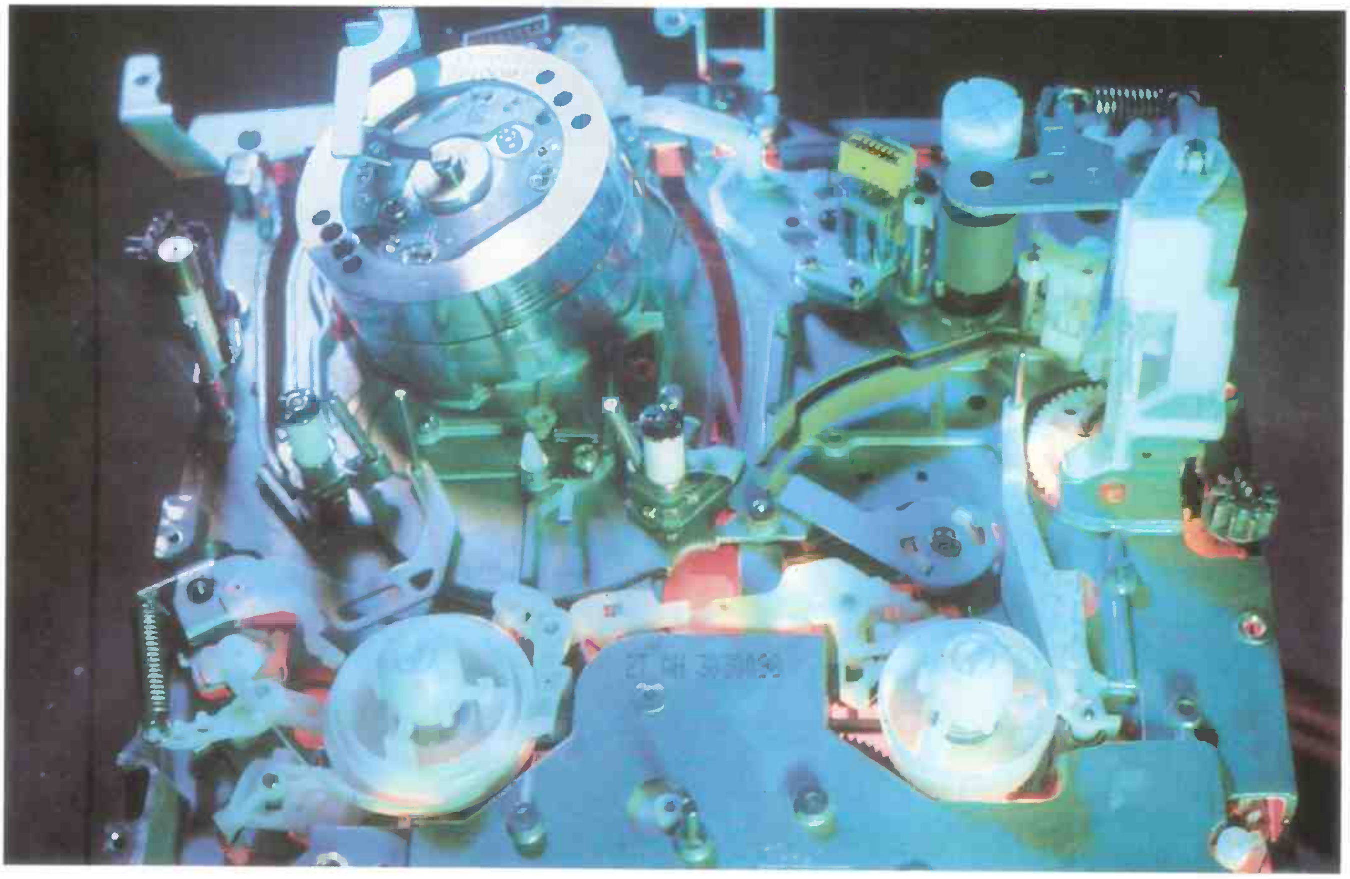
NOVEMBER 1993 £2.20

TELEVISION

SERVICING·VIDEO·SATELLITE·DEVELOPMENTS

FREE 164-page CATALOGUE



The Panasonic K VCR Deck

Line Output Stage Operation

Satellite Receiver Modifications

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TELEVISION

November 1993

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

INDEXES AND BINDERS
Indexes for Vols. 38 to 42 are available at £3.50 each from Video Interface Products Ltd., who can also supply a five-year consolidated index on computer disk. For further details see page 25.
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ISSN 0032-647X

OUR NEXT ISSUE DATED DECEMBER WILL BE PUBLISHED ON NOVEMBER 17

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BC109C	10p
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BC160	30p
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BC556	8p
BC557	7p
BC558	8p
BC559	8p
BC560	8p
BC637	20p
BC638	20p
BC639	20p
BC640	20p
BCY70	16p
BCY71	16p
BCY72	16p
BD115	30p
BD124P	50p
BD131	25p
BD132	25p
BD133	50p
BD135	20p
BD136	20p
BD137	20p
BD138	20p
BD139	20p
BD140	20p
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BDX65	80p
BDW23	55p
BDW24	55p
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BDW94	50p
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BFY64	25p
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BLY48	85p
BR100	14p
BR103	37p
BR303	85p
BRY49	38p
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BSX20	15p
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BT109	90p
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BT151	58p
BTY79	140p
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BU922	130p
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BUT12	80p
BUT56A	150p
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BUX85	50p
BU69A	200p
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BUZ71	75p
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MJ15003	325p
MJ15004	370p
MJ2501	110p
MJ2955	55p
MJ3000	115p
MJ3001	115p
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MJE340	25p
MJE350	80p
MJE520	30p
OC28	350p
OC29	250p
OC35	350p
OC36	250p
OC45	50p
OC72	50p
OC200	180p

R2008B	100p
R2010B	100p
S2800D	52p
S2800M	72p
T2800D	52p
T2800M	72p
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TIP3055	42p
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TIS90	15p
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TIS93	20p
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VN10KM	60p
VN56AF	100p
VN88AF	115p
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ZTX108	11p
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ZTX303	24p
ZTX304	17p
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2N4064	100p
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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
BYX55/600	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	80p
I.C. SOCKETS	
8PIN	5p
14PIN	8p
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
AN274	250p
AN301	330p
AN303	250p
AN304	360p
AN315	210p
AN316	350p
AN360	100p
AN362	140p
AN366	150p
AN610	160p
AN612	160p
AN3312	350p
AN3320K	800p
AN3331K	900p
AN3792	400p
AN3794	450p
AN3795	500p
AN3821	800p
AN3821K	600p
AN3822K	700p
AN3830K	800p
AN3990K	300p
AN3991K	400p
AN5010	450p
AN5011	400p
AN5015	350p
AN5020	200p
AN5025	250p
AN5030	550p
AN5033	400p
AN5034	500p
AN5111	550p
AN5132	250p
AN5135	600p
AN5138	450p
AN5150	600p
AN5151	600p
AN5215	100p
AN5250	150p
AN5256	150p
AN5260	350p
AN5262	175p
AN5265	150p
AN5352	600p
AN5355	450p
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AN5421	150p
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AN5512	250p
AN5515	200p
AN5520	550p
AN5521	250p
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AN5613	200p
AN5615	300p
AN5620	330p
AN5622	350p
AN5625	400p
AN5712	350p
AN5722	140p
AN5730	160p
AN5732	160p
AN5753	170p
AN5763	450p
AN5790	300p
AN5791	350p
AN5836	450p
AN5862	300p
AN6135	150p
AN6136	250p
AN6247	200p
AN6270	400p
AN6300	600p
AN6306	550p
AN6307	250p
AN6320	300p
AN6328	400p
AN6332	390p
AN6337	420p
AN6341	550p
AN6344	440p
AN6350	610p
AN6359	500p
AN6360	320p
AN6362	480p
AN6371	470p
AN6387	560p
AN6811	130p
AN6884	240p
AN7105	210p
AN7110	130p
AN7114	150p
AN7115	150p
AN7116	90p
AN7120	130p
AN7130	110p
AN7140	450p

