laser. One process, called magnetically-induced super-resolution (MSR), increases storage capacity by up to four times. Improved signal processing, which reduces the need for error detection, can increase disc capacity by up to 1·5 times.

The day when discs and tape are replaced by solid-state memory storage devices is a long way off in the future. The capacity of today's EPROMs and EEPROMs is around 16Mbytes, which is fine for still video cameras but not for video with movement. Dr. Park suggests that the storage capacity will be increased to around 1Gbytes by the year 2000, enough for storing an hour of compressed video on a chip device the size of a credit card. This sounds impressive but is still some way behind the capacity offered by tape – and the chips wouldn't be cheap.

In Conclusion

A discussion on likely winners and losers took place at the end of the conference. The panel felt that software producers, the providers of direct-to-home services, and companies like NTL that produce digital compression systems should do well. Sony, Bell Atlantic and Time-Warner were seen as companies to watch. Virtual reality (VR) could also become a big market, especially for entertainment and theme parks. One panellist suggested that the first company to develop a VR sex system will clean up! On a more sombre note, no one thought that consumer systems like CDi and 3DO would be successful.

Modern TV Receiver Techniques

Part 14: Teletext

Eugene Trundle

Teletext is the oldest form of digital broadcasting technology. It has now been in use in the UK for twenty years, during which period teletext decoders have steadily shrunk in size and cost and the service has been improved. Teletext uses spare capacity in the field blanking interval to transmit data in the form of pulses that provide 'typing instructions' for pages of text and graphics. A TV set that contains a teletext decoder extracts this data from the overall transmission and stores it so that, when requested by the viewer, page readouts appear on the screen.

There are five teletext 'levels' that offer progressively better presentation of text and graphics on the screen. The 'higher' the level, the larger the memory and the more sophisticated the decoder required. Perhaps because of lack of enthusiasm amongst viewers we have, in the UK, progressed barely further than level 1, which is the most basic form of broadcast text. Access time however has been reduced by transmitting more data per TV field, by clever arrangement of the transmitted page sequences and by increasing the receiver's memory capacity.

The Field Blanking Interval

In Part 10 we saw that the field blanking period, during which the beams return from the bottom of the screen to the top to start a new field scan, lasts for a period equivalent to

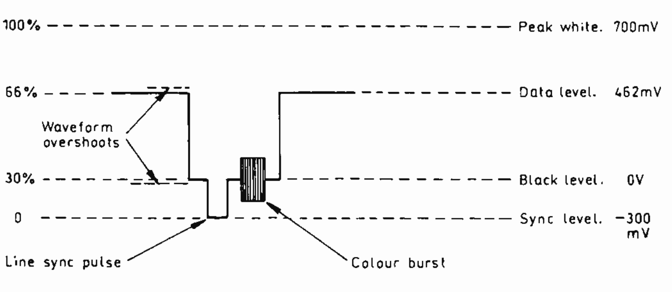

Fig. 1: Teletext data levels.

25 lines, i.e. 1·6msec. The field sync pulse group occupies 7·5 lines/480μsec of this space, leaving a period of 17·5 lines/1·12msec before the start of the video information for the first line of the next displayed TV field. This generous amount of time was originally allocated because early TV sets had a rather slow field flyback. Subsequently, with field timebases that had a faster flyback and advantages in technology at both ends of the transmission chain, it became possible to put some of these spare lines to good use: they were used to carry video insertion test signals (VITS) that provide signal identification, network switching and performance appraisal. The VITS occupy lines 19 and 20 in even fields and lines 332 and 333 in odd fields. The preceding twelve lines, 7-18 and 320-331, are used for text data.

Each text data line carries a colour burst to maintain the colour decoder subcarrier oscillator synchronisation and the usual line sync pulse. The text pulses occupy the rest of the line. This is the same period as the ordinary picture signal: 52μsec.

To prevent intercarrier buzz with f.m. sound systems the amplitude of the text pulses is limited to 66 per cent of the peak white signal, see Fig. 1. Binary zero is represented by the text signal hitting black level, binary one by the signal rising to the 66 per cent level. This represents 462mV with a standard 1V peak-to-peak video signal. The pulses are not square: they are filtered before transmission and further rounded in the receiver's i.f. and demodulator circuits. Thus by the time they reach the text decoder they are of approximately sinusoidal shape. In addition the pulses are transmitted in NRZ (non return to zero) form. This means that the signal remains high to indicate a string of binary ones and low when a string of binary zeros is being transmitted.

Text Data Format

The text data rate is 6·9375Mbits per second, which is 444 times the 625-line scan frequency. The pulses are not necessarily locked to the scan rate however. A data train representing 01010101 etc. to the end of the line will thus give rise to a quasi-sinewave at 3·46875MHz. At this rate there's room for 360 data bits on each TV line used for the purpose. These 360 bits produce a single row of text characters or graphics in the teletext screen display.

The 360 bits per line are divided into 45 eight-bit bytes. The first five of these bytes synchronise the decoder and provide an 'address' that indicates where the row is to be located in the text display. The remaining 40 bytes determine the characters in the row, which can thus have a maximum of 40 letters, numbers or graphic blocks. Where there's to be a blank or gap in the display the code for a blank space is sent so that data is always present.

The text display has 23 rows: thus a maximum of 23 x 40 = 920 characters can be displayed on a single page to make up simple maps, diagrams and alphanumeric text. Upper- and lower-case letters can be produced as well as figures, symbols and 'building blocks' for graphics, in any of eight colours formed by the three primaries plus black and white.

Fig. 2 shows the code table. Starting at the top on the left-hand side the first four bits define the row number and the next three the column number. The codes are then used to determine the character so that capital A for example would be called up by byte 1000001 (bits 1-7) while byte 1111101 produces the symbol #. Notice that to change from a capital to a lower-case letter only bit six changes, and that the codes for numbers consist of their binary equivalents followed by the code 011.

The 32 codes in columns 0 and 1 are control codes that indicate whether the codes in the following columns represent alphanumeric characters or graphics and give some 'attribute', such as a colour, to the characters in the row. These control codes all have bits 6 and 7 at zero: they produce no display themselves, occupying a single blank space in the displayed row – usually in the background colour of the preceding character.

Protection

Because the data is subject to interference and noise during its journey from the transmitter to the decoder protection against data corruption is required. It's provided

$b_7 b_6 b_5$ →						0_{0_0}	0_{0_1}	0_{1_0}		0_{1_1}		1_{0_0}	1_{0_1}	1_{1_0}		1_{1_1}	
Bits	b4	b3	b2	b1	Col → / Row ↓	0	1	2	2a	3	3a	4	5	6	6a	7	7a
	0	0	0	0	0	NUL ①	DLE ①			0		@	P	—		p	
	0	0	0	1	1	Alpha^n Red	Graphics Red	!		1		A	Q	a		q	
	0	0	1	0	2	Alpha^n Green	Graphics Green	"		2		B	R	b		r	
	0	0	1	1	3	Alpha^n Yellow	Graphics Yellow	£		3		C	S	c		s	
	0	1	0	0	4	Alpha^n Blue	Graphics Blue	$		4		D	T	d		t	
	0	1	0	1	5	Alpha^n Magenta	Graphics Magenta	%		5		E	U	e		u	
	0	1	1	0	6	Alpha^n Cyan	Graphics Cyan	&		6		F	V	f		v	
	0	1	1	1	7	Alpha^n ② White	Graphics White	'		7		G	W	g		w	
	1	0	0	0	8	Flash	Conceal Display	(		8		H	X	h		x	
	1	0	0	1	9	Steady ②	Contiguous ② Graphics	)		9		I	Y	i		y	
	1	0	1	0	10	End Box ②	Separated Graphics	*		:		J	Z	j		z	
	1	0	1	1	11	Start Box	ESC ①	+		;		K	←	k		¼	
	1	1	0	0	12	Normal ② Height	Black ② Background	,		<		L	½	|		||	
	1	1	0	1	13	Double Height	New Background	-		=		M	→	m		¾	
	1	1	1	0	14	SO ①	Hold Graphics	.		>		N	↑	n		÷	
	1	1	1	1	15	SI ①	Release ② Graphics	/		?		O	#	o		■	

Fig. 2: ASCII codes used for teletext data transmission. Codes can be referred to by their column and row, e.g. 2/5 = %. Control characters marked (1) are reserved for compatibility with other data codes; those marked (2) are presumed before each row begins.

by adding an 'odd-parity bit' at the end of each of the seven-bit codes shown in Fig. 2 so that each becomes an eight-bit byte. The idea is that the parity bit added always results in an odd number of one bits in the byte. The decoder can then check whether any bytes with an even number of ones have been received and reject these as being corrupt. This simple system has two limitations: it doesn't work if an even number of bits in the byte are incorrect, and it doesn't provide data correction. Despite this it is adequate for use with text symbols, where a minor error often goes unnoticed, and is anyway corrected when the page is cyclically updated.

Some of the transmitted data requires greater protection however. If anything goes wrong with the data that determines the page number the wrong page could appear on the screen when it's called up by the viewer, while if the row address data is wrong the row will appear in the wrong place on the screen. To avoid this the bytes that provide this information and the real-time clock data are heavily protected by means of a Hamming code, in which every alternate bit is a parity bit: bits 2, 4, 6 and 8 convey data while bits 1, 3, 5 and 7 provide protection – see Table 1. This enables single-bit errors to be detected and corrected by inversion. The penality incurred is that the amount of information conveyed by the byte is reduced.

Row Coding

The first row of a transmitted page, row 0, is the most important one since it contains the magazine and page numbers, the service name, the date and time. It's called the header row. To capture a page for display the viewer keys in the magazine and page numbers: when this keyed-in data corresponds with the transmitted code the relevant page is selected and displayed on the screen.

The data format for the header row is shown towards the

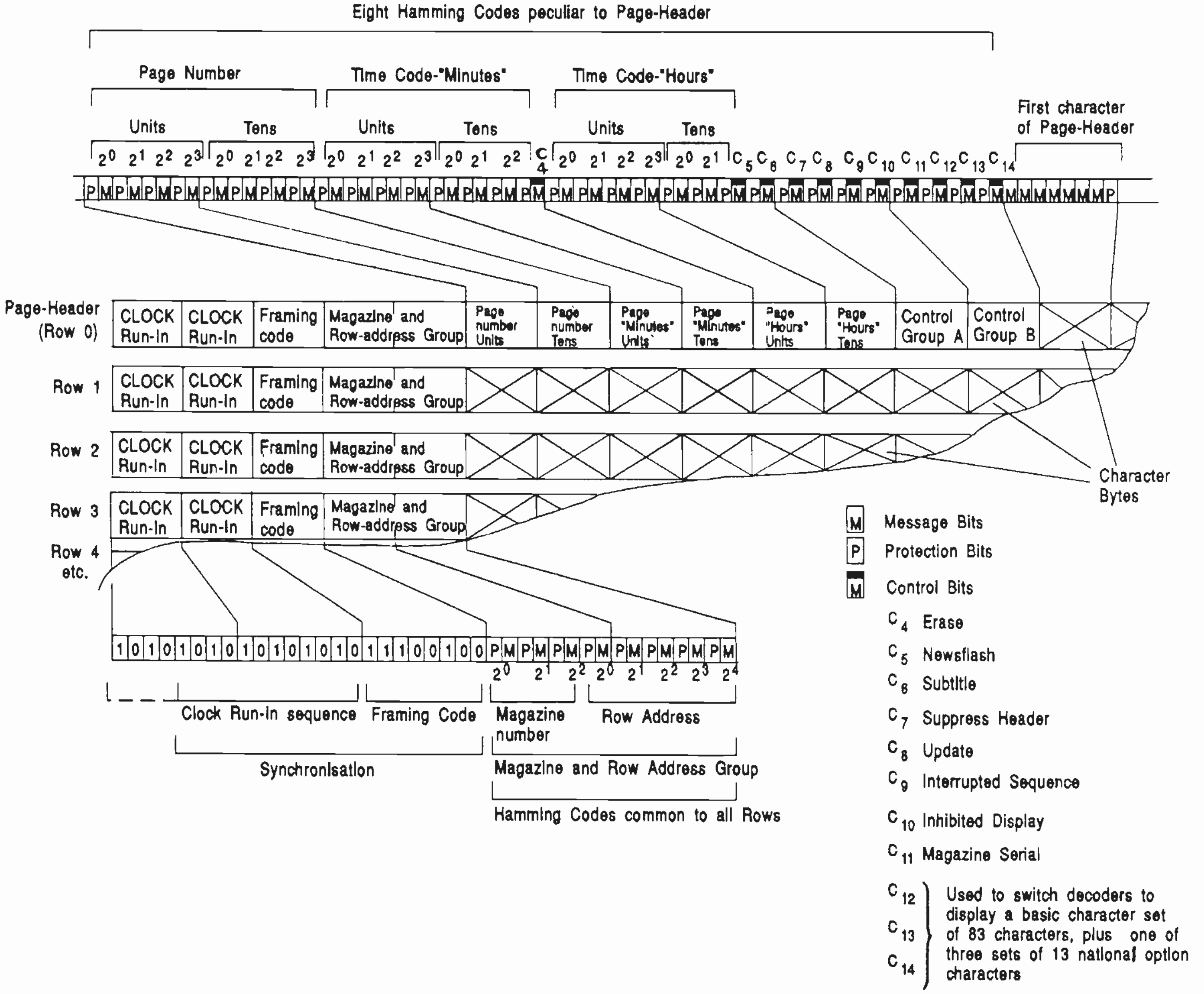

Fig. 3: Teletext row coding. The 'diamond-crossed' bytes carry display data, 32 characters in the header row and 40 in the others.

top in Fig. 3. There's first a clock run-in sequence that consists of two bytes carrying a series of ones and zeros – 101010 etc. This synchronises the decoder's bit-sampling clock oscillator. Next comes a framing code byte whose purpose is to identify the start of the data bytes in the following pulse train. Its pattern is 11100100, chosen to give a reliable reset signal to the rest of the decoder and to be amenable to correction by a circuit that's able to put right single-bit errors. Fig. 4 shows the principle of the framing code detector: when the and gate's output goes high it signals to the decoder that the next bit is the first one of the first data byte. Thereafter the circuit is reset at eight-bit intervals by a byte clock, thus individually partitioning off the bytes.

The next two bytes, which are Hamming-protected, provide the magazine and row-address information. In the header row this is followed by page number and time code (not necessarily real time) bytes to enable the viewer to select a particular page at a specified time. Two bytes that provide control information relating to the whole page follow – the codes that govern news flash, subtitle, update and similar functions, all with Hamming protection.

Eight data bytes of the header row have thus been used, leaving 32 for the display of characters. Except for the page number, the header row text is the same for all the pages of any one transmission: it shows the name of the service (Ceefax, Skytext, etc.) and the day, date and real time in hours, minutes and seconds.

The following rows have the same clock run-in and framing codes as the header row. These are followed by individual magazine and row-address bytes, which are the only ones that have Hamming protection in an 'ordinary' row. Bytes 6 to 45 contain eight-bit codes for the text or graphics in the line. Each byte is transmitted with the LSB (least significant bit) first and the parity bit last.

Control Codes

Some further explanation is required for columns 0 and 1 in Fig. 2. At the beginning of each transmitted row the decoder assumes that what follows will be steady, normal-height white alphanumeric characters on a black background, also that any graphic blocks will be contiguous (joined together). Any change from this, at any point along the line, requires the insertion of a control byte to tell the decoder. Thus if the second half of a row is to be concealed (say it's a quizz answer), the 'question' text will be followed by the code 0001100 then the answer code. The answer will then be revealed only when the viewer keys 'reveal'. The next row will be reset automatically. Thus if this is to be concealed the first byte must again be 0001100. Similarly if one word in a row is to flash it must be

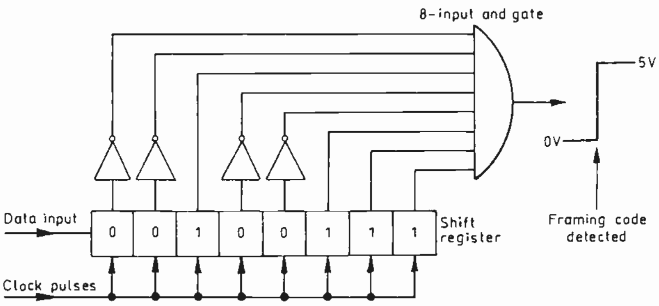

Fig. 4: Framing code detector: only the bit pattern 11100100 can open the and gate to produce a 0-5V transition. The clock pulses step the bits rightwards through the shift register.

preceded by code 0001100 then code 1001000.

Suppose that we want to transmit a row with red graphics at the left changing to green graphics half way across, perhaps as part of a map or diagram. After the row coding the first byte will be 1000100 to set the display mode followed by the graphics codes. Just before the transition to green point code 0100100 is sent to change the colour, followed by more graphics codes. There doesn't have to be a gap in the display where the control byte is inserted: in the graphics-hold mode (column 1, row 14, Fig. 2) the decoder repeats the previous graphic symbol in the control code space. This can't be done with alphanumeric characters, so the control byte in this case produces a gap in the display: it appears in the background colour.

Because bits 6 and 7 of these control codes are both at zero they are sent straight to the character generator at the output end of the decoder.

Page Transmission and Access Time

We've seen that each text line transmitted during the field blanking period can produce one row of text on the screen. So with 24 rows in the display 24 lines will be required. As the current rate is 12 teletext lines per field, it takes two fields to transmit a single teletext page. At a field rate of 50 per second, 25 pages a second can be transmitted – 1,500 pages a minute. Thus access time – the period between requesting a page and its appearance on the screen – largely depends on the number of pages being transmitted. If 750 pages are being transmitted the worst-case access time will be 30 seconds and the average wait 15 seconds – this is with the pages transmitted repeatedly in sequence.

To improve the system's 'user-friendliness' high-priority pages such as indexes and commonly-used pages are transmitted more often than others. Another time saver is the 'row-adaptive' feature, which enables the totally blank rows that occur in many text pages to be omitted from the data stream. It's also possible to interleave the text rows of several pages to give a perceived improvement in the access time: this is why each row has a magazine number (see Fig. 3). Subtitles (page 888) have the highest priority: they are transmitted on the first available line after the cueing point.

These techniques are limited in their effectiveness: in most cases they shorten the access time to some pages while lengthening the wait for others. From the user's point of view the most effective reduction in page access time comes from the use of the Fastext system.

Memory Capacity and Fastext

As the parity bits don't have to be stored the memory capacity required for a single page of text is 24 (rows) x 40 (characters) x 7 (bits), which comes out at 6,720 bits. This is the amount of memory that was provided in the earliest text decoders. Later types have a two-page memory (2K x 7 bits in practice) and automatically store the page following the one being displayed. Thus if you select page 100, page 101 will also be captured and held and can be called up for immediate display. This action prompts the decoder to search for, acquire and store the next page (102) in the now unused half of the memory, overwriting the stored page 100 with the page 102 data. Philips Components uses this system in the popular Euro-CCT (Computer Controlled Teletext) decoder.

A Fastext decoder incorporates a larger memory that can hold the selected page and the next seven, which are automatically loaded in sequence by the decoder. This is based on the premise that viewers usually step through pages sequentially. As each page is discarded the next page in the sequence is loaded. Thus virtually instantaneous page display is achieved.

The broadcaster's text editor can assist with the Fastext function by anticipating the user's requirements and sending additonal instructions to the decoder, based on the current page and its contents, for extra page acquisition. This works as follows. The bottom row of the text page has four colour-coded prompts which may typically be news, sports, travel and financial information. The remote control handset has four buttons with corresponding colours. Pressing any one of these selects magazine and page numbers simultaneously, loading appropriate pages into the memory for instant selection. If travel is selected for example the coloured prompts may change to air, sea, road delays and continue, the latter providing an escape from the travel menu.

A 'packet' system, in which additional data rows are transmitted but not necessarily displayed on screen, is used for Fastext data acquisition. The packets contain additional control data rather than characters and are sent before the teletext pages (which become packets 0 to 23) so that the control data arrives before the actual page. Packet 24, which is displayed as a row, is used for the Fastext prompts while packet 27 provides the page-linking data.

There are eight packets in the text specification for various purposes that include extended character sets (primarily for other languages) and general-purpose data

Table 1: Hamming code protection.

Message	*Hamming coded bits* 1	2	3	4	5	6	7	8
0	1	0	1	0	1	0	0	0
1	0	1	0	0	0	0	0	0
2	1	0	0	1	0	0	1	0
3	0	1	1	1	1	0	1	0
4	0	0	1	0	0	1	0	0
5	1	1	0	0	1	1	1	0
6	0	0	0	1	1	1	0	0
7	1	1	1	1	0	1	0	0
8	0	0	0	0	1	0	1	1
9	1	1	1	0	0	0	1	1
10	0	1	1	0	0	0	1	1
11	1	1	0	1	1	0	0	1
12	1	0	0	0	0	1	0	1
13	0	1	0	1	1	0	1	1
14	1	0	1	1	1	1	1	1
15	0	1	0	1	0	1	1	1

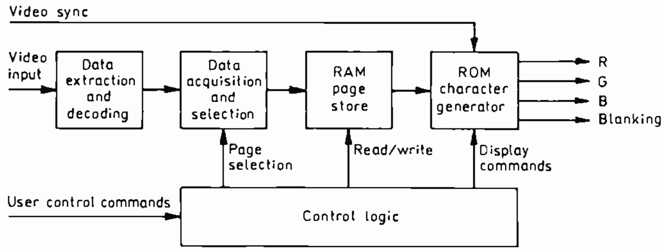

Fig. 5: Basic decoder block diagram to show the working principle.

transmission. Packet 30 is an interesting one, providing PDC (Programme Delivery Control) for VCRs. More on this later.

Decoder Overview

Fig. 5 shows a teletext decoder in the simplest possible block diagram form. The first block removes the data pulses from the video signal and decodes them. The next block selects the data requested by the viewer, according to instructions sent via the control logic block, and passes it to the page memory (RAM) whose write-in control signal also comes from the control block. Read-out from the RAM is again governed by the control block: it occurs at a slower rate, a complete field scan period being required for a page in the memory to be read out – it's written in during short 52μsec bursts at varied intervals. The data from the RAM is passed to a character-generator ROM which uses it to produce the characters, graphics and symbols shown in the body of Fig. 2 and to give them the colours and attributes dictated by the control data stored with the character codes. The ROM chip's outputs consist of RGB signals in serial data form plus a blanking pulse train. They are all passed to an RGB signal processing chip of the type described in Parts 6 and 7 of this series, after which the RGB signals are applied to the picture tube.

Decoder Operation

Fig. 6 provides a more detailed idea of the internal workings of the decoder. A composite video signal (video plus sync) at about 2V peak-to-peak is fed in at the left-hand side. The sync pulses are stripped from it and fed to field sync and line divider stages. They are also passed to the set's timebase generators and continue (generated within the decoder) when there's no TV signal present so that stored pages can, if required, be viewed 'after hours'.

The two clock run-in bytes synchronise and phase lock the data clock, which supplies 6·9375MHz pulses to the data separator to enable it to make zero or one decisions with each received bit. An adaptive slicer is used here, like the one described on page 505 of the June 1993 issue. The serial pulse train produced in this way must next be converted to parallel form. This is done by clocking the pulses into an eight-bit shift register then stepping them out into an eight-line bus each time the clock divider is reset by the framing code detector shown in Fig. 4. The eight data bits in the byte thus captured are held in the data latch (centre of Fig. 6) ready for transfer into the memory.

The bytes are checked for corruption, one at a time, in the parity-check block which puts up an error-inhibit flag in the read/write control block when a byte with incorrect parity is detected.

The Hamming-coded bytes are similarly checked, and

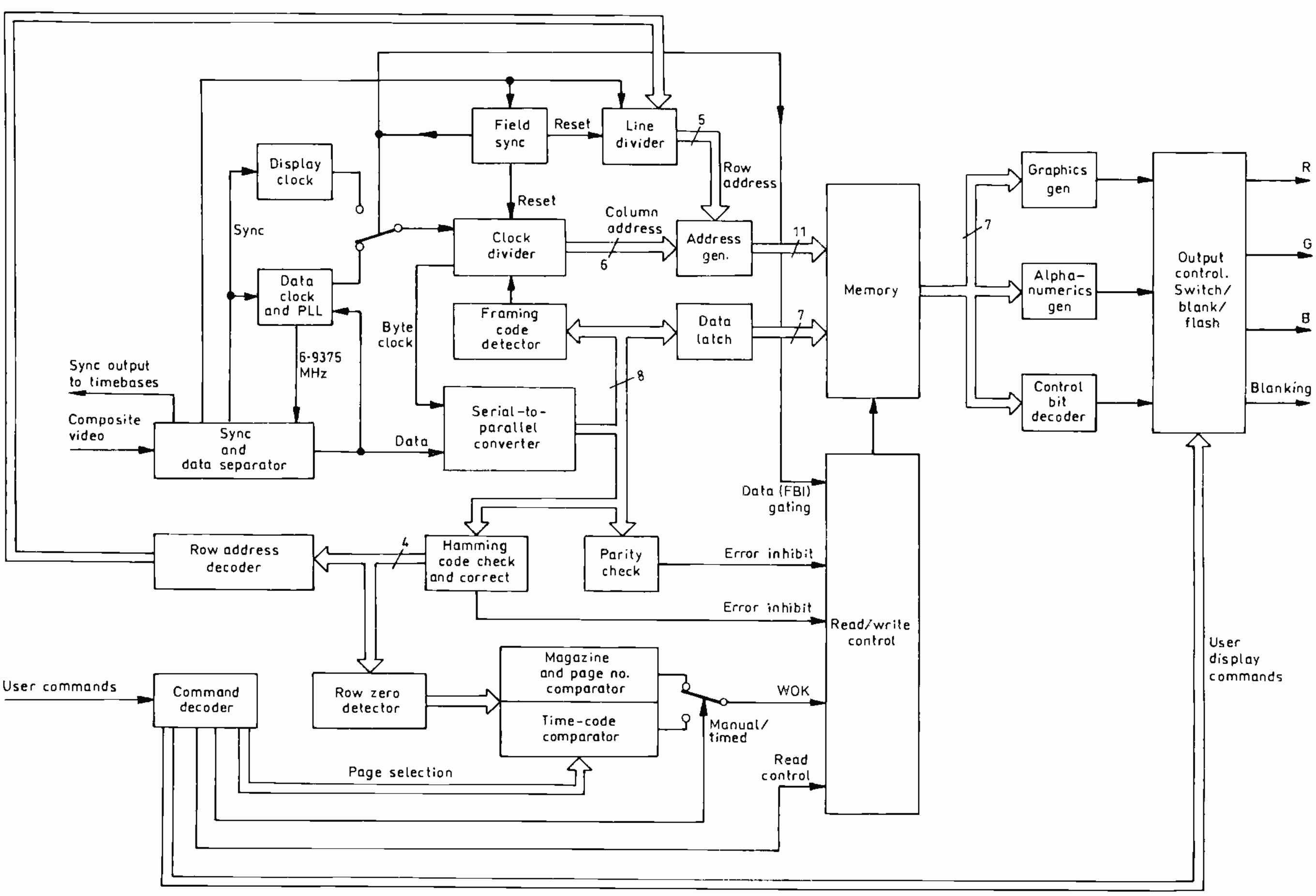

Fig. 6: A more detailed decoder block diagram to show the basic operation: practical processing arrangements are much more complex than this.

corrected if necessary, in the Hamming checker. This again inhibits the write-into-memory cycle should it detect an uncorrectable byte error. The data output from the Hamming block is in four-bit parallel form – four bits because, as we saw in Table 1 and Fig. 3, the other four bits in the byte are parity bits. It passes to the row address decoder which tells the memory, via the address generator, where the following 40 bytes of data are to be stored; and also to the row 0 detector which comes to life when it sees the row 0 code in the two bytes immediately after the framing code. The row 0 detector produces magazine, page and time-code data which are latched into comparators for updating each time a new header row is transmitted. The other input to each comparator consists of data entered by the viewer. When the magazine and page numbers at both sides of the comparator match exactly a WOK (Write OK) signal is passed to the read/write section, permitting data to be written into the memory from the seven-bit data latch. In the timed-page mode, transmitted and user-logged time codes are compared to produce the WOK command.

Thus the conditions required for a write-into-memory operation are: that the magazine and page numbers (and if required the time code) matches that requested by the viewer; that the data is complete and uncorrupted; and that the control bits in the header row are present and correct. When all these conditions have been satisfied the data is written into a memory address specified by the row and column address lines. In most decoders the memory has a two- or eight-page capacity that's automatically filled with data representing one or more linked pages as described earlier. Memory access time must be well under 1µsec, which is the nominal period between displayed characters.

Data from the viewer's infra-red remote control handset is fed into the command decoder in serial form, typically via an I2C bus. After serial-to-parallel conversion it's passed to the comparators and to the character output contol section to operate such functions as reveal and superimpose.

Next Month

We've now seen how the text data is acquired and stored in memory: next month we'll look at readout and character generation, then relate all this to practical teletext decoders and the chips they use.

HELP WANTED

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Wanted: Tuner for the Hitachi Model CNP190 (type ET512B B21-25 with connection to the contrast control and press-buttons). Also a BU508A transistor. Donald Bills, 69 Greenfields Road, Kingswinford DY6 8EG.