AN7145	195p
AN7146	210p
AN7154	180p
AN7156	240p
AN7168	260p
AN7178	270p
AN7222	180p
AN7254	150p
AN7256	250p
AN7310	90p
AN7311	30p
AN7410	250p
AY3-1015	290p
AY3-1270	800p
AY3-1350	450p
AY3-8910	360p
AY3-8912	400p
BA301	85p
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	280p
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
HA1125	150p
HA1137W	135p
HA1197	150p
HA1199	145p
HA1319	240p
HA1338	300p
HA1339A	350p
HA1377	160p
HA1388	120p
HA1389	210p
HA1392	200p
HA1394	280p
HA1397	250p
HA1398	240p
HA11219	280p
HA11221	180p
HA11225	150p
HA11235	145p
HA11251	240p
HA11423	210p
HA11724	800p
HA12002	300p
HA12003	250p
HA12005	320p
HA12017	130p
HA13001	170p
HA13002	250p
HA13006	400p
HA13007	400p
HA13108	350p
HA13412	600p
HA13432	400p
HA17524	250p
HA17805	100p
ICL7106	650p
ICL7611	90p
ICL7660	240p
ICM7555	60p
ICM75556	80p
KA2101	100p
KA2102	150p
KA2130	150p
KA2206	150p
KA2209	125p
KA2210	230p
KA2212	80p
KA2213	130p
KA2214	150p
KA2261	100p
KA2263	100p
KA2264	100p
KA2284	100p
KA2401	150p
KA2412	350p
KA2912	125p
KA2914A	300p
LA1130	240p
LA1150	150p
LA1185	150p
LA1201	75p
LA1210	140p
LA1222	80p
LA1230	130p
LA1231	210p
LA1364	200p
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LINEAR ICs – Cont.

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2SC3604	650p
2SC3605	60p
2SC3606	100p
2SC3607	150p
2SC3608	120p
2SC3631	130p
2SC3636	280p
2SC3651	600p
2SC3657	400p
2SC3659	600p
2SC3668	120p
2SC3675	160p
2SC3678	280p
2SC3679	200p
2SC3680	380p
2SC3685	450p
2SC3687	650p
2SC3688	750p
2SC3691	150p
2SC3692	150p
2SC3705	120p
2SC3715	480p
2SC3717	120p
2SC3719	150p
2SC3729	460p
2SC3743	270p
2SC3746	120p
2SC3747	120p
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2SC3858	550p
2SC3870	200p
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2SC3890	150p
2SC3895	400p
2SC3897	650p
2SC3907	420p
2SC3909	450p
2SC3927	550p
2SC3946	120p
2SC3950	120p
2SC3953	120p
2SC3954	150p
2SC3973	275p
2SC3975	275p
2SC3987	220p
2SC3996	1200p
2SC4006	100p
2SC4020	280p
2SC4023	325p
2SC4056	350p
2SC4106	200p
2SC4123	450p
2SC4124	250p
2SC4169	60p
2SC4236	550p
2SC4237	750p
2SC4242	200p
2SC4262	50p
2SC4301	550p
2SD198	140p
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2SD201	260p
2SD257	195p
2SD313	40p
2SD315	75p
2SD325	30p
2SD330	110p
2SD348	460p
2SD357	40p
2SD358	40p
2SD371	240p
2SD380	650p
2SD381	80p
2SD388	170p
2SD389	90p
2SD400	14p
2SD401	50p
2SD402	120p
2SD415	120p
2SD424	400p
2SD426	150p
2SD427	350p
2SD438	45p
2SD467	15p
2SD468	25p
2SD471	75p
2SD525	50p
2SD526	70p
2SD545	60p
2SD549	120p
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2SD555	500p
2SD560	150p
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2SD640	350p
2SD642	50p
2SD655	60p
2SD661	60p
2SD666	70p
2SD667	70p
2SD668	120p
2SD669	40p
2SD673	350p
2SD676	250p
2SD716	80p
2SD717	180p
2SD718	100p
2SD722	240p
2SD725	270p
2SD734	60p
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2SD-762	140p
2SD-763	140p
2SD-768	180p
2SD-772	200p
2SD-773	40p
2SD-774	60p
2SD-777	400p
2SD-784	650p

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2SD-811	450p
2SD-819	400p
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2SD-1961	50p
2SD-1978	50p
2SD-1984	150p
2SD-2012	50p
2SD-2046	50p
2SJ-48	425p
2SJ-49	425p
2SJ-50	425p
2SJ-56	700p
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2SK-19	45p
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2SK-55	100p
2SK-68	100p
2SK-73	75p
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2SK-118	50p
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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-195	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
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2SK-322	140p
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2SK-58	100p
2SK-73	60p
2SK-74	50p
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2SK-81	50p
2SK-85	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

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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/600V	44p
BR62 6A/200V	80p
BR64 6A/400V	72p
BR251 25A/100V	150p
BR252 25A/200V	165p
BR254 25A/400V	185p
BR256 25A/600V	200p
BR258 25A/800V	240p
BR351 35A/100V	185p
BR352 35A/200V	200p
BR354 35A/400V	220p
BR356 35A/600V	230p
BR358 35A/800V	260p
BY164 1.5A/100V	40p
BY179 1.5A/800V	40p

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TIC206D 4A/400V	60p
TIC225D 6A/400V	69p
TIC226D 8A/400V	68p
TIC236D 12A/400V	85p
TIC246D 16A/400V	105p
TIC253D 20A/400V	190p
TIC263D 25A/400V	205p
TI2800D 8A/400V	52p

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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
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SG613	800p

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VC700, VC772, VC7810, VC782, VC7822,
VC7282MK2, VC783, VC783, VC786, VC800,
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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, 8951,
FV10, FV11, FV12, FV13, FV14, FV20,
FV21, FV22, FV26, FV30, FV32, FV33 £1.05

FIDELITY
HS200, 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 £1.00
FVHP905, FVHP906, FVHP907, FVHP908,
FVHP910, FVHP911, FVHP915, FVHP916,
FVHP918, FVHP5000, FVHP5005,
FVHP5050, FVHP5075, FVHP5100 £1.00
VBR330, 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,
GHV9000, 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
VTL30 £1.50

ITT
VR3605, VR3905, VR3935, VR3954,
VR3985 £0.90
VR3913, VR3914 £1.00
VP3826, VR3906, VR3916, VR3926,
VR3946, VR3948, VR3976, VR3986,
VR3995, VR3997, VR6948 £0.65
VR3927, VR3928, VR3977 £1.40
VR3993, VR3994 £0.85
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 £1.35
NV600, NV688, NV777, NV788,
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,
NV390, 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
SV6500 £1.00
SV6600 £1.50
SV8000 £1.20
SV8100 £0.60
SV8500, SV8520, SV9500 £1.50
SV7300, SV7400, SC8400, SC8420,
SV9200, SV9300 £1.20

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

SANYO
VTC5000, VTC5150, VTC6000, VTC6500,
VTCM10, VTCM11, VTCM20, VTCM21,
VTCM30, VTCM31, VTCM50 £0.75
VTC5300, VTC5350, VTC5400, VPR5800 £1.00
VTC5500 £0.95
VTC9100, VTC9300 £2.20
VTC1100, VHR1100, 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,
VC5F3 £0.90
VC600, VC651, VC681, VC682,
VC684, VC685, VC693, VC699, VC700,
VC772, VC781, VC782, VC783, VC785,
VC786, VC793, VC800, VC7810,
VC7822, VC6F3, VC6V3, VCA100,
VCA102, VCA103, VCA104, VCA202 £0.70
VC7750, VC8000 £1.50

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

TOSHIBA
V55, V57 £0.85
V5250, V5280 £2.30
V33, V53, V56, 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

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

DECCA
VR8300 REEL MOTOR £19.00

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

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

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

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

HITACHI
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, VR3985
VR3913, VR3914 REEL MOTOR £19.00
VR3993, VR3994

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

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

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

ORION
NEVHL, VC150, VC180 REEL MOTOR £13.50
VH201, VH205, VH212, VH250, VH254,
VH228, VH3, VH300, VH303, VH312, VH700,
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, VH893,
VH900, VH974, VH1012, VH1204,
VH1440, VH1500, VH1660, VH1800,
VH2004, VH3030, VH3050, VH3060,
VH4010, VH4015, VH4020, VH5010,
VH5015, VHF2A, VP220, VR2948,
VR2949, VR2956, VR2957, VR2966,
VR2980, VXL20, VXL25, VXL30