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Video Head	VID 2558	£44.82
Pinch Roller	VID 1803	£3.83
Idler	VID 1006	£3.46
Tension Band	VID 1432	£5.87
Remote Control	IR 9034	£14.52
Repair Kit	VID 7930	£12.58
VR-2010		
Video Head	VID 2578	£62.15
Pinch Roller	VID 1827	£5.70
Belt Kit	VID 7588	£1.09
Idler	VID 1252	£5.20
Loading Gear	VID 1253	£7.23
Modification Set	VID 1254	£10.81
Tension Band	VID 1431	£4.85
Remote Control	IR 9034	£14.52
FISHER		
FVH-P520		
Video Head	VID 2500	£17.39
Pinch Roller	VID 1788	£3.15
Belt Kit	VID 7532	£1.35
Take Up Idler	VID 1015	£3.65
FF×REW Pulley	VID 1016	£0.94
Idler	VID 1023	£3.20
Tension Band	VID 1378	£2.76
Take Up Reel Table Rubber Tyre	VID 1293	£0.77
Supply Reel Table Rubber Tyre	VID 1293	£0.77
FVH-P530		
Video Head	VID 2500	£17.39
Pinch Roller	VID 1788	£3.15
Belt Kit	VID 7532	£1.35
Take Up Idler	VID 1015	£3.65
FF×REW Pulley	VID 1016	£0.94
Idler	VID 1023	£3.20
Tension Band	VID 1378	£2.76
Take Up Reel Table Rubber Tyre	VID 1293	£0.77
Supply Reel Table Rubber Tyre	VID 1293	£0.77
FVH-P720×720K×721		
Video Head	VID 2500	£17.39
Pinch Roller	VID 1810	£3.04
Belt Kit	VID 7532	£1.35
Gear Idler	VID 1013	£4.51
Idler	VID 1014	£3.06
Loading Gear Set	VID 1230	£1.02
Cassette LED	VID 1981	£1.53
Tension Band	VID 1376	£2.38
Take Up Reel Table	VID 1295	£8.07
Supply Reel Table	VID 1294	£6.55
FVH-P722×725		
Video Head	VID 2501	£28.57
Pinch Roller	VID 1810	£3.04
Belt Kit	VID 7813	£1.19
Gear Idler	VID 1013	£4.51
Idler	VID 1014	£3.06
Loading Gear Set	VID 1230	£1.02

3-V-57	Part No.	Price
Cassette LED	VID 1981	£1.53
Tension Band	VID 1376	£2.38
Take Up Reel Table	VID 1295	£8.07
Supply Reel Table		
FVH-P980K×KV		
Video Head		
Pinch Roller		
Belt Kit		
Idler		
Clutch		
Cassette LED		
Tension Band		
Supply Reel Table		
FUNAI		
VCR-4600		
Video Head		
Pinch Roller		
Belt Kit		
Clutch		
Gear Holder		
RF Clutch		
Cassette LED		
VCR-5843		
Video Head		
Pinch Roller		
Belt Kit		
Idler		
Cassette LED		
GEC		
V-4004		
Video Head		
Pinch Roller		
Belt Kit		
FF×REW Arm		
Clutch Plate		
Capstan Motor		
Cassette LED		
Tension Band		
Repair Kit		
GOLDSTAR		
GHV-8000×8200×8210		
Pinch Roller		
Belt Kit		
Idler		
Bracket Centre		
Clutch Gear		
Limiter Roller		
Cassette LED		
Tension Band		
VCP-4100×4130		
Video Head		
Pinch Roller		
Belt Kit		
Idler		
Bracket Centre		
Clutch Gear		
Limiter Roller		
Cassette LED		
Tension Band		
VCP 4200×4326		
Video Head		
Pinch Roller		
REW Belt		
Cassette LED		
GRANADA		
VHS-EY1×EY2		
Video Head		
Pinch Roller		
Belt Kit		
Reel Drive Unit		
Loading Gear A		
Loading Gear B		
Capstan Motor		
Cassette LED		
Tension Band		
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	Part No.	Price
VT-11		
Video Head	VID 2504	£15.84
Pinch Roller	VID 1788	£3.15
Tension Band	VID 1389	£1.44
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	£2.44
Take Up Idler	VID 1038	£1.29
Roller Bar	VID 1363	£4.67
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	£1.44
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	Part No.	Price
HR-3300		
Video Head	VID 2511	£10.74
Pinch Roller	VID 1756	£3.23
Take Up Clutch	VID 1031	£2.26
Take Up Idler	VID 1038	£1.29
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	£1.44
Repair Kit	VID 7918	£12.51
Mains Transformer	VID 2223	£24.18
Take Up Reel Table Rubber Tyre	VID 1080	£0.68
Supply Reel Table Rubber Tyre	VID 1080	£0.68
Cassette Housing	VID 1099	£21.75
N-895		
Video Head	VID 2514	£35.50
Pinch Roller	VID 1813	£3.15
Belt Kit	VID 7540	£0.68
Clutch Mechanism	VID 1082	£15.84
Capstan Motor	VID 2166	£53.24
Loading Motor	VID 2167	£14.11
Front Loading Motor	VID 2168	£12.64
Cassette LED	VID 1981	£1.53
Tension Band	VID 1387	£2.55

	Part No.	Price
Remote Control	IR 8947	£14.80
Repair Kit	VID 7919	£17.92
Cassette Housing	VID 1315	£21.90

£20.10
£3.06
£1.95
£7.28
£1.53

£9.19
£3.13
£1.79
£0.90
£0.95
£0.82
£1.27
£0.59
£0.29
£3.49
£10.86
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£9.19
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£2.04
£6.12
£1.53
£1.53
£2.39
£8.22

£18.57
£3.15
£1.16
£1.61
£7.28
£26.85
£16.70
£1.53
£5.78

£57.10
£5.70
£1.09
£5.20
£7.23
£10.61
£4.85

£3.15
£1.19
£1.61
£16.57
£1.53

SALORA	Part No.	Price
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	£3.43
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	£32.50
Pinch Roller	VID 1787	£3.43
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	£3.43
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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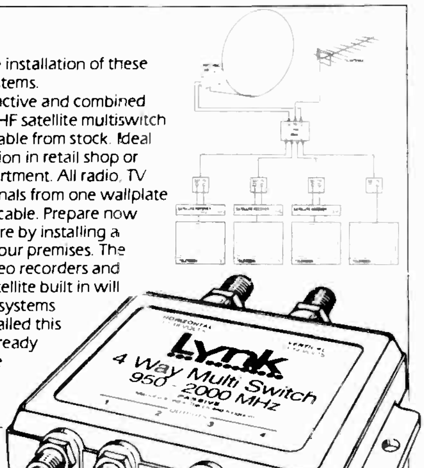

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TV Fault Finding

Reports from Philip Blundell, AMIEIE, Brian Storm, Edward Joyce , J.G.Grieve, Michael Dranfield, John Edwards, Richard Flowerday, John Hepworth, and Terry Lamoon

Philips GR1-AX Chassis

With most Philips chassis the h.t. supply to the line output stage is removed when the scan coils plug is disconnected. Beware! On some versions of the GR1-AX chassis this is not the case. I was caught out by a set that was dead with a whistling noise coming from the power supply. A resistance check across the 95V supply reservoir capacitor C2660 produced a reading of 600Ω. I figured that removing the scan coils plug should have disconnected the line output stage so, as the leak was still there, I chased around the power supply for a while. Finally I resorted to following the 600Ω leak along the print and ended up at the line output transformer, not the scan coils plug as I would have expected. All that was wrong was a leaky BUT11AF line output transistor. Fitting a new one and attending to some dry-joints in the line driver stage got things working again. **P.B.**

Philips 2A Chassis

If the power supply is slow to start check whether R3670 still reads 33Ω. When its resistance value goes high the power supply takes a few seconds to start. **P.B.**

Grundig Cinema 9050

There was a fault with the screen drive motor in this projection set – in this model the screen rises up out of the cabinet like Reginald Dixon at the Tower Ballroom! Usually when you switch the set on the channel display appears, the screen rises then the line timebase starts up. With this set however the channel display appeared, the screen began to rise, then the display went to standby and the screen weent down again. If you held the mains switch down the screen would move up jerkily with the channel display constantly going from 1 to standby.

The set has to be out of standby for the screen to rise. A check showed that the out-of-standby signal from the tuning board was pulsing when it should have been steady. The tuning board is powered by a mains transformer, rectifier and regulator. There was 1V of 50Hz ripple on the output from this arrangement. The regulator is on the Omniplatte (convergence etc.) board. As the rectifier D6013 is a full-wave type there shouldn't have been a 50Hz ripple. Resistance checks on the transformer solved the problem: one half was open-circuit because of a dry-joint where the leads are soldered to the mains fuse board. **P.B.**

Panasonic TC1485 (Z3 Chassis)

Intermittently dead faults are not exactly my favourites. So it was with a heavy heart that I lifted this portable on to the work bench. To start with the set worked perfectly. Subsequently it lapsed into an inoperative state. A check showed that there was no power-on signal from the system microcontroller chip IC1101, but further checks in this area revived the set which continued to work faultlessly all day. Next day the set couldn't be prodded into life. Everything appeared to be fine except that IC1101's reset line seemed to be slightly lower than usual. Suspicion then fell on a small yellow component, C1122 (0·01μF), which proved to be leaky. A replacement restored reliable operation. **B.S.**

Samsung CI5013T (P58SC Chassis)

If one of these sets won't start, with no standby light, or possibly trips check R811 (100kΩ) which tends to go high in value. It's connected to pin 8 of the TDA4601 chopper control chip. **E.J.**

Hitachi CPT2044/46/48

If the field size varies or there's field collapse, replace the 1μF capacitor C603 – it's a blue tantalum type! **E.J.**

Philips GR1-AX Chassis

A fault you sometimes get with these sets is no go with the standby LED flashing after a few seconds. If the cause is not the line output transistor it could be the 15V zener diode D6613. **E.J.**

Ferguson 59M5 (ICC5 Chassis)

The picture looked as though the tube's emission was low: it lacked blue until the brightness was turned up, when blue flared across the picture. We found that RV73 (47kΩ, 1W), the d.c. feedback resistor in the blue output stage, had risen to a very high value. **E.J.**

Ferguson B14C (TX90 Chassis)

No sound has become a common fault with these sets. Fusible resistor R509 (1·8Ω) goes open-circuit or high in value. Note that this is the Thomson, not the earlier TX90 chassis. **E.J.**

Panasonic TX21T1 (Alpha 2 Chassis)

The fault with one of these sets was that the picture went red after a short while in operation. We checked this and that and froze everything on the c.r.t. base panel, none of which helped. It turned out that a disc ceramic capacitor, C353 (220pF), was going leaky. It decouples the emitter of the red output transistor. **E.J.**

Ferguson ICC7 Chassis

If the set is dead but not tripping you'll probably find that RP62 (0·1Ω) is open-circuit and the BA157 rectifier diode DL09 short-circuit. DL09 takes its feed from the line output transformer, generating the 65V supply across CL09. RP62 is in the chopper circuit. **E.J.**

Philips CTX Chassis

There was an off-tune, slightly distorted picture with buzz on sound, higher channels being worse. Teletext consisted of garbled gobbledegook. The scan tuning wouldn't lock, though you could use the fine tuning. The cause of the trouble on this occasion was a leaky capacitor within i.f. transformer 5158. It's best to replace the whole can. Don't be tempted to tweak cores: this may appear to help, but the teletext doesn't like the result. **J.G.G.**

Osaki P10R

This set was dead but there were no blown fuses. The cause of the fault was no output from the 12V regulator IC402, a big, square block. I fitted the Nikkai AL2711K and all was well during a long test run. The set is similar to the **Nikkai Baby 10.** **J.G.G.**

Sony KV2212

This set was permanently in the search tuning mode. When we removed the back we saw that the channel search button was stuck down. A call to our Sony dealer friend proved to be fruitful. He didn't have the switch but provided us with the part number and recommended replacement of all ten pushbuttons on this panel to prevent further trouble. When we removed the panel we found that six of the buttons were stuck down. The Sony part no. is 1-552-774-00. **M.Dr.**

NEI 2131

There was sound but no vision, just a blank raster. A scope check showed that the amplitude of the sandcastle pulse at pin 8 of the TDA3561A colour decoder chip was low. The cause was traced to the TDA3653 field output chip (pin 7). Replacing this restored the video information. **M.Dr.**

Toshiba 2100TBT

This set would develop a ripple on the picture. It got worse as the set warmed up. Many tins of freezer, much heating with a hairdryer and extensive component replacement failed to cure the problem. We eventually found that connecting a 2·2μF, 63V capacitor between the tuner's VT pin and chassis cleared the effect. Solder the capacitor as close to the VT pin as possible. **M.Dr.**

Osume CTV1486T

When it was warm this set would keep flicking between the picture and teletext. In addition text characters would intermittently flash up on the screen. We found that the expensive SAA5243P/E VIP chip on the teletext PCB was running very hot. As its supply voltage was correct we replaced the chip, curing the fault. **M.Dr.**

Philips CF1 Chassis

One of these sets had several fault symptoms – no line or field sync, no sound output and flyback lines across the entire screen. The culprit was the TDA2577A sync/timebase generator chip. We had a TDA2577 in stock but when this was fitted there was normal sound but field collapse, so the A suffix is obviously important. **J.E.**

Finlux 1632

There was excessive width, severe EW bowing and the EW amplitude and width controls had no effect. We found that inductor Lz4 was badly dry-jointed at one end, where there were burn marks on the PCB around the joint, Rz26 (10kΩ) was open-circuit and the BD241A EW modulator driver transistor Tx4 was short-circuit base-to-emitter. **J.E.**

Hitachi CPT2278 (NP83CQ-2 Chassis)

One of these sets screamed at me until I disconnected pins 6 and 10 of the line output transformer. This stopped the screaming and restored the correct h.t. output from the power supply, thus proving that the transformer had failed. **J.E.**

Logik 4090/Ferguson TX90 Chassis

A corrugated ripple effect on all vertical contents of the picture could be reduced by lowering the brightness or contrast level, i.e. the beam current. The cause of the fault was C189 (22μF, 50V) which when checked measured only 0·5μF **J.E.**

Solavox 22R09/ITT CVC1215 Chassis

The job card said "bang then dead". When you get this look no farther than C701 (10μF, 350V) which explodes. It's quite a common fault. **J.E.**

Bush 2520

It took several attempts before this set would switch on. We found that the positive temperature coefficient thermistor R802 in the power supply was dry-jointed while R800 (820kΩ) read just under 2MΩ. When these components had been replaced the set started up with no further problems.

Another of these sets suffered from low-gain, noisy reception, as if the tuner had failed. The cause of the fault was the TDA4505 chip IC100 however. **J.E.**

Matsui 2180TT/Saisho FST212T

This set was dead. The mains bridge rectifier was providing a supply for the STR58041 chip in the power supply but the latter provided no output. A new chip plus mica washer and heatsink compound got the set going. **J.E.**

Goodmans 2043T

The power supply was working, providing the correct h.t. voltage at pin 17 of the chopper transformer, but the set remained lifeless because there was no h.t. at the B+ terminal of the line output transformer. Diode D8035 was open-circuit. **J.E.**

Panasonic TC21M1R (Z4 Chassis)

Intermittent field collapse was the fault with this set. It appeared at random and didn't seem to be affected by time or temperature. Must be a capacitor, we thought! When the fault was present the trigger input at pin 2 of the field output chip IC451 was missing. In addition the voltage at this pin rose to 5·8V.

Attention was turned to the field oscillator, which is part of the video processor chip IC601 on board C. Although the voltages here were correct there was no ramp waveform at pin 34, to which the oscillator's timing components are connected. The culprit was the 3·3μF tantalum capacitor C402. Remember – beware of blue tants! **R.F.**

Ferguson A51F (ICC7 Chassis)

One of these sets would very intermittently revert to the standby mode. The customer said that "it went off every five minutes", but it took over a week of soak testing for the problem to show up in the workshop. When it did, we found that the line oscillator's supply at pin 40 of IV01 was missing, though the voltage at the power control pin of the microcontroller chip IR01 was low – the correct state for a running set. Attention was turned to the standby switching transistors TR16/17. The latter turned out to be open-circuit, though freezing it brought the set back to life. A replacement transistor cured what was an extremely vexing problem.

Incidentally TR18 is not to be found in the set though it's shown in the circuit diagram. **R.F.**

Akura CX26

Although this set would produce stereo sound with a Nicam broadcast there was no f.m. sound with video playback at r.f., nor from a test pattern generator. There was plenty of demodulated f.m. sound at pin 5 of the i.f. chip IC101, but this disappeared into the Nicam board, where all the audio switching takes place, and didn't come out again. Swapping parts with another set proved that the EEPROM chip IC002 was responsible, though we couldn't work out why! When changing this chip much time can be saved by first going into the service mode and noting the various adjustment levels. **R.F.**

Bush 2814T

I had no service manual for this Turkish manufactured set, which had no e.h.t. and no tube heater supply. Fortunately it didn't take long to establish that R603 (3·9kΩ, 5W) was open-circuit. It's in the h.t. feed to the line driver stage. Be warned: replacing the back on these sets would try the patience of a saint! **J.H.**

JVC CX500ME

This is a multi-standard 5in. colour set with a radio and a cassette player section. The radio and tape sections worked but the TV section was dead. When TV was selected the voltage from the power supply fell to 4V. Disconnecting various things proved to be fruitless. The cause of the fault was a high-resistance section of the function selector switch. **J.H.**

Hitachi C25-P819 (G7P Mk II Chassis)

These sets are in the Images range of FST models. Failure to start usually means that one or more of the following resistors has gone high in value or open-circuit: R931 (150kΩ), R932 (120kΩ), R919 and R920 (both 100kΩ). If one of them goes only 20-30kΩ high it can cause intermittent starting. These resistors are connected in series pairs to pins 4 and 5 of the TDA4601 chopper control chip. **J.H.**

Mitsubishi Euro 4 Chassis

This set's memory, which is an EAROM, wasn't working. Following the usual practice, the chip operates with a –30V supply. We found that this supply was missing because of an open-circuit winding on transformer T951 (pins 1 and 4). **J.H.**

Pioneer SV2102

This was the first Pioneer TV set I've come across. There was e.h.t. but no sound or vision. The chassis is rather a daunting sight and the set weighed a ton. I decided to phone Pioneer for advice and was told to replace an i.c., type U4606 (they didn't give the circuit reference number, mind). Doing this cured the fault, but take note: if you order the chip from SEME you'll find that it is reasonably priced in the general spares list, but if you use the Pioneer part number you'll need a mortgage to pay for it. **J.H.**

Matsui 1455

The problem with this set was field collapse, though the output stage seemed to be working normally. Checks around the jungle chip were inconclusive and a replacement made no difference. So it was back to the driver and output stages. The power supply arrangement here is a bit unusual. By making cold checks I eventually found that the 10Ω safety resistor R310, which acts as a surge limiter, was open-circuit. This stopped the driver stage working. **T.L.**

ITT TX3126 (Monoprint B Chassis)

At switch on this set would trip, with a momentary display. I decided to check the outputs from the power supply and found that the 16V line showed no signs of life at switch on. The reason for this was that the 1,000µF reservoir capacitor C715 was short-circuit. Make sure you use the correct capacitance value – if it's too high it will hold the set off after an initial switch on, as I found out. **T.L.**

Matsui 1466

There was no sound or vision with this portable set, though the channel indicator was working. I went straight to the regular culprit with this model, R502 (330kΩ) in the power supply. It goes high in value. Fitting a replacement restored normal operation. **T.L.**

Mitsubishi CT25M1TX

When this set was switched on there was virtually no contrast in the display and flyback lines were present. A check on the voltages around IC251 produced a reading of 1·2V instead of 2·9V at pin 7. On tracing the supply back to Q704 I found that the 12V line was very low. When tested Q704 turned out to be leaky, a replacement restoring a perfect display. **T.L.**

Matsui 2160

If the fault is no sound or picture with normal channel change lights, check the output from the STR58041 chopper chip IC501. If this is missing fit a replacement. **T.L.**

Ferguson 51P7 (TX98 Chassis)

This set was brought in with the complaint that the channels would change on their own, the sound would mute and the text would do odd things. We had it on test for several days without any fault putting in an appearance, but the customer insisted that it was faulty. So we phoned a Ferguson expert who suggested an answer. All you have to do is to cut the print at pin 11 of the infra-red preamplifier chip and add an 0·1µF capacitor across the cut. This was done and the set was sent back, never to return. So the modification worked. If it doesn't you replace the tube base. **T.L.**

Camcorner

Reports from David C. Woodnott and Keith T. Keeton

Amstrad VMC100

For no colour check the 2SC3929 transistor Q517 on the camera PCB. It buffers the chroma signal feed to the deck section. **D.C.W.**

Ferguson FC07

This JVC-designed camcorder had no camera E-E picture. A common cause of this symptom (a blank white viewfinder screen) is lock-up of the microcontroller chip: removing then refitting the clock battery normally provides a cure. Not so this time! On inspection we found that the iris remained closed – pictures were obtained when the iris mechanism was manually operated. The cause of the fault was traced to D4 on the IMG SSG panel. It was open-circuit. In fact this glass-type diode was literally shattered. An interesting point is that it's shown in the manual as a chip component.

No cause for the failure of this component could be found and a replacement provided a complete cure. The diode's physical position on the PCB puts it in contact with the rear edge of the deck mechanism. It seems possible that a knock to the optical block could produce a mechanical shock that was transferred to the D4 area, cracking the glass. **D.C.W.**

Panasonic NVMS2

The problem with this camcorder was incorrect white balance. We traced the cause to poor soldering at P001 on the camera operation PCB. **D.C.W.**

Sony CCDF250

The reported fault was "viewfinder and E-E camera pictures disappear after a few minutes' use". Sure enough they did! We traced the camera picture signals, both Y and C, through to the output pins of the encoder chip IC606 on board CV9. At this point they are applied to a Y/C mixing and buffering circuit consisting of Q602, Q617 and Q619, a composite video signal appearing at the emitter of Q619. This signal disappeared intermittently, causing the fault symptom.

The Y/C mixer stages are direct coupled, and voltage checks here showed that the d.c. conditions varied wildly. Static checks and the replacement of several components in this area didn't help. The voltages at the pin connections varied even when the three transistors were removed from the board! Sabotage was suspected. . . The cause of the problem turned out to be a 120μF, 6·3V electrolytic capacitor (C704) that decouples the 5V rail. It had leaked over part of the print in the Y/C mixer section. I suppose the moral is that if odd symptoms that defy logic persist, look for a leaky capacitor. **D.C.W.**

Amstrad VMC100

The fault report with this point-and-shoot model said "no functions with the cassette housing open". We found that CP403 and the 9·6V regulator transistor Q402 on the main PCB were both open-circuit. We checked for shorts then fitted replacement components. This provided a cure – until eject was pressed. CP403 then failed, but this time Q402 was all right. As no likely cause could be discovered CP403 was replaced, a tape was loaded and a recording was started. Everything was o.k., even when eject was pressed: the recordings were found to be o.k. when checked in a playback machine. But after much soak testing CP403 again failed while the machine was in the eject mode.

In sheer desperation I dismantled the unit once more and connected an analogue ammeter in series with CP403. Tape loading was achieved without mishap, but when the eject button was pressed the ammeter showed that there was an excessively heavy overload, far in excess of normal. The cause of the trouble was finally traced to the loading motor, which was going short-circuit to chassis intermittently, thus explaining why the fault occurred only in the eject mode. **D.C.W.**

Sony V900

These camcorders are very reliable and are easy to fix once they are opened up, but a very large number of patch leads are required. Once you are able to power the machine the assembly looks like spaghetti. Repair is not a job for the beginner. We've had the following faults:

(1) There was playback/recording for a few seconds, then a warning symbol appeared. We found that in fast forward the take-up reel didn't move while the clutch was slipping. A new take-up reel restored correct operation.

(2) There were horizontal stripes on the playback picture. We found that the tape path couldn't be adjusted. There was a faulty tape guide, a new roller assembly putting matters right.

(3) The LCD was o.k. but there was no power to the camera/VCR section, with the electronic viewfinder dead. Checks around IC101 on board FD10P showed that the 5V supply was present at pin 54, there was oscillation at pins 55/58 but the VTR power-on output didn't go low. IC101 was faulty, a replacement restoring normal operation. This is a fairly common fault. **K.T.K.**

Sony V700

Here are a couple of faults we've had with this model:

(1) There was no playback picture (black screen) and no sound. Checks showed that the 5V PB supply was low at 1·5V. The cause was transistor Q280 (type 2SC4081R, part no. 872990535).

(2) No playback picture (black screen) but this time the sound was o.k. Checks showed that there was an input signal at pin 41 of IC650, which turned out to be faulty. It's type CXA1207R (part no. 875203619). **K.T.K.**

Long-distance Television

Roger Bunney

This column first appeared over thirty years ago, when the magazine was called *Practical Television*. It was initially written by Charles Rafarel, who carried out much research on long-distance television reception techniques in the early days. When Charles died in 1971 I was asked to take over and have written the column ever since. The aim has been to carry on in the way that Charles would have approved – describing experimentation and innovation and providing news.

There have been rapid advances in reception technology over the last twenty years. These include solid-state receivers, the varicap tuner and improved ways of resolving weak signals. At the same time it has become much easier to obtain suitable equipment. Thus receiver modification, the norm in the Sixties, is no longer necessary. The ATS-6 SITE experiment in 1975/6 gave us the first chance to sample satellite TV reception: reports on the success of several enthusiasts in receiving these weak signals were reported in this column. V.H.F. TV in the UK is now but a memory: Bands I and III are at present wastelands of PMR, baby alarms and other 'officially sanctioned' intruders despite being allocated as broadcast bands in Europe. Along with these developments, DXing has also changed. We have to exploit new TV signal reception possibilities as they arise.

Satellite TV is now an established and growing consumer market. Satellites offer a mass of TV and radio programmes, video feeds of various sorts and news links that can be received using simple equipment and aerials. You don't need massive aerials on tall masts, simply a clear view of the sky from the south east through to the south west. Many DX enthusiasts are now monitoring the various satellite bands and birds. This may not be true DX, being line-of-sight rather than over-the-horizon, but there is much of a DX nature to see and with the weaker signals DX techniques still apply.

From next month I intend to include satellite loggings, with a view to encouraging readers to investigate the various signals that can be received; also to provide information on the equipment required, with the emphasis on practical and inexpensive ways of satellite DXing. Our terrestrial DX-TV coverage will of course continue, and readers letters will as always be welcome. If you do write to tell us about satellite receptions, please mention the equipment being used.

November was a very quiet month for conventional DX reception. There were a few Sporadic E signals, a couple of auroral events and one day of exceptional tropospheric reception – and that was about it! No reports have come in of reception as a result of the Leonids meteor shower. The collated SpE log is as follows:

6/11/93	TVE (Spain) chs. E2, 3, 4; RAI (Italy) chs. IA, B; TVA (Italy) ch. IA.
7/11/93	+PTT (Switzerland) E2, 3, 4; RAI IA.
8/11/93	TVE E2, 3, 4.
13/11/93	DR (Denmark) E3; TVE E2.
15/11/93	DR E3; TVE E2.
20/11/93	NRK (Norway) E3.
27/11/93	TVE E2; RAI IA; +PTT E2.

Iain Manzies logged auroral events on the nights of the 14th and 19th, with signal 'manifestations' in Band I.

There was an excellent tropospheric lift on the 8th, with signals from ARD (Germany), DR/TV2 (Denmark) and SVT1/2/TV4 stations (Sweden) in Band III and at u.h.f. More exotic signals were logged by Simon Hamer in Powys, including TVP1 (Poland) ch. R8 and YLE (Finland) ch. E6. Two extremely good catches in an otherwise dull month.

My thanks to Iain Menzies (Aberdeen), Simon Hamer (Powys), Roger Fussell (Torpoint), Brian Williams (Penarth) and Peter Schubert (Rainham) for sending in reports.

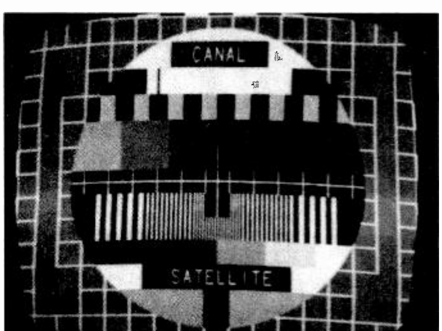
News Items

Ireland: A new Gaelic language TV channel, Telefis na Gaeilge, will come on air during 1994 with three hours of programmes a day to start with.

UK: The ITC is offering a local delivery licence, as the cable franchises are now called, for the west Kent area, including Tonbridge, Tunbridge Wells and Sevenoaks. Use of both cable and broadcast transmission is envisaged. For the latter a 40MHz bandwidth in the 40GHz band will be allocated – though no equipment for this is currently available.

India: Doordashan is currently transmitting five channels via Insat 2B, but most viewers remain tuned to Star TV from Hong Kong via AsiaSat 1. To encourage viewing the five-channel Doordashan service will be duplicated via terrestrial transmitters in the main urban areas: low-power transmitters are to be installated in Calcutta, Madras, Bombay and Delhi using channels E5, 7, 23, 26 and 29.

Zambia: Independent radio and TV transmission licences are to be issued – bids were to be received by the end of 1993. Radio stations will use Band II, with f.m.



Left: Canal Satellite from Telecom 2B at 5°W. Signals from this satellite are easy to receive in the southern UK with a 60-80cm dish. Centre: Nile TV, a new Egyptian channel transmitted via Eutelsat II F3 at 16°E. Reception by Andrew Sykes in Halifax, using a standard Pace receiver and an 80cm dish. Right: Another photograph from Andrew Sykes, showing a typical news feed menu transmitted by the EBU, usually via Eutelsat II F4 at 7°E. Items come from various European broadcasters.