PHILIPS
VR6540 REEL MOTOR £16.00

SAISHO
VR705, VR805 REEL MOTOR £13.50
VR905, VR2000

SAMSUNG
VB510 REEL MOTOR £11.00

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

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

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

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

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

CASSETTE HOUSING

GRANADA
VHSDP1 CASSETTE LIFT ASSEMBLY £15.00
VHSVJ2 £24.00

FERGUSON & JVC
3V38, 3V39, 8943, 8944, 8951, 3V35,
3V36, 3V49, HRD110, HRD111, HRD120,
HRD121, HRD225 £24.00
3V42, 3V43, 3V44, 3V45, 3V48,
3V53, 3V54, 3V55, 3V57, 8945, 8947,
8948, HRD140, HRD141, HRD150,
HRD157, HRD158, HRD160, HRD250,
HRD257, HRD455, HRD565, HRD566,
HRD725, HRD755 £24.00
8948, 8950, FV10B, FV12L, FV13H,
FV14T, FV20B, FV21R, FV22L, FV26,
FV395, HRD230, HRD430, HRD530 £24.00
3V58, 3V59, 3V64, 3V65, FV11R,
8950, 8951, HRD170, HRD180,
HRD370 £24.00

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

NATIONAL
NV730 £31.00

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

PHILIPS
CASSETTE LIFT ASSEMBLY
69120366 £15.00
DV186, 190, 286, 471, 562, 761,
VR6180, 6182, 6185, VR6285, 6290,
VR6291, 6293, 6362, 6367, 6393,
VR6467, 6468, 6470, 6561, 6670,
VR6760, 6761, 6870, 6970 £15.00

TELEFUNKEN
VR2970 £24.00

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

TOSHIBA
V55, V57 £24.00
V65, V66 £24.00

PANASONIC MODE SWITCHES

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

ON/OFF MAIN SWITCHES

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

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

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

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

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

VIDEO LAMPS

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

VIDEO SENSOR LAMPS

AIWA, AKAI, ALBA, AMSTRAD, BLAUPUNKT, FIDELITY, FISHER, FUJITSU, FUNAI, GEC, GOLDSTAR, GRANADA, GRUNDIG, HINARI, HITACHI, ITT, JVC (HRD SERIES), MATSUI, MITSUBISHI, NEC, ORION, NATIONAL PHILIPS, SAISHO, SALORA, SAMSUNG, SANYO, SHARP, SIEMEN, SONY, TELEFUNKEN, THOMSON, FERGUSON, TOSHIBA
(SENSOR LAMP CODE NO. VL05) £1.60

AKAI, GRANADA (VHSTJ2), HITACHI (VT3000), ITT (VR3912/VRP3833), JVC (HR2200/3300/3330, HR3660), MITSUBISHI (HS200), TELEFUNKEN (VR510, VR519/610), THOMSON (VK300/305/306/3301), FERGUSON (3V00/3V16/3V22/3V24/3292/8900/8901/8902/8903/8909/8912/8922/8925) £0.30
(CASSETTE LAMP 9V 80mA 310mm WIRES CODE NO: VL01)

BLAUPUNKT, ORION (VH1/2A), NATIONAL (NV2000, NV2010, NV3000, NV8150, NV8200, NV8400, NV8600, NV8610, NV8620), SHARP (VC2300, VC6000, VC6200, VC6300, VC7300, VC7700, VC8000, VC8300) £0.50
(CASETTE LAMP 6V 150mA CODE NO: 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
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00D-4-247-001 HT1	TX90	£14.00
060-3-093-001	TX100	£14.00
(110) 060-3-087-001	TX100	£14.00
(110) 060-3-084-001	TX100	£14.00
060-3-098-001	TX100	£14.00

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29201-024-04		£14.00

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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 140-10326	NC3	£14.00

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	CVC20	£11.50
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2432981	CPT 1444	£15.00
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	CPT 2178	
OUTPUT TV MODULE	HM6251 (REF 2370551)	£5.50
	HM6232	£5.50

IDLERS & PULLEYS REPLACEMENTS

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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. 58 59			
VS700	IDLER	BV321979	£6.00
VS125. 126 155	IDLER ASSY	MZ366960J2	£11.00
VS165. 240. 244 245 247 248, 250 512. 515. 516			
VS22 38 105. 112 115 116 205. 220			
VP7100. VS9300	T-UP IDLER	PU47752	£4.50
VS9500 VS9800			
VP7100 VS9300	UNLOADING IDLER	PU46381	£4.00
VS9500 VS9800			
VP7100 VS9300	REW IDLER	PU46380	£6.00
VS9500 VS9800			
VP77 VS10	REEL IDLER	BV327815	£3.00
VP68	IDLER	BV336067	£5.00
VS1 3 4 9 12	REEL TABLE	BR347731	£5.50
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VS23 35 37 53. 55	CLUTCH	ML373043	£13.00
VS66 75 VSA77			
VS9700	FF IDLER	BV321761	£3.20
VS9700	REW IDLER	VV321762	£4.25

AMSTRAD

VCR7000	IDLER	150290	£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			
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3V16. 3V22 8902	T-UP IDLER	PU49280	£5.50
8903 8909 8912 8922			
3V23. 3V29 3V30	REEL IDLER	PU48967	£2.50
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3V23. 3V31	ROLLER ASSY	PU49042A	£4.00
3V29. 3V30 3V31	T-UP IDLER	PU51402	£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
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3V58, 3V59 3V64	IDLER ARM	PU58645	£2.25
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FV30. FV32 FV33 8950 VC141L			
3V42. 3V43	CLUTCH ASSY	PU55822	£13.50
3V42. 3V44. 3V45	CLUTCH ASSY	PU57658	£11.50
3V48. 3V53. 3V54 3V55. 3V57 8947. 8948			
3V42 3V43. 3V44	T-UP CLUTCH	PU56043-1-4	£2.80
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3V42. 3V43 3V44	SUPPORT CLUTCH	PU56044-1-5	£2.80
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3V00 3V01. 3V16	LOADING IDLER	PU43681	£4.00
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3V00 3V01. 3V16	REW IDLER	PU46308	£6.00
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3V16. 3V22 8902	IDLER	PU49281	£1.70
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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
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FVHP725 730. 830. FVHP840			
FVHP615. 618. 620	REEL T-UP ASSY	FI1430410400900	£5.50
FVHP622. 710. 711 FVHP720 721 722			
FVHP725. 730 830. FVHP840			
FVHP905. 906. 908.	GEAR IDLER ASSY	FI1430490402400	£4.00
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FVHP975. 980. 990	IDLER	FI1430420400700	£4.50
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FVHD40. 55 140	REEL DRIVE ROLLER		£6.00
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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	5681471	£3.30
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VT9300-9500. 6500	PLAY IDLER	6861462	£3.20
VT680. 6800 9700		6861461	
VT9900			
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
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VT100. 110 111 113	FF-REW ARM	6886792	£2 75
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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
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VT3000	REW IDLER		£6.00
VT680. 6500 6800	FS-BRAKE	6861505	£3 00
VT9700 9900			

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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	PU556822	£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
HRD180. 250. 257. 455 565 566 725 755 HRP50			
HRD140 150. 157. 158	TAKE UP CLUTCH	PU56044-1-5	£2 80
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VX730. 735. 750 755	LIMITER POST LEVER		£1.30
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HS337. 338 347. 349	IDLER	552B01701	£6.50
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HS306 307. 318. 319	IDLER	641C34301	£2.00
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HS347 349 412	IDLER	522B02002	£3 00
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HS337. 338 411 421	REEL DISK	522P00601	£5 00
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HS306 307. 318. 319	GEAR WHEEL	641D71101	£1.50
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HS306 307. 318 319	GEAR WHEEL	641D71001	£1 50
HS400 410 710			