Belgium: Because of severe financial problems RTBF is curtailing its contributions to the ARTE channel.
Malta: The authorities have made strong complaints about the use of their allocated u.h.f. channels, 21 and 29, by Italian stations. An unlicensed Maltese station, Super One Television, has been carrying out tests on ch. E43.
Poland: The satellite channel Polsat has been given a ten-year licence for terrestrial broadcasting throughout the country.

Transmitter Updates

Belgium: Liege ch. E39 e.r.p. increased to 315kW, ch. E42 reduced to 500kW.
France: The following stations are now in operation. Avignon TDF-3 ch. E33, TDF-6 ch. E36, both 55kW e.r.p.; Saint Raphael TDF-5 ch. E36 80kW e.r.p.; Caen TDF-6 ch. E61, TDF-5 ch. E64, both 100kW e.r.p. All with horizontal polarisation.
Belgium: ARTE-21 transmissions, Leglise ch. E11 10kW, Liege ch. E42 500kW, Profondeville ch. E49 200kW, Anderlues ch. E61 200kW. Sports-21 transmissions, Wavre ch. E28 500kW, Leglise ch. E60 200kW, Tournai ch. E63 20kW (vertical). AFN-TV transmissions, Everberg ch. E33 2kW, Casteau-Shape ch. E34 4·5kW (vertical). Canal Plus transmissions, Liege ch. E39 315kW, Wavre ch. E50 500kW, Anderlues ch. E58 200kW. ARTE-21 programmes are scrambled from 1900 local time. Canal Plus transmissions are scrambled all the time.

Our thanks to the EBU and the BDXC for the above information.

Meteor Showers 1994

Many thanks to Neil Bone, Director of the Meteor Section, the British Astronomical Association, for providing the dates of the main meteor showers during 1994 and the related notes as follows:

Lyrids shower April 19-25th, peaking on the 22nd.
May Aquarids May 1st-20th, peaking on the 5th.
Cetids May 7th-June 10th, peaking May 14-25th.
Delta Aquarids July 15th-August 20th, peaking August 1st.
Perseids July 25th-August 20th, peaking August 11-12th.
Giacobinids – little activity expected this year.
Orionids October 16-27th, peaking on the 20-22nd.
Taurids November 1st-30th, peaking on the 3rd-8th.
Leonids November 15-20th, peaking on the 17-18th.
Geminids December 7-15th, peaking on the 13th.

The Quadrantids shower occurred in early January. The most active showers are the Quadrantids, Perseids and Geminids. In recent years the Perseids have provided a double peak (August 11-12 and 12-13th), associated with the return of the parent comet. Activity is moderate with the May Aquarids and Orionids. Leonids are uncertain: outbursts every 33 years suggest that 1998/9 will produce a major shower, with the preceding years showing enhanced activity. There is activity at six-yearly intervals with the Giacobinids, 1998 being the next date. The other showers listed produce low but steady activity.

Satellite TV

Once a sought after station TV Shqiptar, Albania will be an every-day signal now that the Albanians have signed a one-year lease for transponder facilities aboard Eutelsat II F3 at 16°E. Another new channel at 16°E is Quorum Satellite Network, which has been transmitting captions. Frequency is 11·163GHz with horizontal polarisation. This business programme is uplinked from London.

There have been suggestions of overheating problems with Astra 1A, leading to transponder allocation reshuffles and power reductions with some downlinks. There were stability problems with this satellite in the early days and it is possible that its estimated life will be shortened.

Singapore Television International has commenced operation in the Far East as a rival to Star TV.

Peace at last over the dispute about the satellite slot at 78·5°E. The Thaicom-1 satellite is to occupy this position while Asiasat-2 will be at 100·5°E. The back-up Thaicom-2 satellite will also be at 78·5°E.

Eutelsat II F5 should now be in orbit at 36°E with 16 Ku band transponders while the elderly Eutelsat I F1 is to be moved to either 36° or 50°E to give greater coverage of the Middle East and Central Russia.

An interesting fault condition has occurred on Intelsat 601 at 27·5°W. The C band Canal France International service for Africa is also present at 11·155GHz, the old CNNI transponder, presumably because of a defect in the cross-strapping circuitry. The signal is not strong but with care can be clearly seen.

TV wars are breaking out across France: in conjunction with Canal Plus, Tele Monte Carlo is offering a programme package to compete with the offerings of the RTL (CLT) group. The latter has wheeled out RTL-TV, RTL+ and RTL2/3/5 as complementary channels to compete with the TMC/Canal Plus package. Talks are understood to be in progress between the competing parties.

Finally NKM, a German company, has just introduced a

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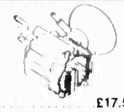

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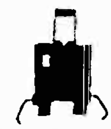

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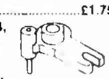

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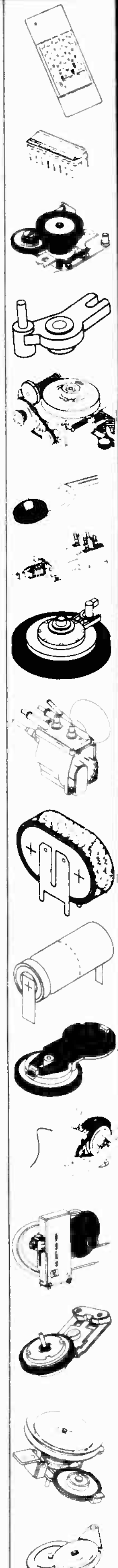

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AN3821K £7.00	BA5406 £2.50	LA1260 £1.75	M51903L £3.50	SAA5050 £7.00	STK7358 £6.50	TA7680 £4.80	TDA2040 £2.00	TMM 2114AP £5.75	2SC2655 £0.60	BC337 £0.07	BA157 £0.07
AN3822 £7.50	BA6104 £2.50	LA1403 £3.75	M5213L £3.10	SAA5231 £9.00	STK7728 £5.30	TA7681AP £5.75	TDA2151 £5.50	TMS1944AN2L £2.00	2SC2958 £2.50	BC372 £0.95	BR100 £0.20
AN5015 £3.30	BA6109 £1.80	LA3160 £1.90	M52184 £1.00	SAB3013 £5.77	STR1096 £4.00	TA7687 £2.00	TDA2161 £3.50	TMS1952 £2.50	2SC2979 £3.00	BC392 £1.50	BR101 £1.40
AN5033 £5.00	BA6124 £2.75	LA3210 £1.90	M52314 £1.10	SAB3037 £11.00	STR3125 £5.50	TA7698A £6.85	TDA2170 £3.25	TMS1956 £2.30	2SC3153 £3.48	BC441 £0.25	BR103 £0.75
AN5132 £3.95	BA6154 £2.50	LA3220 £1.00	M54519P £1.00	SAF1032P £6.00	STR4090 £16.00	TA7698AP £7.50	TDA2270 £2.20	TMS1965NL £2.00	2SC3402 £0.40	BC461 £0.25	BR303 £1.50
AN5265 £1.35	BA6208 £2.75	LA3350 £1.50	M54543 £1.75	SAF1039P £2.00	STR40090 £8.00	TA7705P £1.50	TDA2320 £0.90	TMS3450 £4.50	2SC3519 £4.68	BC547 £0.07	BRY56 £0.75
AN5510 £4.50	BA6209 £3.20	LA3361 £1.50	M54544L £3.50	SAS560 £3.50	STR4211 £5.95	TA7709 £2.50	TDA2510 £5.00	TMS3615 £1.75	2SC3678 £2.70	BC548 £0.07	BT116 £2.50
AN5512 £2.00	BA6219 £1.95	LA3600 £1.50	M54548L £4.50	SAS570 £3.00	STR440 £6.50	TA7738 £2.50	TDA2521/3 £9.75	U410B £1.60	2SC3715 £4.80	BC549 £0.07	BT128P £4.50
AN5521 £3.50	BA6222 £3.10	LA3700 £2.50	M58478P £4.75	SAS580 £3.50	STR441 £8.50	TA78L010P £1.75	TDA2522Q £10.75	U416B £1.60	2SC458 £0.20	BC557 £0.30	BT129P £4.50
AN5730 £3.20	BA6229 £1.85	LA4100 £1.90	M58655P £6.50	SAS590 £3.50	STR451 £15.00	TA8101N £4.25	TDA2530Q £6.00	UA767PC £1.20	2SC789 £2.54	BC559B £0.07	BT151/800R £1.75
AN5750 £2.50	BA6238A £1.95	LA4102 £1.20	M58839 £8.00	SL1430 £2.80	STR454 £4.85	TA8102P £4.25	TDA2532 £3.00	UA78/10 £2.00	2SD1047 £2.75	BC639 £0.18	BY126 £0.20
AN5760 £2.00	BA6239 £3.75	LA4125 £5.50	M708 £5.50	SL1431 £1.60	STR50020 £7.90	TA8644 £5.50	TDA2532Q £3.00	UA78M15 £2.00	2SD1051 £0.85	BC640 £0.30	BY127 £0.08
AN5900 £1.50	BA6259 £3.00	LA4140 £0.70	M709 £4.75	SL1432 £2.00	STR50103A £5.50	TAA310A £2.00	TDA2540 £2.75	UAA1008DP £2.00	2SD1128 £1.54	BD131 £0.50	BY133 £0.20
AN6326 £4.00	BA6301 £2.00	LA4160 £1.25	MA150-E £2.20	SL471DP £2.20	STR5412 £5.95	TAA550 £2.10	TDA2541 £2.00	UC38445 £5.00	2SD1138 £0.85	BD132 £0.40	BY164 £0.90
AN6332 £4.40	BA6302A £2.10	LA4182 £2.10	MB3106 £1.00	SL480 £3.30	STR58041 £6.75	TBA120S £0.50	TDA2543 £5.25	UPC1185H2 £5.00	2SD1159 £0.75	BD137 £0.35	BY164/SKB2/02 £0.90
AN6341 £2.75	BA6304 £1.70	LA4183 £2.75	MB3730 £2.75	SL490 £3.00	STR6020 £6.50	TBA530 £1.50	TDA2560 £3.75	UPC1225H £3.75	2SD1207 £0.75	BD237 £0.22	BY179 £1.10
AN6344 £6.50	BA6305 £1.75	LA4192 £1.70	MB3731 £3.25	SL901B £3.00	TA4180 £3.00	TBA560 £1.60	TDA2600 £6.80	UPC1230 £3.00	2SD1273 £1.00	BD238 £0.22	BY179/SK2/08 £1.10
AN6346 £4.50	BA681 £0.90	LA4422 £1.30	MC13002P £5.00	SL917B £4.00	TA4193 £5.00	TBA750Q £4.20	TDA2576A £6.00	UPC1238V £2.10	2SD1275 £1.30	BD243B £0.30	BY184 £0.85
AN6346 £4.50	BA7001 £1.90	LA4440 £2.70	MC1310 £1.25	SN76670N £1.25	TA4194 £5.50	TBA800 £0.85	TDA2578 £3.00	UPC1263 £3.00	2SD1288 £1.70	BD243C £0.40	BY189 £2.00
AN6359 £5.50	BA718 £1.80	LA4445 £2.50	MC1330P £2.95	SSA1075 £5.90	TA4301 £4.50	TBA820M £0.45	TDA2578A £3.80	UPC1288V £5.00	2SD138 £0.85	BD244 £0.30	BY190 £2.00
AN6360 £3.75	BA728 £1.10	LA4460 £1.70	MC14001BCP £1.10	SSA1250 £3.50	TA4345 £3.40	TBA920S £1.50	TDA2579 £3.50	UPC1361C £3.90	2SD1391 £4.20	BD244C £0.30	BY223 £2.00
AN6362 £4.25	BA7767S £5.00	LA4461 £1.80	MC14093B £1.50	ST082 £12.00	TA4350 £6.00	TCA640 £3.75	TDA2581Q £8.00	UPC1362C £4.50	SDC1397 £3.75	BD278A £0.80	BY206 (BYB96R)
AN6387 £5.50	BTT6018 £3.50	LA4500 £2.70	MC14426P £2.50	ST1195 £5.50	TA7120 £1.25	TCA650 £3.95	TDA2582 £2.55	UPC1363 £1.90	2SD1398 £2.25	BD434 £0.80	£0.55
AN6612 £2.20	CNX62A £3.50	LA4570 £2.20	MC14429P £2.20	STA401A £3.75	TA7137 £1.25	TCA660B £3.50	TDA2590 £2.25	UPC1365 £4.50	2SD1426 £4.58	BD508 £0.90	BY210/800/BYV96
AN6651 £0.60	HA11215A £3.50	LA5522 £2.20	MC14497P £5.50	STA441C £3.00	TA7176 £2.50	TDA1005 £2.70	TDA2591 £2.70	UPC1377C £3.50	2SD1432 £5.00	BF195 £0.07	£0.55
AN6671K £5.50	HA11223 £3.75	LA5527 £1.95	MC14516BCP £2.00	STK0029 £4.30	TA7176AP £2.40	TDA1010A £1.30	TDA2593 £1.50	UPC1378H £2.00	2SD1453 £1.60	BF196 £0.15	BY227 £0.20
AN6677 £5.70	HA11225 £2.10	LA6358 £1.00	MC1458/UPC1458	STK043 £15.00	TA7193AP £6.00	TDA1011 £1.20	TDA2594 £3.00	UPC1379 £2.20	2SD1455/2SD1730	BF197 £0.15	BY228 £0.50
AN6884 £2.75	HA11226 £3.75	LA7016 £2.50	£1.95	STK082 £12.00	TA7193P £6.00	TDA1013 £2.60	TDA2611A £2.00	UPC1382 £1.50	£3.80	BF198 £0.07	BY229 £1.15
AN6912 £2.00	HA11235 £3.10	LA7096 £4.00	MC3359 £1.10	STK2029 £8.50	TA7205 £1.75	TDA1013A £1.90	TDA2640Q £4.50	UPC1394 £1.70	2SD1496 £4.00	BF199 £0.14	BY299 £0.50
AN7111 £1.50	HA1124A £1.75	LA7210 £3.10	MCU2632 £1.90	STK2125 £10.00	TA7205AP £2.50	TDA1015 £1.20	TDA2653A £3.50	UPC1420A £7.00	2SD1497 £2.60	BF244 £0.40	BY96D £0.30
AN7112 £3.00	HA11414 £2.50	LA7305 £6.90	MEA2050 £4.60	STK2250 £9.20	TA7222 £2.25	TDA1020 £2.50	TDA2822 £2.00	UPC1458 £1.95	2SD1497-02 £5.95	BF259 £0.22	BYV96D £0.55
AN7116 £1.20	HA11701 £3.10	LA7309 £3.75	MEA2901 £3.00	STK3041 £5.70	TA7223 £2.50	TDA1022P £4.50	TDA3190 £0.95	UPC1513HA £2.00	2SD1497-06 £5.95	BF422 £0.15	BYW56 £0.50
AN7143 £2.20	HA11713 £8.90	LA7507 £4.00	MH27316 £3.00	STK40090 £8.00	TA7227P £2.30	TDA1035 £1.90	TDA3303 £7.50	UPC1520CA £2.48	2SD1650 £3.50	BF458 £0.22	BYW96E £0.50
AN7148 £1.70	HA11714 £3.50	LA7520 £3.25	ML232B £4.50	STK4121 II £8.75	TA7230P £1.65	TDA1035T £1.90	TDA3330 £9.50	UPC339C £0.70	2SD1877 £2.30	BF459 £0.22	BYX10 £0.50
AN7158 £4.00	HA11715 £3.20	LA7800 £1.50	ML237 (BTT6018)	STK4141 II £7.90	TA7232P £1.50	TDA1037 £7.90	TDA3540 £4.00	UPD4011 £1.75	2SD639 £0.35	BF469/BF471 £0.25	BYX55/600 £0.55
CNX62A £1.50	HA11747A £12.75	LA7801 £1.50	£3.50	STK4142 II £10.00	TA7233P £2.10	TDA1044 £2.50	TDA3541 £2.25	UPD4066 £1.95	2SD667 £1.00	BF471 £0.25	FB2506 £1.50
AN7160 £6.00	HA11749 £7.00	LA7820 £1.90	ML238B £7.50	STK4151 £11.50	TA7240 £3.00	TDA1044U £1.50	TDA3560 £5.00		2SD725 £3.70	BF472 £0.25	IN4001 £0.06
AN7169 £3.50	HA11750 £3.50	LA7830 £2.50	ML923 £5.50	STK4171 II £12.00	TA7241 £2.50	TDA1057 £2.00	TDA3561A £5.00		2SD787E £0.30	BF870/BF472 £0.25	IN4002 £0.06
AN7171K £4.50	HA12005 £3.80	LA7913 £1.30	ML923DP £4.50	STK430 £6.00	TA7241AP £3.00	TDA1082 £3.50	TDA3562A £5.00		2SD811 £2.95	BU108 £0.75	IN4004 £0.10
AN7205 £1.95	HA12017 £2.00	LM1011N £3.00	ML926 £4.20	STK4311 £10.20	TA7243 £3.30	TDA1083 £1.70	TDA3565 £3.00		2SD836 £1.70	BU126 £1.40	IN4005 £0.10
AN7213 £1.10	HA12026 £2.00	LM1017/M192B1	MM314APL £1.75	STK433 £7.50	TA7245 £4.50	TDA1151 £1.50	TDA3571BQ £9.52		2SD837 £0.80	BU208 £1.00	IN4006 £0.08
AN7218 £1.20	HA2413 £1.20	£2.30	MM53108N £1.25	STK435 £8.00	TA7267P £2.80	TDA1154 £2.70	TDA3590 £6.00	TRANSISTORS	2SD845 £2.50	BU208A £1.25	IN4007 £0.08
AN7220 £1.60	HA13001 £1.80	LM1035 £5.75	MM5387 £2.90	STK4352 £5.80	TA7270P £2.50	TDA1170S £1.50	TDA3651 £3.00	2N3773 £1.90	2SD868 £3.50	BU208D £1.15	IN4148 £0.10
AN7222 £2.10	HA13402 £8.20	LM1036N £3.70	MM5402 £1.50	STK437 £12.00	TA7271P £3.25	TDA1180 £1.80	TDA3651AQ £6.50	2SA1095 £5.50	2SD869 £3.00	BU208T £1.00	IN5408 £0.25
AN7223 £7.60	HA13403 £4.00	LM1112CN £3.30	MM5405N £3.50	STK4392 £7.00	TA7274 £2.60	TDA1180P £3.00	TDA3653 £3.00	2SA1102 £1.90	2SD870 £3.50	BU326A £1.00	KBL08 £1.95
AN7224 £1.40	HA1350 £9.00	LM13600 £5.00	MM5456 £2.25	STK441 £10.50	TA7280P £3.00	TDA1190 £1.90	TDA3654 £2.80	2SA1112 £0.95	2SD871 £4.50	BU406 £0.90	OA91 £0.20
AN7225 £1.90	HA1368R £2.55	LM1868N £1.50	MM5457N £2.50	STK459 £11.00	TA7281P £3.00	TDA1270M £4.10	TDA3810 £2.90	2SA1124 £0.35	2SD895 £2.00	BU406D £1.50	OT112 £2.20
AN7273 £2.00	HA1374 £6.00	LM1894N £5.75	MM5458N £2.50	STK461 £10.50	TA7299P £3.00	TDA1365 £4.90	TDA3950 £3.00	2SA1220 £1.10	2SD898 £2.75	BU407 £0.50	RGP15G £0.45
AN7310 £1.10	HA1377 £2.00	LM317T £1.00	MM55108 £2.65	STK463 £12.00	TA7302 £1.30	TDA1412 £1.00	TDA440 £2.00	2SA1386 £4.70	2SD898B £2.75	BU426A £1.00	RGP15J £0.55
AN7311 £1.75	HA1388 £4.00	LM324 £0.80	MM7317 £3.75	STK465 £12.00	TA7303 £1.10	TDA1470 £5.00	TDA4420 £2.45	2SA564 £0.40	2SD900B £4.10	BU500 £1.00	RGP15K £0.35
AN7315 £1.75	HA1392 £3.00	LM339 £0.80	MM74C901 £1.10	STK5315 £7.50	TA7310 £1.75	TDA1501A £3.20	TDA4422 £3.95	2SA673 £0.20	BC107B £0.10	BU508A £1.00	RGP30K £0.70
AN7324 £4.50	HA1394 £4.00	LM339N £0.75	MPD4011C £2.00	STK5322 £6.50	TA7312 £1.75	TDA1506 £8.50	TDA4500 £3.80	2SA942 £0.35	BC108 £0.10	BU508AF £1.70	RHI £1.30
AN7410 £2.10	HA1397 £5.40	LM384 £3.60	MPD4069C £1.10	STK5325 £5.50	TA7313 £0.90	TDA1510 £3.20	TDA4501 £5.80	2SA985 £0.95	BC108B £0.10	BU508D £1.00	RM11C £0.45
AN7415 £1.40	HA1398 £3.50	LM386N £0.80	MPD4081 £1.10	STK5331 £3.75	TA7313AP £1.40	TDA1510A £3.20	TDA4503 £4.50	2SB1016 £1.50	BC115 £0.16	BU806 £0.75	SG264 £8.50
AN7420 £3.20	HA1406 £2.00	LM556CN8 £2.50	MPD4514BC £5.00	STK5332 £3.50	TA7314 £2.00	TDA1512 £3.75	TDA4505 £6.75	2SB772 £0.40	BC118 £0.12	BU807 £0.75	SG613 £12.00
AN7818F £1.60	HA1457 £2.10	LM6402G-2003	MPD5521066 £11.00	STK5333 £6.00	TA7323 £3.25	TDA1515A £2.50	TDA4510 £4.40	2SB775 £1.60	BC147A £0.07	BUT11 £0.95	SKB/02 £0.60
B1403 £1.00	HA4219 £2.70	£10.00	MSL9378RS £3.50	STK5338 £6.00	TA7325 £2.00	TDA1520 £3.95	TDA4600 £2.60	2SB819 £0.55	BC159 £0.09	BUT11AF £1.95	SKB/08 £1.20
BA1320 £1.50	HD14081 £0.25	LM641 £1.80	SAA1006 £2.50	STK5339 £4.00	TA7325P £1.50	TDA1522 £1.50	TDA4600-2 £2.80	2SB965 £2.30	BC171 £0.09	BUW84 £1.65	SKB2/02 £0.90
BA1332 £1.00	HD4539 £0.70	LM748CN 8 PIN	SAA1025 £5.80	STK5361 £6.25	TA7328 £2.00	TDA1670A £3.00	TDA4601 £2.70	2SC1413A £2.50	BC172 £0.09	BUX84 £0.80	SKB2/08 £1.10
BA301B £1.50	KA2210 £2.30	£1.25	SAA1124 £3.95	STK5421 £6.50	TA7335 £1.50	TDA1701 £4.00	TDA4610 £4.50	2SC1826 £1.80	BC172C £0.07	SD12659 £0.75	SKE1/02 £0.60
BA318 £2.50	L7805 £0.80	LM748N £2.00	SAA1174 £6.50	STK5422 £6.00	TA7335P £4.20	TDA1770A £3.00	TDA5101 £2.00	2SC1942 £5.50	BC182L £0.09	T9064V £2.28	SKE1M15 £0.65
BA328 £1.10	L7806 £0.80	M104 £7.00	SAA1250 £4.00	STK5434 £6.50	TA7342 £2.10	TDA1870A £2.60	TDA7250 £6.00	2SC1983 £1.30	BC183 £0.09	TIP110 £0.45	SKE2G2/02 £0.75
BA3308 £2.10	L7808 £0.80	M293B1 £15.00	SAA1251 £8.50	STK5451 £5.50	TA7343 £1.75	TDA1905 £1.40	TDA7606AP £2.40	2SC2003 £0.25	TDA8180 ORIGINAL	TIP112 £0.45	SKE2G3/04 £1.30
BA333 £1.40	L7812 £1.00	M490BB1 £14.50	SAA1276 £4.50	STK5471 £5.25	TA7350 £2.10	TDA1908A £2.25	TDA8180 £6.00	2SC2027 £4.50	£9.50	TIP29 £0.30	SKE4F1/04 £0.45
BA3416L £2.75	L7815 £0.80	M491B/BB1 £11.50	SAA1290-02 £10.70	STK5476 £6.00	TA7358 £1.50	TDA1940 £2.80	TDA8190 £3.80	2SC2230 £0.50	BC184 £0.09	TIP30 £0.45	SKE4F1/06 £0.45
BA3505F £2.75	L7818 £0.80	M50127AP £6.00	SAA1293-02 £8.00	STK5481 £5.00	TA7607 £3.50	TDA1950 £2.50	TDA8341 £5.50	2SC2238 £0.75	BC212 £0.09	TIP31 £0.30	SKE5F3/10 £2.20
BA3704 £2.75	L7824 £0.95	M50453-012P £6.20	SAA1293-03 £5.70	STK5482 £5.20	TA7607AP £2.40	TDA2002 £1.40	TDA9503 £3.00	2SC2331 £1.00	BC213 £0.09	TIP32 £0.30	SR2M £0.75
BA4210 £2.50	L7905 £0.80	M50560-01P £2.70	SAA3027 £5.00	STK5720 £7.00	TA7609P £2.70	TDA2003 £1.30	TDA9513 £2.95	2SC2335 £1.50	BC214A £0.07	TIP41 £0.27	T9053V £1.40
BA4220 £2.00	L7912 £0.80	M51014L £1.95	SAA5000 £7.50	STK5730 £5.25	TA7614 £2.50	TDA2004 £1.70	TEA1009 £2.00	2SC2531 £0.26	BC214B £0.07	TIP42C £0.40	T9064V £1.50

ASK FOR SEMICONDUCTORS NOT LISTED. PRICES SUBJECT TO CHANGE

SEND FOR PRICE LIST ☆ ☆ ☆ Trade Counter now open Monday-Friday 9.00-5.30. Saturday 9.00-1.00. Closed between 1.30pm-3.00pm every Friday. Nearest Underground Station – Southfields District Line.

special satellite receiver with a static threshold below 2·5dB. The SRX200E features digital signal processing and is intended as a monitoring or test receiver. Price is DM5,500, in Germany – carriage extra. For further information write to NKM-Eleektronik GmbH, PO box 1705, D-79507 Loerrach, Germany.

TV-DXing for Beginners

Last month we described suitable aerials for Band I reception. The choice of aerials for Band III and u.h.f. reception is perhaps more difficult. For Band III, various imported aerials such as those in the Triax range are available while Jaybeam still produce Band III aerials in the UK, mainly for the Irish market. An eight- or eleven-element aerial is best for DXing, to provide adequate forward gain and directivity, minimising pick-up from Band III mobile radio services. The potential for Band III DX reception is high, particularly if you live in the east or north east where signals from Scandinavia, Germany, France and the Benelux countries are frequent when tropospheric conditions are suitable. Those to the west often receive signals from Spain, Portugal, France and Ireland.

U.H.F. aerial systems are more readily available. For maximum forward gain and directivity, to discriminate against local and often strong UK transmissions, a Yagi aerial with half-wave elements or multiple (X formation) directors is a good choice. Well-known systems include the Fuba XC391, the Triax Unix 92, the Antiference XG range and the Jaybeam full-wave system. An alternative approach is to use a stacked bow-tie array. This consists of a reflector panel with perhaps four full-wave dipoles in front. Examples include the Triax Grid and Wolsey Colour King range. The gain over the bandwidth is flatter with this type of aerial.

There are locations where the chance of tropospheric DX reception in Band III and at u.h.f. is not good – where mountains, hills or heavily forested slopes obstruct likely signal paths for example. In such a situation it's best to devote whatever funds are available to an improved Band I installation – the alternative is satellite reception!

Band I reception is prone to interference – from thermostats, ignition, electric motors, CB harmonics, overloading etc. Because of this it's best to provide filtering before any amplification is added. Amplifiers should be installed indoors, adjacent to the receiver. High-gain Band III and

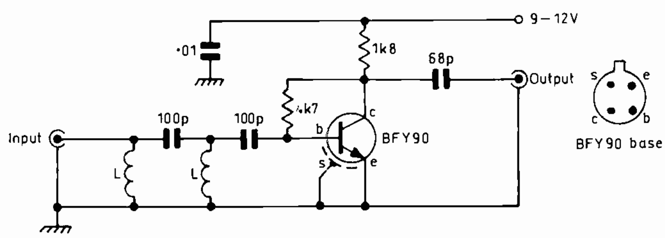


Fig. 1: A simple, easy-to-build v.h.f. amplifier. Typical voltage gain figures 16dB at 50MHz, 13dB at 100MHz, 11dB at 200MHx. The coils (L) consist of ten 1/8th inch diameter turns, close spaced, of 24 s.w.g. enamelled wire. The supply requirement is 9-12V at 5mA.

u.h.f. aerial systems usually have head amplifiers fitted, to overcome cable losses and improve the signal/noise performance. Note that a low noise figure is more important than maximum gain, i.e. an amplifier that provides a gain of 12dB with a 1·5dB noise figure will give better results than an amplifier with a gain of 40dB but a noise contribution of 5dB. Many Band III/u.h.f. amplifiers are available from specialist dealers. Manufacturers include Fringe, Triax, Labgear, Teldis and Antiference. Head amplifiers are normally powered via the coaxial downlead.