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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
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NV322 NV600. NV688	IDLER UNIT	VXP0463	£2.75
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NV300 NV333 NV340	IDLER ARM	VXL0997	£3.60
NV366			
NV300 NV330 NV333	IDLER UNIT	VXP0401	£0.75
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NV300. NV330. NV333	PLAY IDLER	VXP0433	£2.75
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NV300 NV332. NV333	ACTION GEAR	VDG0016	£0 60
NV340 NV366 NV600 NV777. NV788 NV2000 NV2010 3000 7000			
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AG6010 AG6015			
NV330. NV333 NV340.	CAM GEAR	VXG0158	£1 00
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NVG30. NVG400. AG1000. AG1200 1500 1810 2100.			
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NV370. NV430 NV870.	CAM GEAR	VDG0209	£1 20
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NV730 NV770	IDLER UNIT	VXP0581	£2.50
NV2000 2010 3000	IDLER UNIT	VXP0331	£1.00
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NV7000 7200 7800	IDLER UNIT	VXP0344	£1.00
NV7000 7200 7800	CLUTCH	VXP0343	£4.00
NV8150. 8200 8300	IDLER UNIT	VXP0245	£0.90
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NV8620	CLUTCH	VXP0343	£4.00
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NVG20 NVG21 NVG25	PULLEY UNIT	VXP0767	£5.00
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NV230 NV250 NV280	WORM WHEEL	VXP0604	£2.00
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NV870 NV890 AG1000			
NV370 NV380 NV630	IDLER	VXP0523	£3.50
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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
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NV830 NV890 NVG7 NVG10 NVG12 NVG15 NVG30 NVG120.			
NVG130 NVG400. NVH70. AG1000			
NV230 NV250. NV260	CLUTCH GEAR		£2 50
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NVG7. NVG10. NVG11. NVG12 NVG14 NVG15 NVG18 NVG30			
NVG120 NVG130 NVG400 NVH70 AG1000			
NV230 NV250 NV260	LIMITER ROLLER		£1.50
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NV465 NV630 NV650 NV777. NV780. NV788. NV810 NV830 NV850.			
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ORION

MULTIPLE MODELS	IDLER	850A200004	£3.50
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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 VH303, VH312			
VH404 VH555 VH700. VH704 VH708 VH719 VH780 VH844 VH900 VH3 VH33			

SAISHO

VR605 VR800 VR900	CLUTCH	650A20000	£6 50
VR1100 1200 1600 2500 3200. 3300			
VR3500 3600. 3800	LIMITER POST		£1.30
VR1100 1200 1800 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	6130374699	£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		
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VPR5800 VTC5300	LOADING ROLLER	143-0-661T-03800	£1.00
VTC5400			
VTC3000	FWD LIMITER		£3.50
VTC3000	IDLER		£5.00

SHARP

	IDLER	N1DL0005GEZZ	£1 50
	IDLER	NIDL0006GEZZ	£1.50
VC600 651. 681 682	IDLER ASSY	NPLYV0107GEZZ	£6 15
VC684 685 693 699 700 783 VC6FR VC6V3			
VC7300. VC7700 7750	PLAY IDLER KIT	NPLYV0041 + NDA1V1007	£5.00

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VIDEO SERVICE KITS

AMSTRAD
VCR700
Contents
BELT SET. PINCH ROLLER. REEL IDLER. VIDEO LAMP
Order Code: SK41 £5.50

FERGUSON & JVC
3V42/43
HRD455/HRD725

Contents	*Economy Kit Contents*
BELT SET. PINCH ROLLER CLUTCH MECHANISM. TENSION BAND	BELT SET. PINCH ROLLER SUPPLY CLUTCH. TAKE UP CLUTCH
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
Order Code: SK62 £13.50	**Order Code: SK63** £6.25

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STK5476	£3.50	TA8215H	£3.00
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STK7348	£2.80	TIPL791A	£0.80
STK7358	£4.40		

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ICPF10	ICPN5
ICPF15	ICPN10
ICPF20	ICPN15
ICPF25	ICPN20
ICPF38	ICPN25
ICPF50	ICPN38
ICPF75	ICPN50
	ICPN75

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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

MITSUBISHI

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NOKIA

SATELLITE	1000P

NORDMENDE

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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
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RC5 STANDARD	900P
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RC5903	900P

SABA

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TC358	1050P
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JXGE	1000P
JXDE	1000P
VHR2300	1000P
RC628	1000P

SHARP

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SIEMENS

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FC631	1000P
FC742	1000P

SONY

RM604, RM605, RM606	900P
32 CHANNEL	900P
RM613	900P
RM632, RM636	900P

TATUNG

FXA	1000P
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FX70 FASTTEXT	850P

TELEFUNKEN

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3V35-42	900P
3V31-32	900P
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REPLACEMENT PHILIPS NI-CAD BACKUP BATTERIES

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Replaces Philips Part No's: 138-10229. 2.4V – 90mAh 260P

REPLACEMENT FERGUSON NI-CAD BACKUP BATTERIES

Replaces Ferguson Part No: 00E6-067-001. 1.2V

Used on: TX10 180P

Replaces Ferguson Part No's: 00E6-066-001. 2.4V

Used on: 3V35, 3V56, 3V58, 3V65 375P

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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
HANTAREX 28021	1600P	LOT35
SHARP C3700 EQ	1600P	LOT36
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AMSTRAD

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AIWA

G900, HVG900, HVZ10

FUNAI

IV89, VCR2100, VCR2800, VCR4530, VCR4540, VCR5653, VCR5800, VCR5840, VCR5843, VCR6000, VCR6100, VCR6800, VCR6803, VCR7000, VCR8000, VCR8002, VCR8003, VCR8007, VCR8100, VCR8103, VCR8200, VCR8500, VIP150, VR68, VR150

FINLUX

VR3009

GRANADA

VHSF63

HINARI

VCR34, VTV100, VTV200, VXL200, VXL7, VXL8, VXL9, VXL10, VXL11, VXL19, VXL34, VXL90, VXL100, VXL200

SHINTOM

VCR4540

TASHIKO

VVF933, VVF93

TATUNG

TVR6111

TENSAI

TVP1000, TVP1050, TVP2000, TVP2050, TVR130, TVR140, TVR1800, TVR1900, TVR2000, TVR2100, TVR2600, TVR2700, VR2300, VR2350, VR2450, VR2500, VR4100

Order code: CH21 Price: 1450P

FUSES

	TIME LAG (20mm)		QUICK BLOW (20mm)	
Value	Order Code	Price	Order Code	Price
160mA	FUSE01	75P	FUSE17	60P
250mA	FUSE02	75P	FUSE18	60P
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
6.3A	FUSE16	60P	FUSE32	50P

CERAMIC PLUG TOP

3A	FUSE33	100P
5A	FUSE34	100P
13A	FUSE35	100P

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Tubed Heat Sink Compound 25 gram	150P

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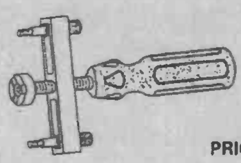

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63v
47uf at 63v .18
100uf at 63v .22
220uf at 63v .35
250v
1uf at 250v .20
4.7uf at 250v .25
10uf at 250v .35
22uf at 250v .40
47uf at 250v .65
100uf at 250v 1.25
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1uf at 400v .23
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10uf at 400v .70
22uf at 400v
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250MA, 315MA, 500MA, 630MA ..1.20
800MA,1A,1.6A,2A,2.5A,3.15A
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TELEVISION

The Pursuit of Economic Success

The government should do something about it! That's a common and understandable response when things are not going as well as one feels that they should. After all, governments have power and resources. Right now the world is suffering from a prolonged recession (of the seven leading industrial economies, only three have grown – not very much – over the past twelve months while four, including Germany and Japan, have actually shrunk). What are governments doing about it? Well, holding some meetings and discussions, and creating documentation. Not a great deal else. Should they be? Perhaps we expect more than we should of what we regard as these omnipotent agencies.

What governments can in practice do is important but rather limited. An interesting book, *National Innovation Systems, a Comparative Analysis*, recently published by the Oxford University Press, highlights this. In it, contributors from most of the relevant countries describe the policies that their governments have adopted and their success or lack of it. One thing that stands out is the fact that a government is only one factor in determining the success or failure of an economy to respond to opportunities and thus grow. There are institutional factors, i.e. how things are done, and cultural ones, i.e. how people react. To do anything about such factors and create helpful conditions takes time. It can't be done overnight, but a degree of urgency is relevant in today's situation.

The authors of the book emphasise the vital role of education and training in economic success. Governments can contribute to this by ensuring that adequate resources are made available – not only for education itself, but for its extension into research. Unfortunately the latter is something that's tricky to handle, with success often elusive. There has been much brilliant academic research in the UK in the past, but not a great deal of success in the all-important progression from research to practical development in the form of saleable goods and services. In the past the USA has been more successful in this respect. The well-known example of Silicon Valley, where the combination of relevant research and an entrepreneurial ethos led to an explosive growth in the electronics industry, springs to mind. That it doesn't always work out as easily as this sounds is borne out by the rather sad example of Philips, a company that has always invested heavily in research, has come up with many firsts but has not been all that successful in terms of sustained economic growth. In the past Philips has suffered from those institutional problems – a rather ponderous management and communications style. Silicon Valley itself has gone through different phases of growth. Nowhere do you get sustained success all the time. That's something we just have to live with.