A few Band I amplifiers are available commercially. At these frequencies constructional techniques are less demanding than in Band III and at u.h.f. Fig. 1 shows a simple preamplifier circuit that will work throughout Bands I/III. Its cost to build is minimal. Use normal v.h.f. construction techniques, i.e. keep component leads short. There are no tuned circuits and provided care is taken with assembly the amplifier will work at up to 450MHz.

An aerial used for the reception of weak signals should be mounted clear of obstructions and in the open. This may give rise to complaints from neighbours. Explain to them what the purpose is and that the aerials won't cause interference or attract lightning. Most will be understanding. Council planning departments can be less tolerant.

An aerial rotator system will generally be required. Radio dealers and specialist firms can supply them. Finally remember that each aerial installation will be unique, to cater for the needs and possibilities at a particular location. We can only generalise here. If you have a specific problem, write in with a stamped-addressed envelope and we'll try to help.

Notes on the Bush 2521T

Chris Watton

One of these teletext sets gave us some trouble recently. It worked fine in the TV mode but when it was put into the text mode there was no display. It had entered the text mode, because the programme buttons no longer changed the channels. Putting it in the mixed mode produced a picture with black text on it – no colours at all. The cause of the trouble was corrupt memory in the control section. It was giving the order to produce teletext with no contrast. You get a similar problem with some Hitachi sets that lose memory, the MDA2062 EEPROM becoming stupified. What you have to do is to reprogram the set. This involves using the buttons on the remote control handset to toggle various bits on or off. The sequence is as listed below. Figs. 1-7 show the relevant bits: the numbers shown against the segments are the handset button numbers that toggle them on or off.

Reprogramming

(1) You first have to fit a temporary press-button switch between pins 15 and 23 of the SAA1250 chip in the handset (connect it between pins 3 and 12 if an OSH2006P chip is used). The small switch from the front of an old VCR is ideal. Switch the set on and select channel 1. The set must be tuned to a station, and it must be in the TV mode.

(2) Press the 'service button' – the extra one added to the handset – and hold it until the display shows CH. Press again to get OP, then select option 1 by pressing the volume up button once. You should now have the display shown in Fig. 1. If any of the segments are incorrect, use buttons 1-8 on the handset to correct them. For example pressing button 1 will toggle the top, right-hand segment on or off.

(3) When the display is correct, press the memory button. Two brackets will appear, as shown in Fig. 2. Now press

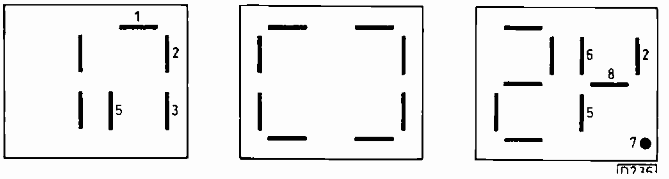


Fig. 1 (left): Option one. Fig. 2 (centre): Brackets (memory). Fig. 3 (right): Option two.

volume up to get to step two. The display should be as shown in Fig. 3. Use the handset buttons to make any corrections required. When the display is correct, press the memory button. The brackets will reappear.

(4) Press volume up again to get to option three, see Fig. 4. Correct any errors and press memory. The brackets will be back.

(5) Press volume up for option four. If the display is not as shown in Fig. 5 correct it with the buttons. Press the memory button then exit the service mode by pressing standby on the handset. This completes the basic programming.

(6) With teletext sets there are two more settings to be carried out before you leave the service mode. After memorising option 4, press the service button again. The display will be HP as shown in Fig. 6 and the set will go into the

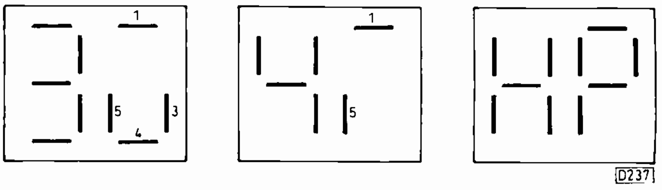


Fig. 4 (left): Option three. Fig. 5 (centre): Option four. Fig. 6 (right): Text position.

mixed (text and picture) mode. Using the volume buttons, centralise the text field at the top of the screen. When satisfactory, press the memory button.

(7) The last operation is text contrast. Press the service button: the display will be CO as shown in Fig. 7. Use the volume buttons to set the text contrast. Then press memory to get the brackets. Finally exit the service mode by pressing the handset's standby button. You may have to carry out the text contrast adjustment a couple of times as it's difficult to judge this with a mixed display.

When the set is switched on again all should be well. Test all functions with the remote control unit, including teletext. If any don't work properly, recheck the settings in the service mode. If some information hasn't been stored the MDA2062 memory chip may be faulty, but it's worth going through the reprogramming procedure a couple of times as the information doesn't always get written in.

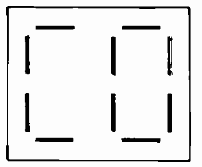


Fig. 7: Text contrast.

If you have an old ITT or Granada handset it may be worth fitting a switch to it to save having to take the customer's handset to pieces. Most remote control units that have an SAA1250 chip seem to be suitable.

General Service Notes

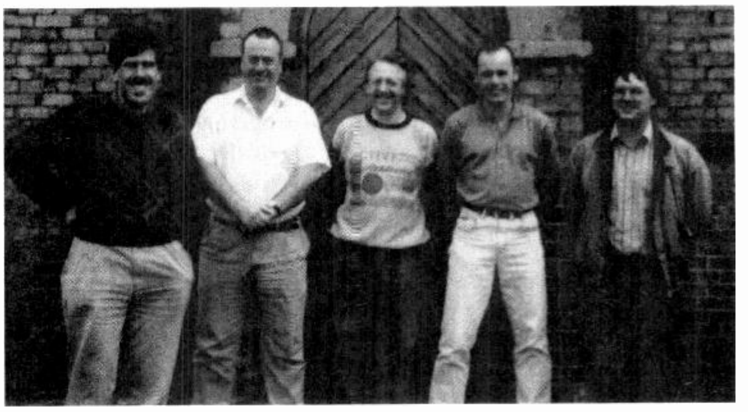
The h.t. should be set (R811) for 115V at TP13 (junction of C813/L803).

A chopper power supply with a TDA4601B control chip (IC800) is used. The usual cause of power supply failure where the BU508A chopper transistor Q800 has gone short-circuit is that R809 (270kΩ) has gone high in value or open-circuit. When Q800 goes short-circuit the 2·7Ω, 4W surge limiter resistor R801 will almost certainly have gone open-circuit. As a matter of course we also replace the following electrolytic capacitors: C809 100µF, 25V; C810 100µF, uprating it from 16V to 25V; C819 100µF, 16V; and C820 1µF, 100V.

The h.t. preset R811 (4·7kΩ) can cause width fluctuations. R605 (5·6kΩ, 4W) in the h.t. feed to the line driver stage can fail, giving the sound but no raster symptom. Dry-joints around the chopper and line output transformers are common.

The chassis used in this model is sometimes referred to as the Indiana 100. It's used in a number of other sets including the Bush 2514, 2514T, 2515, 2515T, 2520, 2520T and 2521 (models with suffix T have teletext); the Alba CTV704, CTV744 and CTV752; the NEI 1451R, 1451TX, 1551TX, 2131R and 2131TX; and the Perdio P1408, P2004, P2005, P2101 and P2102.

Back to Basics



Steve (centre) with some of his recent weekend VCR servicing course students.

It's easy for those of us who spend many bench hours coping with Joe Public's assorted sick VCRs to mistake practical experience for basic knowledge – until we are confronted with a baffling fault symptom that calls for theoretical reasoning before we start on the practical repair.

That may sound a bit pompous, which Steve Beeching is not. Five of us discovered this in July when we attended a weekend VCR training course arranged and conducted by Steve near his home at Barnby in the Willows, Notts. Barnby boasts a phone box, a friendly inn called The Willow Tree and a village hall, once a schoolroom, where the course sessions were held. The accompanying photograph shows Andrew, Roy, Phil and Alan with Steve in the middle – now you know what he looks like. Me? – just behind the camera.

Packing video information on to a slow-moving tape is one thing, packing all that theory into a slow-moving brain like mine without head saturation is something else. But with Steve's expert and entertaining tuition we all managed to improve our grey cell tracking. The concentrated coverage included tape track patterns, f.m. and luminance signal recording, colour recording/playback, servos, systems control, tape transport and hi-fi sound. This rich diet was washed down with welcome cups of coffee provided by Steve's wife Elaine, while lunch breaks were sandwiches at The Willow Tree.

Saturday evening was 'half term', when brain bashing was relieved by an excellent fine-weather barbecue provided by Steve and Elaine at Grove Farm. This included an opportunity to inspect the workshop where camcorders and VCRs surrender their faults.

We all have gaps in our knowledge – mine are chasms – and few would find that they had nothing to learn on Steve's courses. A customer complains about bent, wobbly pictures when he views hired tapes. Yes, he's not using his TV set's AV channel: but are you sure why a shorter line sync time-constant is necessary for VCR use, and why there is usually no problem with a machine's own recordings? These and many other mysteries were solved during the course. I now have a much lower IQ (Ignorance Quota).

A few hours spent with Steve is more profitable than weeks of inefficient bench work. At £50 the weekend was an excellent investment. I recommend it! C.A.

Solution to Test Case 374

– see page 253 –

Nobody could accuse the Ferguson TX9 chassis of being complicated, certainly not in its colour output amplifier and tube drive department. The RGB outputs from the colour decoder chip are d.c.-coupled to simple class A output stages and then go via 2·7kΩ flashover protection resistors to the tube's cathodes. Dylon, by now thoroughly demoralised, was left wondering where he'd gone wrong in his diagnosis with this most basic of colour-tube drive circuits.

Perusal of the circuit diagram and the manual's parts list which, unusually and very helpfully, gives the functions of all the components finally provided the answer. There are three video signal clamps within the TDA3560 chip, one each for the R, G and B channels. The clamp voltages are stored by separate 0·1μF capacitors, C68, C65 and C64 for R, G and B respectively. C68 was faulty of course, a replacement providing a complete cure – once the gain and background presets in all three channels had been set up.

Even then the long-suffering Dylan was not quite through. Now that the drives were present in full measure there was a distinct lack of contrast despite the tube rejuvenation. But we won't turn this into Test Case 374b. The cause of this symptom was R263 (820kΩ) in the beam-current limiter circuit – it had gone high in resistance value. By the time that Dylan had finished with the set the lovely Anne Diamond had long since departed from the screen. The early evening newsreader looked o.k. though.

Satellite Scene

Contributions from David Finan, Steve Cannon, Chris Watton and Graham Rees

Amstrad SRX200 Tuning Modifications

The following modification, which is made to the remote control unit and not the receiver itself, enables the Amstrad SRX200 to tune through all 48 channels. When the remote control unit is opened you'll see a D6121G502 chip as shown in Fig. 1(a). Solder leads to pins 4 and 14, and another one to the adjacent resistor R3, as shown. A suggested colour coding is also shown. Next drill two small holes in the base of the remote control unit and fit two small touch switches. I used two switches from an old Sony C5 VCR. Connect them to the previously added leads as shown in Fig. 1(b).

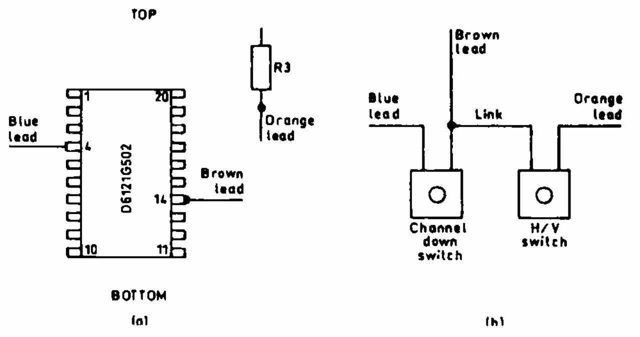


Fig. 1: Modification to the Amstrad SRX200's remote control unit to enable the receiver to tune through all 48 channels.

Because of its original design, channels 17-48 are of opposite polarity to that selected automatically by the receiver. This is why the additional H/V button has to be pressed. You will find that channels 32 (1,685MHz) and 33 (965MHz) cannot be obtained: the receiver will pull these in however if the H/V button is not pressed. When this modification is carried out the channel frequency (less 10GHz) is displayed by the receiver.

It's also easy to modify these receivers to enable the 'out-of-band' channels 62 (RTL5) and 61 (Filmnet) to be selected. This is done by adding a switch and 47kΩ preset as shown in Fig. 2. When the switch contact is linked to R120 normal channel selection is obtained. With the switch in the other position, adjust the 47kΩ preset for an RTL5 picture (make sure that the H/V lamp is lit). A press on the H/V switch should then bring in Filmnet – scrambled of course, but you can hear the sound! **D.F.**

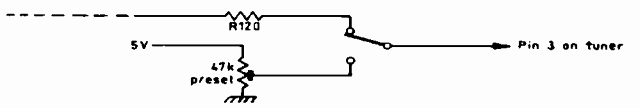


Fig. 2: Modification to enable the Amstrad SRX200 to select channels 61 and 62.

Fault Reports

Philips STU802: One of these receivers came to us because it was dead. On inspection we found that the power supply's 5V output was low at 3V. As all the other outputs were o.k. we came to the conclusion that something was loading the 5V line, but a 5V reading could be obtained only with no load at all connected. Although there was no ripple on the line we replaced the 2,200μF smoothing capacitor C15. This provided a complete cure.