The book quotes Korea and Taiwan as examples of "education-led growth", where a highly educated workforce has enabled manufacturers to move rapidly from the production of basic commodities to more sophisticated products with greater added value. The lesson here is obvious: invest in education, but also ensure that it is by and large relevant to economic needs. To establish the right educational balance to succeed in this respect is not easy. One can say that in the UK this is a matter that calls for attention. Money poured into education can all too easily be wasted.

Whether defence expenditure has over the years helped various economies – the famous spin-off effect – is something that has been debated at length in the past. The book throws some interesting light on the subject. Basically it seems that defence-led research can have beneficial side-effects – the classic examples are probably the US electronics and aerospace industries in the Fifties and Sixties – but as such research becomes more and more devoted to specific technological requirements so its ability to contribute to general economic activity and growth becomes less.

The other major factor that the authors of the book highlight as being vital to economic success is free trade. Here again it's not enough on its own – the UK has generally in the past adopted free trade policies. But without it there's no exposure to fresh ideas and new technology. One has only to reflect on the sad state of the ex-communist economies to appreciate the vital importance of free trading amongst innovative, internationally orientated companies to economic progress. The latter point, an international outlook, is another important factor today. It's essential for manufacturers to think in terms of global markets.

So what can governments do? Generally the aim must be to foster an atmosphere that encourages entrepreneurship and innovation. The trouble is that this is rather a nebulous aim. It's a matter of trying to achieve the right institutional, educational, financial and entrepreneurial mix. But at least we have some pointers to what can lead to success.

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COVER PHOTO
This month's cover photograph shows the K deck, which is used in the latest range of Panasonic VCRs. See article on pages 36-39.

REED BUSINESS PUBLISHING

Camcorner

Reports from Brian Storm, Ian Bowden, Simon Bodgett, Brian Davidson and Savio DaCosta

Panasonic NVMS90

We've had a few of these come in with intermittent colour and/or luminance, maybe with flickering in the electronic viewfinder, all caused by damage to the ribbon cable between the hi-fi sound head amplifier CBA and the main board. It rubs on the corner of the chassis, with the result that a black burn mark eventually shows on the ribbon lead. Replace the cable, part no. VWJ0394, and to prevent further damage insulate the chassis corner with tape. **B.S.**

Sony CCDF250

This machine had a damaged cassette carrier: the customer must have forced it open, breaking the carrier locking mechanism in the process. When the carrier had been replaced the machine appeared to work well, but when it was powered for the first time after being fully reassembled the machine laced up without a cassette being inserted, the mode motor could be heard to shunt backwards and forwards, then the machine switched off. With the cases removed the machine again worked correctly. Back on with the cases and the fault condition was restored.

We removed the cover screws and after much careful flexing and prodding discovered that the small, flexible PCB (FP89) that connects the mechanism and mode switch to the CC15P PCB was bent in a S shape. As a result it touched the aluminium mechanism base. The mode problems were caused by the fact that the PCB covering had worn through, connection 4 (mode switch 2) shorting to chassis. **I.B.**

Panasonic NVMC6

The cassette carrier was damaged: because it was bent out of shape it wouldn't close. We replaced the carrier and tested the unit. When playback was selected the machine started to pull the tape from the cassette then stopped and unlaced. When record was selected the machine went into the rewind mode. It seemed that the unit was detecting the end of the tape.

There's only one photodetector on the supply reel side of the tape path. This detector is exposed to the infra-red emitter before tape lace-up, its view being blocked when the tape is pulled out. The emitter should be switched off before the tape starts to move, so that the detector isn't activated. The top loading ring that's attached to the supply side guide assembly was found to be one tooth too far anticlockwise however. Thus when the emitter was switched on the tape hadn't moved far enough to block the beam. With the ring aligned correctly all was well **I.B.**

Sony CCDF355

There was no sound output when this machine's own recordings or known good ones were played back, though audio was produced when the camera's output was monitored. We checked the r.f. playback signal at pin 11 of IC401 on the f.m. modulator/demodulator sub-PCB. A signal was present here but as no level is specified we were not sure whether it was sufficient. We took a feed from pin 15 of IC401 – this is after the f.m. demodulator – to an external audio amplifier and obtained correct audio. But there was no output from either pin 29 (line audio) or pin 27 (earphone audio). The fault was cured by replacing the chip. **I.B.**

Sony CCDTR55

The camera section wouldn't turn on properly. You got a blank screen with increasingly scrambled lines that turned into a misty picture which became magenta and was then o.k. It took us some time to trace the cause. We suspected missing clamp pulses at the colour encoder and discovered that L302 was dry-jointed.

Another of these machines wouldn't wind the tape into the cassette fully when ejecting it. We replaced both spool carriers and the idler gear as a kit. This was perhaps a bit over the top, but when these mechanisms are in bits it's not worth taking a chance. **S.B.**

Ferguson 3C03

The owner complained that the picture twitched and flashed and there was no colour recording. A vectorscope check showed that the colour carrier frequency was miles out. After replacing the SSG circuit's clock crystal without putting matters right I came to the conclusion that the SSG chip was faulty. Replacing it is not an easy job. I was pleased that the results looked perfect. **S.B.**

Akai PVC4

This camcorder had a white-balance fault – the camera picture was pink. It turned out to be a bit of a job. Poor red/blue separation was producing a magenta bias. This is normally caused by a faulty delay line, and one had to be fitted before the real culprit could be tracked down – the R/B separation control. **S.B.**

Panasonic NVS1E

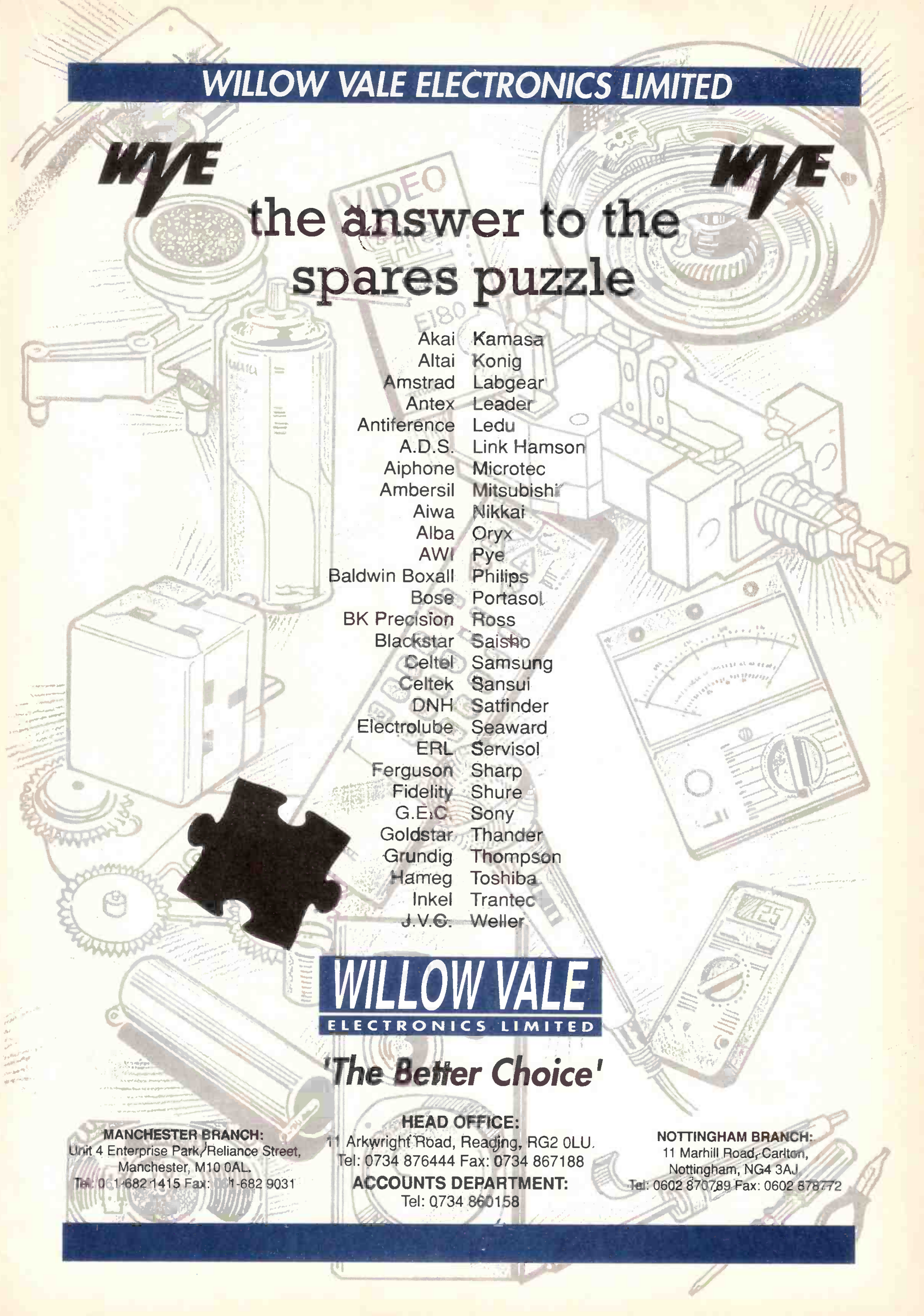
The symptoms with this machine were intermittent colour from the video output and a blue line down the centre of the picture. They had started after the customer had dropped the camera. I phoned Panasonic to check on the price of a new side panel for the camera and the availability of replacement PCBs. As these are no longer available we carried out a careful visual check and found that delay line DL8001 was cracked. A replacement provided a complete cure. **B.D.**