Another STU802 was sent to us with a report that there was "no picture and the power supply whined". Checks on the outputs at the secondary side of the power supply suggested that it was working all right, but the whining did seem to come from this area where quite a bit of work had been carried out. I thought it best to eliminate the whining first. After replacing D8 and D9 (both type 1N4148) the power supply worked without making any noise at all and, lo and behold, we had sound and a picture as well. These two diodes provide supplies for the power supply chip. They read o.k. out of circuit, but presumably one or other of them was breaking down under load and causing misoperation of the chip. **S.C.**

Amstrad SRD510: This dead IRD had a blown power supply. A fair crop of parts was required to put it right – IC600 (3284), C612 (220μF), C613 (1nF), C611 (1μF, 50V), TR600 (MJF18004), R610 (2·2Ω), R609 (4·7Ω), R604 (2·2Ω), R602 (47kΩ) and R601 (10Ω). Quite a bang, but the fuse hadn't blown. The joints around the chopper transformer didn't look too great: perhaps this was the reason for the mass destruction. **C.W.**

Pace SS9200: The customer's complaint was of poor video, with pulling and cogging. Scope checks showed that the video waveform was o.k. from the tuner to the emitter of Q29, but there was virtually no waveform at the modulator's video input. The only component between these two points is the 10μF electrolytic C163. Close examination showed that during manufacture it had been inserted the wrong way round. A replacement put matters right – the capacitor had taken eighteen months to break down. **G.R.**

Pace PRD800: This receiver wouldn't tune in any stations and had Sky One on every channel with vertical polarisation. As resetting the microcontroller chip didn't have any effect I monitored the voltage at pin 15 of the tuner (Mod 1) and found that it didn't vary when I scanned through the tuning. This tuning voltage comes from pin 16 of chip U9. A new chip cured the fault. **G.R.**

Amstrad SRD400: The customer complained that he couldn't store any of the new channels on the lower numbers. The channels could be tuned in, but not stored. As a first step I checked the supply at pin 8 of the SDA2516 channel memory chip IC104. There should be 5V here but the reading was zero. I then realised that the chip had been inserted the wrong way round during manufacture. Putting it in the right way round cured the fault. **G.R.**

Pace SS9200: The customer complained that there were "no pictures". A check on the outputs from the power supply showed that they were all about 30 per cent low. This suggested that there was a fault on the primary side of the supply, so I started to check the various components here. All but one read correctly. The reading I obtained with R13 was 0·8Ω, but as my meter is not too reliable at such a low value I didn't think much of it. After a lot of other component checks I rang Pace Technical who advised me to treble check R13. As I obtained a reading of 0·5Ω with a new component I replaced the resistor in the receiver. It then worked all right, with all the voltages correct. **G.R**

Letters

CUSTOMERS

The owner of an Amstrad TVR3 came into the workshop requesting a second opinion after being quoted about £85 plus VAT to repair his set, the problem being that when a tape was inserted the machine would immediately go into the play mode, no other function being possible. There's a switch marked 'repeat' at the back and it was in the 'on' position. Simply flicking it to 'normal' cured the problem – the switch provides continuous playback of tapes such as advertisements etc. if required. The customer was delighted that his equipment wasn't faulty, but argued about paying a token charge of £5.

When he'd left the workshop I thought it a pity that Carlton Television hadn't been present. Mind you it wouldn't have been newsworthy to film Joe Public getting the skilled, cheap, excellent service this trade provides. For anyone wondering why £5 was charged for flicking a switch, the flick took three seconds but it then took twenty minutes to explain to the owner what had happened – he just couldn't accept the reason for the switch – followed by five minutes spent haggling over the fiver! Like you, I'm in business to make an honest living. Many more like that customer and I'll call it a day.

When he was well clear I phoned the dealer who'd given him the quote. Apparently it was given over the phone because the 'customer' had insisted that any competent engineer should know what was wrong with the equipment without looking at it: after a long conversation that was getting nowhere he'd been given the figure to get him off the phone.

John Edwards,
Welling, Kent.

A local lady came into the shop recently with a modern Hitachi VCR for repair. We gave it a service then phoned her to say that it was ready. While we had it we discovered that the lady worked for a high street multiple where all kinds of electrical goods and cameras, along with computers and everything else, are sold (for nothing) and serviced. When our customer returned we quizzed her as to why she hadn't taken the video to her own place of work, where she'd actually bought it. Her reply was instant: "Good God man, do you think I could afford the prices they charge?"

Chris Watton,
Boston, Lincs.

A FAX REPAIR

After a letter of mine complaining about the high cost of some companies' service manuals was published some months back I was contacted by several engineers with offers of help. They also agreed with my views. By that time I'd already obtained a second-hand manual for the Amstrad FX9600T fax machine. For the benefit of other engineers who may find one of these machines on the bench, here are the details of what is apparently one of its most common faults.

The power supply board seems to work for a couple of years or so then fails to start up again when mains power has been switched off for a while. It can be started by placing a hairdryer or fan heater near the back of the machine, where the PSU resides. Sometimes the power supply will hunt, lighting various LEDs and producing messages on the display, before springing to life. Once in operation it will continue to work until the next power cut. A replacement power supply PCB, which was available from Amstrad stockists for around £30 until a short while ago, would have been the easy answer. But it has now been declared obsolete. It would have been a shame to write off such a modern machine with so many useful functions because of lack of spares, so I decided to try to repair it.

A look at the chopper power supply circuit revealed a number of components that could cause failure to start up. The cause of the fault was eventually traced to C7 (220μF), which is very close to the main transformer. As the transformer runs quite warm, it had obviously dried out the electrolytic whose value had fallen by over fifty per cent. Replacing C11 (10μF) and any other small electrolytics while they are accessible is a good idea. The larger smoothing electrolytics don't seem to be affected by the heat generated nearby.

All FX9600 range machines (T/AT/TP/ATP) seem to use this power supply.

Mike Goodall,
Littleport, Cambridgeshire.

SATELLITE RX MODIFICATION

The circuit shown in Fig. 1 is a modified version of the one devised by David Finan (November issue, page 43) for adding extra sound channels with Amstrad SRX100/200 satellite receivers. With the original version the receiver powered up in the new mode each time so that the user had

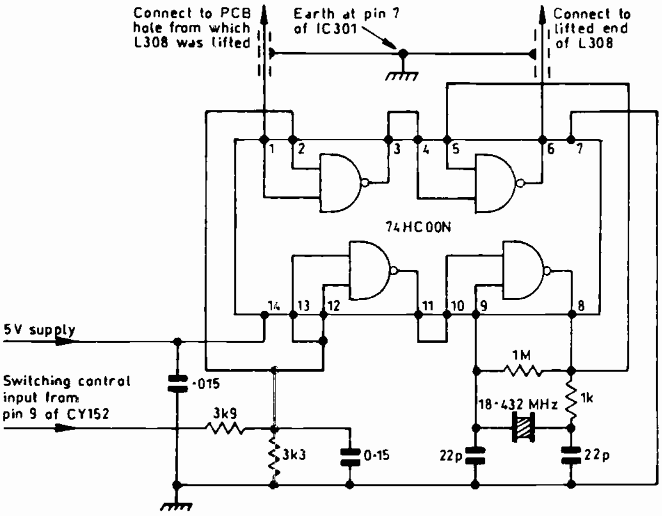


Fig. 1: Amstrad SRX100/200 modification

to operate the TV/SAT button to obtain the normal sound channels. The reason for this is that the TV/SAT LED (used to control the added board) always powers up with the LED alight. The revised circuit overcomes this disadvantage by some rearrangement of the gates – the control signal is diverted to a nand gate that controls the receiver's internal oscillator and is inverted to switch the added on-board oscillator.

Allan Mitchell,
Enfield, Middx.

ASBESTOSIS

I am helping an elderly lady who has contracted an asbestos disease and believes that her work at GEC in

Coventry in the late Fifties may have exposed her to asbestos. One of her jobs was TV receiver assembly. I am keen therefore to hear from any readers who are familiar with the internal construction of TV sets manufactured by GEC in Coventry between 1956 and 1960 and could possibly confirm whether or not the sets ever contained asbestos-based thermal or electrical insulating material and, if so, where such material was located. Both asbestos-based composites and woven or fibrous material are of interest. Another point of interest is whether any other ex-GEC, Coventry employees have been diagnosed as suffering from asbestos-related diseases. The cost of photostats of any relevant manuals, parts lists etc. would be refunded. I can be reached on 0742 586 899 (answerphone) or the address below.
Seb Schmoller, 312 Albert Road,
Sheffield S8 9RD.

LES LAWRY-JOHNS

It was with incredulity that I read the obituary to Les Lawry-Johns in the December issue. Although I'd never seen, spoken or corresponded with him his death feels like that of a close acqaintance. His name first came to my attention when, as a young boy, I came across his book *Radio Repair: Questions and Answers* in my local Public Library. It was the first and, in my opinion, only book I've come across that provides a truly practical, down-to-earth treatment of the subject: its subtle humour brings the subject to life. I sensed in the author a kindred spirit, and saved over two months of my pocket money to buy myself a copy.

My interest in such matters was stirred and, nearly ten years later, as a medical student with a keen interest in audio-visual servicing I still use the book as a source of inspiration when my repair efforts come to a dead end. Although by the time I started to read *Television* Les no longer contributed regularly, imagine my delight when a friend lent me some back issues and I was able to read in his column about the day-to-day antics of this legendary figure of my childhood. His humorous, amiable character made a change from the 'we don't fix those any more' attitude that so often prevails today. He will be sorely missed, but his name and larger-than-life personality will undoubtedly live on.
Edmond Aviglia,
Birmingham.

Editorial note: We have received a number of letters from readers who found Les's articles a source of enlightenment, amusement and inspiration. He cheered us all up no end.

HAMEG REPAIRS

We feel that we must reply to the letter from Roger Burchett in your November issue. It gave a simplified account of what happened and was in places factually inaccurate. We also feel that it was unfairly critical of our practices.

The repair to which Mr. Burchett refers was sent to us back in June 1987. We advised him that an investigation charge of £30 would be applied if he decided, following our fault investigation, not to have his oscilloscope repaired – such a charge simply reflects work already carried out. Our estimate consisted of £30 for parts, £30 for labour, £30 for a full calibration to manufacturer's specification plus £11 for return carriage. Mr. Burchett declined to go ahead and was charged only the £30 investigation charge, Hamig having waived the carriage and storage charges.

It is our policy to carry out complete recalibration after every repair. This ensures that the many thousands of satisfied Hameg scope users can depend on their equipment always meeting its full specification, our aim being to provide our customers with a quality service. Mr. Burchett's repair would not have included complete recalibration.

We hope that this letter will make our viewpoint clear to your readers.
Hameg Instruments Ltd.,
Luton, Beds.

CITY AND GUILDS REPLY

A recent letter from Darren Coyle of Derry, Northern Ireland made some critical comments about the City and Guilds Certificate in Electronics Servicing (224). According to Mr. Coyle he was told during an interview for a job that his City and Guilds qualifications were not recognised and were considered to be 'Micky Mouse' qualifications. At the same time he praised the college course he took as being one of the best he has come across – a curious contradiction. Mr. Coyle also suggested that City and Guilds needs to market its qualifications to employers more.

The City and Guilds Electronics Servicing certificate, which is available at three levels, was developed specifically for the electronics servicing industry and is widely recognised as being the most relevant qualification for those who want to make a career out of servicing radio, television and electronic equipment. Trainees from companies such as Mastercare and Homeserve, which provide servicing for major high street stores, are sent to colleges to gain this qualification. Having spoken to the personnel departments at several electronics firms, including one in Derry, Northern Ireland, I feel that the job Darren Coyle may have applied for required higher level qualifications than City and Guilds at Level 3 – maybe an HND or a Degree in Electronics. In this case his City and Guilds qualification would not have been appropriate. But to say that the qualifications are considered to be 'Micky Mouse' is an extremely sweeping statement: our research indicates exactly the opposite.

With respect to marketing, while we do market our qualifications to employers – market research indicates that there is almost 100 per cent awareness of City and Guilds amongst employers – inevitably we cannot reach everyone and some people may be misinformed about the range and quality of the qualifications we offer.
Anne Nicholls,
Marketing and Public Relations Department,
City and Guilds.

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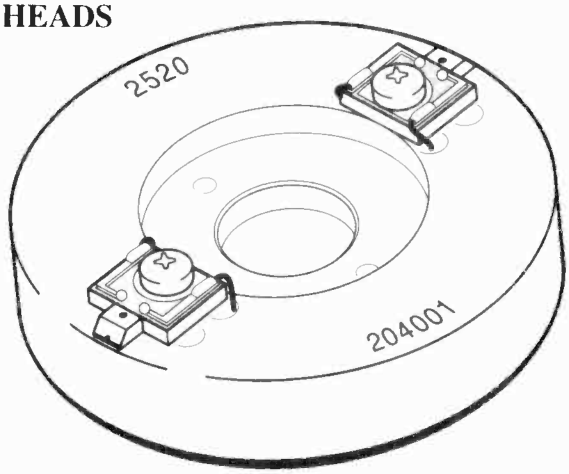

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***FM CORDLESS MICROPHONE** Small hand held unit with a 500' range! 2 transmit power levels. Reqs PP3 9v battery. Tuneable to any FM receiver. Price is £15 REF: MAG15P1

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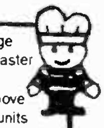

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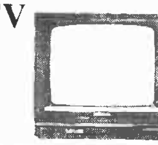

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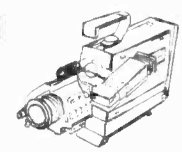

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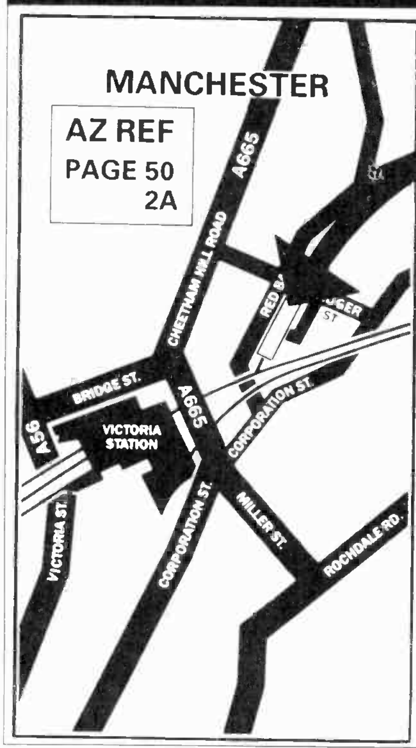

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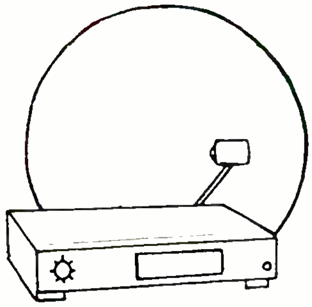

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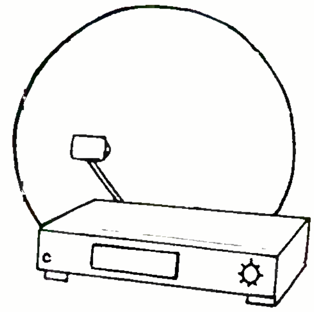

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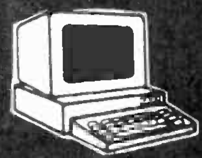

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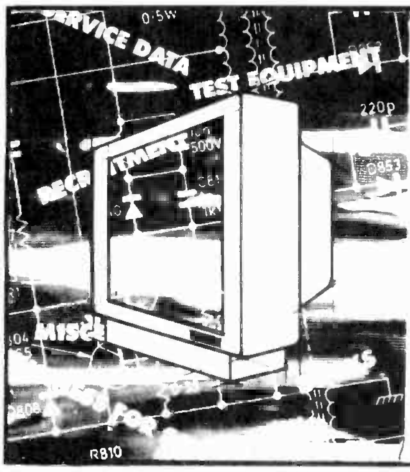

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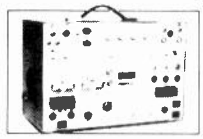

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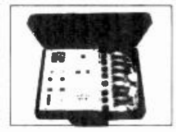

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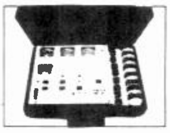

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