Panasonic NVM7

The owner was furious with this unit – it shut off while he was changing tapes when filming Niagara Falls. The tape was stuck: it wouldn't unwind from the loading point. IC6004 was the cause of the fault. All inputs were present but there was no output to the loading motor. **S.DaC.**

Panasonic NVM5

The VCR/camera select door switch was inoperative, so you couldn't record. A new switch restored full operation – the old one had cracked in half. **S.DaC.**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Panasonic's Digital TV Chassis

Part 3 ***Ray Meadows***

This month we'll deal with the text, audio and scan processor sections of the chassis. In the concluding instalment next month we'll take a look at various features incorporated in some of the models sold in Continental European markets.

Teletext

The text decoder is based on the ITT-Intermetall TPU2735 teletext processor chip. Apart from peripheral components all that it requires in addition is a RAM chip. It provides full level-one functions (FLOF) plus TOP text, the alternative text magazine structure used by some German broadcasters. As its internal ROM contains a full Continental character set, the correct text can be displayed with all European satellite transmissions. With D2-MAC equipped models the chip can also decode MAC vertical blanking interval type text such as that transmitted by Filmnet Plus via Astra.

The teletext processor chip (TPU) operates in the same way as a conventional text processor but expects a digital video input. An advantage is that this digital input allows it to provide ghost cancellation, which can improve text reception when short-term multipath signals with a delay of up to 0·8μsec are present. Other internal features include a small dynamic RAM buffer for the external memory, and RGB switching between the text and any external RGB signals entering via the AV1 scart connector. These 'external' signals can include picture-in-picture information in a suitably-equipped receiver. The TPU chip's character generator section also provides the many on-screen display messages available – in up to six languages.

Conventional page memory is provided by an MN41256 DRAM, which is arranged as 32K by 8 bits. This is enough to store sixteen pages of text though there will be a reduction, depending on the text mode, because of the FLOF index and TOP table.

Fig. 1 shows a block diagram of the text system.

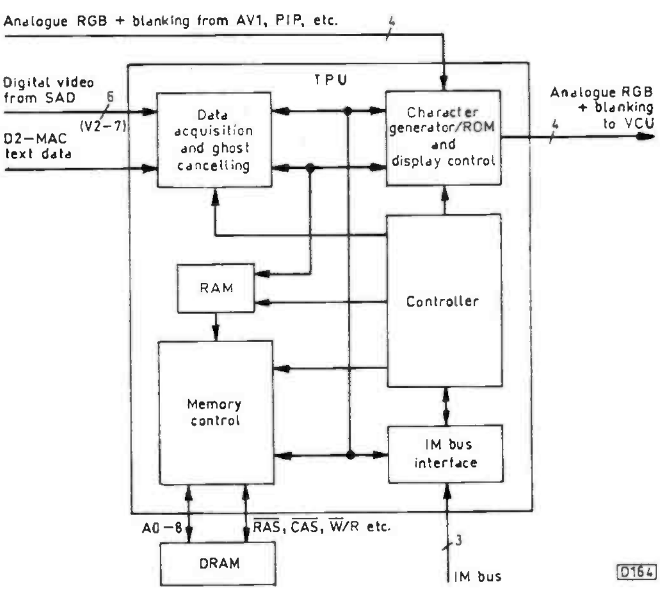

Fig. 1: Block diagram of the teletext circuit.

Audio Processing

The Audio Control Processor (ACP), the Multi Sound Processor (MSP), the Audio Multiplex Unit (AMU) and a few peripheral components, including an 18·432MHz audio clock crystal, take care of the audio processing. Fig. 2 shows the arrangement. Models that can receive only basic f.m. sound and the German Zwietone signals use just the ACP chip: for Nicam reception the MSP and AMU chips have to be added.

The ACP chip processes all the audio signals – analogue f.m., external via the AV inputs, digital Nicam and D2-MAC. It has inputs for the demodulated mono f.m. carrier, stereo or second-language f.m., Secam a.m. and D2-MAC sound. When unused, these inputs are connected to chassis via capacitors. Any audio option can thus be selected. With sets intended for sale in the UK the demodulated f.m. inputs are not used, since there are no analogue multisound services. Instead, the f.m. signal is processed with the Nicam signal in the MSP and AMU chips, reducing the number of filters required.

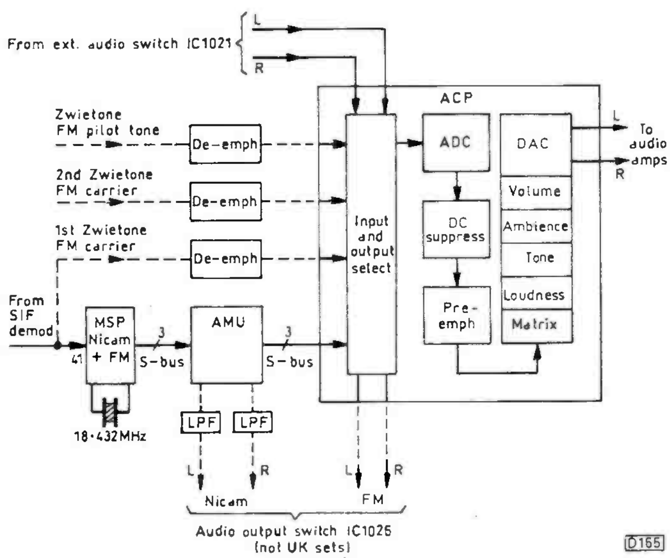

Fig. 2: Block diagram of the audio processing system (full options).

When the audio section in a Continental model receives demodulated f.m. and Zwietone signals each input is gain-adjusted to avoid distortion, then de-emphasised and dematrixed as necessary. The left- and right-channel signals are digitised by two pulse-width modulators, producing two single-bit data streams. A third pulse-width modulator is included for digitising the pilot tone with Zwietone transmissions.

At this point in the chain any digital Nicam signals from the AMU chip appear on the digital sound bus (the S-bus). Information on which analogue and digital audio options are available is sent to the CCU chip via the IM bus: the CCU then enables selection of mono f.m., Nicam, etc. as required. The ACP chip carries out this input selection then digitises the signal which is passed to the chip's audio control block for balance, tone and ambience adjustment. Ambience effects are achieved by using frequency-selective filtering for each channel then phase-shifting and feeding the result back to the opposite channel. The final sections of the ACP chip provide volume control and then DA conversion, after which the signals leave the chip to head for the audio amplifiers.

The Nicam signal is decoded and sorted out inside the MSP and AMU chips. All UK receivers are fitted with these two i.c.s. The Nicam and f.m. sound signals from the i.f. strip arrive at pin 41 of the MSP chip via a simple CR filter network. Internal functional blocks within this device include a 17·7MHz Nicam clock, AD conversion for the f.m. signal, a quadrature mixer and a Nicam decoder. The audio output from this chip, in the form of 64-bit data sequences, is passed to the AMU chip via the S-bus. This bus has three lines, for separate data, clock and ident signals. The AMU chip is used to provide further de-emphasis and filtering for the Nicam signal, which leaves via another section of S-bus to pass to the ACP chip for selection as required.

Scan Processing

The Deflection Processor Unit (DPU) chip is responsible for generating and processing the scan signals: it contains line, field and EW parabola generators and protection circuits, and requires very few peripheral components. Its IM bus interface with the CCU chip enables software adjustments of the scan parameters to be carried out in Service Mode 1. Fig. 3 shows a simplified block diagram.

The digital video signal from the video analogue-to-digital converter chip (SAD, see Fig. 5 last month) is fed to pins 32-38 of the DPU chip. Though the SAD chip provides an 8-bit video output, only seven bits are fed to the DPU chip, the least significant bit (V0) being ignored. The DPU chip low-pass filters the video input then passes it to independent line and field sync separators. This parallel processing results in excellent sync performance – I've found for example that the receivers lock perfectly to scrambled satellite TV signals. There's also a composite sync input, at pin 29, for use with MAC signals – pre-processing is required in this case because the DPU chip cannot decode digital packet sync. Since UK sets are not equipped for MAC reception this pin is simply linked to chassis via a small capacitor.

An internal counter that calculates the number of fields from the received line frequency provides field synchronisation. During normal 'coupled' operation this is fixed at 50 or 60Hz. 'Uncoupled' operation occurs when the received sync signals are weak. In this mode a range of operation is allowed: with a PAL signal it's 45-55Hz while with an NTSC signal it's 54-66Hz. The same range is used for VCR operation, where the signal is strong but of unstable frequency: in this mode the trigger window is narrower. The DPU chip determines the appropriate mode of operation and constantly monitors it.

The sync signals are then used to generate line and field waveforms. An internal high-speed processor also produces an EW parabolic waveform. The field and EW signals leave the DPU chip in the form of pulse-width modulation, being integrated by the external circuits described in Part 1.

When the set is first powered no external sync signals are available. In this situation the DPU chip divides the 4MHz clock signal from the CCU chip to produce a line-frequency output at 15·25kHz. Since the frequency is low there's slight overscan, which is useful under warm-up conditions. Once

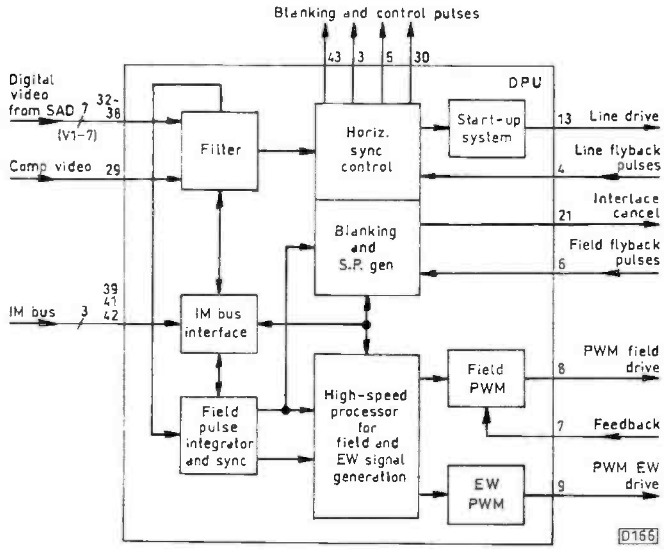

Fig. 3: Simplified block diagram of the DPU chip.

standard sync data is read from the EEROM via the I2C bus the line frequency is raised to 15·625kHz. As soon as external signals are available the DPU chip locks to them, using the sandcastle pulses as a reference. To avoid on-screen disturbances these changes take place during the field blanking interval. The 4MHz clock is also used as a fall-back when the video source is changed from PAL to NTSC. A 15·25kHz scan is maintained during the brief period when the system clock is being switched over.

Other signals generated by the DPU chip include a combined chroma burst and line blanking pulse (at pin 43) which is used by the ACVP chip for chroma switching and by this chip and the VDU chip to produce the vertical blanking interval drive pulses for black and peak-white correction. A composite field and delayed line pulse output at pin 3 is used by the VDU chip for blanking, while a line blanking pulse output is provided at pin 5 for DTI and DFU operations. A special pulse is provided at pin 21 in the full-screen text mode. It produces a small vertical shift on every other field, the effect being to merge the two fields to avoid interlace flicker. Because of this a text/mix mode is not available, though interlaced text is allowed for subtitles and newsflash displays.

To operate correctly the DPU chip requires two further inputs. The first of these is a flyback pulse from the line output transformer. It's obtained from pin 1 of the transformer, where the pulse amplitude is typically around 60V peak-to-peak. After passing through D1506 and R1506 and being clamped by D1507 the pulse amplitude at pin 4 of the DPU chip should be 5V. The second input is a flyback pulse from the field output stage (see Fig. 4 last month). This is fed in at pin 6 and, as previously explained, is used to prevent excessive current in the field scan coils in the event of failure of the output coupling capacitor. Note however that the chip is only looking for the presence of a 2V d.c. signal at pin 6, so it can be made to operate if one is provided.

It's common practice in TV receiver servicing to check the field output waveform provided by the sync/timebase generator or the jungle chip. As the output from the DPU chip consists of pulse-width modulation, it will be displayed as a difficult to view digital waveform. A better place to check is at the junction of C567 and R566 (see Fig. 4 last month) where the signal is integrated.

When any type of scan problem occurs it's worth checking the 4MHz clock pulses from the CCU chip as a first step.

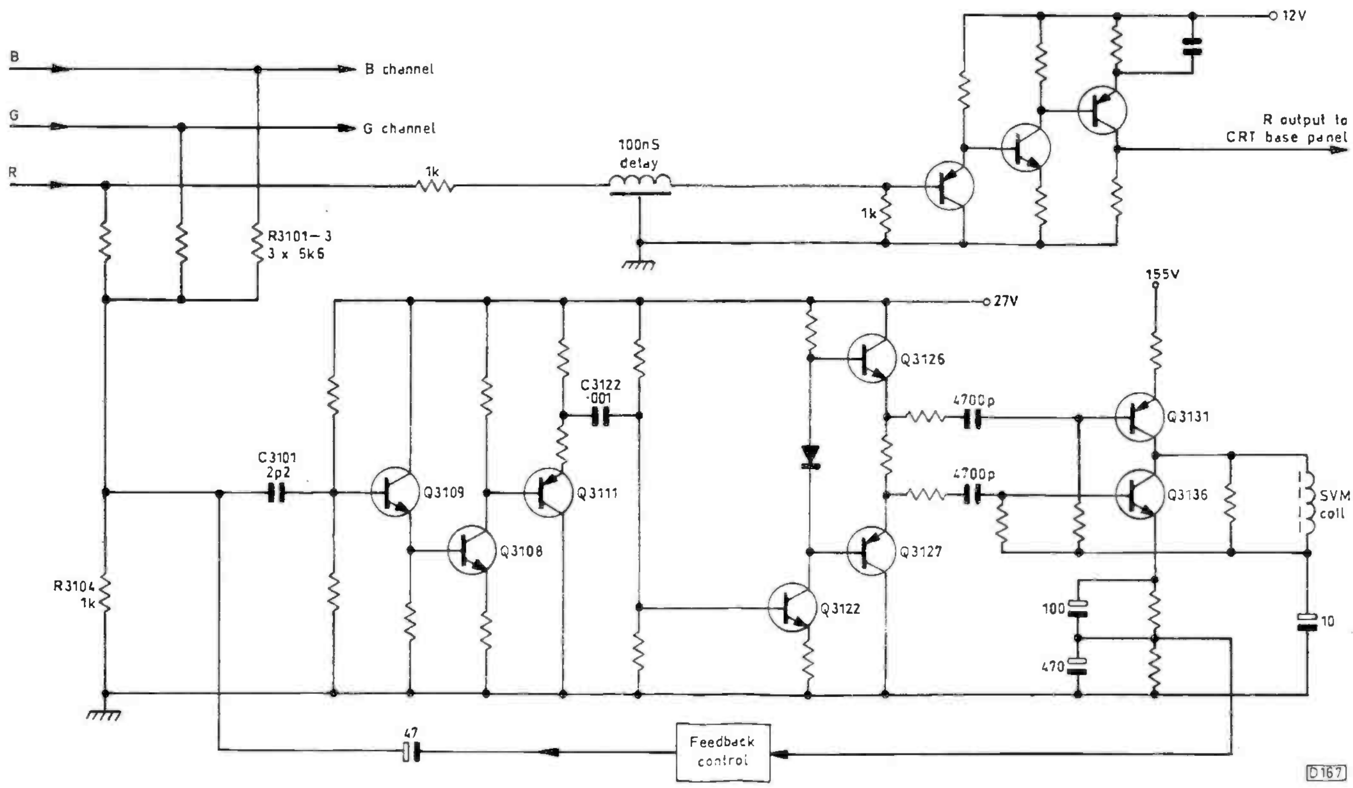

Fig. 4: The SVM board circuitry, simplified and with only the red channel is shown.

Scan-velocity Modulation

An item not previously mentioned is the Scan-velocity Modulation (SVM) board. This modulates the line scan speed in accordance with the content of the video signal to improve the sharpness of black-to-white and white-to-black transitions. It's not something new, but the SVM board used in the Euro 1 chassis is significantly more complicated than that used in the Alpha 3 chassis. Fig. 4 shows a simplified circuit of the red channel and the SVM system.

The RGB outputs from the VDU chip pass from the digital panel to the c.r.t. base panel (board Y) via the SVM panel (board S) – Fig. 6 in Part 2 last month was incorrect in this respect. When the RGB signals arrive at the S panel they are delayed by three 100nsec delay lines. An emitter-follower and two-stage amplifier in each channel return the signals to their initial level, after which they are fed to panel Y.

The SVM circuit needs to know when luminance transitions occur. So a sample of the undelayed signals is fed via the 2·2pF capacitor C3101, which acts as a high-pass filter, to the emitter-follower Q3109. After amplification by Q3108/3111 the signal is a.c. coupled to Q3122 by C3122. At this point the signal consists of positive and negative pulses that coincide with black-white and white-black transitions respectively. Q3126 and Q3127 form a push-pull amplifier, with Q3131 and Q3136 as the output transistors that drive positive and negative needle pulses through the SVM coil. This is positioned on the neck of the tube.

During a black-white transition the positive pulse accelerates the line scan slightly. Conversely with a white-black transition the scan is decelerated. The net processing delay in the SVM circuit is 100nsec, which is matched by the delay added to the RGB signals.

Next Month

In the concluding instalment next month we'll take a look at some of the features incorporated in various Continental models that use the Euro 1 chassis.

OBITUARY

We deeply regret having to report the death of George R. Wilding on July 30th. George had been a regular contributor to the magazine for many years, both under his own name and various pen-names such as M.G. Hull and H.K. Hills. His articles concentrated on the circuit techniques used in TV receivers and on various aspects of servicing – all based on his own considerable experience. George had written for *Practical Television/Television* almost from the start, and was a great help to successive editors, always ready to give friendly advice whenever asked. We shall greatly miss him.

George started as a radio and public address engineer. He joined the Automatic Telephone Co. Ltd. as a radio/electrical inspector, testing apparatus for radio controlled aircraft and allied equipment. This was followed by a period during which he taught basic radio and a.c. theory at the Central Technical College, Liverpool. During the war he taught similar subjects at the RAF Technical College, Shrewsbury. Then for over twenty years after the war he ran his own specialist radio and TV servicing business in Liverpool. He also continued with his teaching activities by running radio and TV servicing courses at the Maghull Centre for Further Education. When he retired, he moved to Paignton, Devon, where he continued with his writing and also ran a TV repair operation. J.A.R.

Teletopics

DIGITAL TV

Over eighty organisations including governments, broadcasters, setmakers and other electronics manufacturers have signed a memorandum of understanding (MOU) which sets out a programme for establishing digital video broadcasting (DVB) in Europe by the end of the present decade. It covers satellite, cable and terrestrial TV, setting out a market-driven approach. Signatories include the BBC, Channel 4 and the ITV companies, the ITC, BSkyB, the Cable Association, National Transcommunications (NTL), Philips, Nokia, Thomson, the European subsidiaries of Matsushita, JVC, Sony and Toshiba, Pace, Amstrad, Hewlett-Packard, General Instruments – and seven governments including the UK.

The MOU follows almost two years' work by a loose, preliminary organisation, called the European Launching Group for Digital Video Broadcasting, which was set up in 1991 to co-ordinate the considerable research work on digital TV being carried out in Europe. Three groups will be responsible for most of the detailed work: they will be concerned with the technical, satellite/cable commercial and terrestrial commercial aspects respectively. The key objectives that have been laid down are as follows: (1) to agree on standards for satellite and cable TV by the end of 1993, enabling services to begin in 1995; (2) to agree on standards for terrestrial broadcasting by the end of 1995; (3) to produce standards for receiving equipment; (4) to develop a strong, competitive DVB technology base in Europe; (5) to contribute to EC and government policy, with the aim of removing obstacles to a market-led introduction of DVB services; (6) to promote the exchange of information between all those involved, leading to commercial agreements for exploiting DVB; and (7) to build links with projects in the USA and Japan. The MPEG-2 video and audio compression standard will be the basis of all European digital TV standards agreed upon under the DVB project. Modulation techniques will vary between different media and have yet to be decided – an EBU sub-group has been asked to come up with proposals. Quadrature phase-shift keying is likely to be adopted for satellite transmissions, 16 or 64 quadrature amplitude modulation for cable use and coded orthogonal frequency-division multiplexing for terrestrial TV. DVB members will pay an annual fee that has been set initially as 10,000 ECUs (about £7,700).

CHANNELS 35 AND 37

The ITC has released some preliminary results of the investigation it commissioned from NTL on the consequences of using u.h.f. channels 35 and 37 for digital TV in the UK. The frequency-planning work has shown that while four or more digital TV channels could be provided for most viewers, using the currently planned Channel 5 transmitting sites, in some areas fewer than four channels could be provided. Coverage would be better than with previously planned services however, and higher powers could be used – the latter could make more digital services available.

While it had been hoped that low-power digital transmissions would reduce interference to VCRs and other equipment to negligible proportions, the study has shown that this is unlikely to be the case. For example in London the number of VCRs that would suffer interference from digital transmissions with an effective radiated power of 1kW is likely to be as much as half the number that would suffer interference from an analogue Channel 5 transmission with an e.r.p. of 250kW. This is a disappointing result – and the situation would be worse if higher-powered digital transmissions were used to increase the channel capacity. The ITC comments that more work is needed on how VCR problems could be minimised should channels 35 and 37 be used for digital TV at some future date, the main preliminary conclusion being that the VCR problem is one that cannot be ignored.

VIDEOS BY PHONE

British Telecom has been carrying out trials of a prototype system, developed by Philips, that would enable video programmes to be sent to subscribers via digital telephone lines. Viewers would use an IR remote control unit and an on-screen menu to select from hundreds of films held in a central store. The technique is known as asynchronous digital subscriber loop technology. The Philips Home Interactive Multimedia Terminal converts an MPEG-1 format compressed digital video signal, sent at 1·5Mbits/sec, to an analogue PAL or NTSC signal – the line can still be used for normal phone calls while a film is being received. There are three main items in the terminal: a standard TI communications interface, a control system, and an MPEG-1 decoder that uses a Philips/Motorola chip set developed for CD-i player use. BT says that there are no plans at present for public trials. Such a system would of course raise political and commercial questions.

In a similar vein Tele-Communications Inc., the largest cable TV operator in the USA, and Bertelsmann have announced plans for an interactive cable channel that enables viewers to choose pop videos: it's claimed that the new channel will be the first of its kind. Customers will initially use the telephone to order their selections. Use of a remote control handset for the purpose should be possible in two-three years' time.

W-VHS TECH SPEC

JVC has released technical specifications for its W-VHS system, which was announced earlier this year. The format is designed for use with the Japanese Hi-Vision analogue HDTV system, and is also compatible with NTSC and S-VHS/VHS systems. There are three recording options: (1) Hi-Vision recording/playback (HD mode); (2) enhanced NTSC recording/playback (SD mode); and (3) simultaneous two-channel NTSC broadcast recording (SD2 mode). Metal-powder tape is used, housed in a VHS-sized cassette. Each cassette gives up to three hours' recording time in the HD and SD2 modes, 540 minutes in the SD mode. The cassettes cannot be played by VHS and S-VHS machines.

In the HD and SD2 modes the tape speed is 33·35mm/sec, the head speed 5·8m/sec and the track pitch 58μm. In the SD mode the tape speed is reduced to 11·12mm/sec and the track pitch to 19μm.

A time-compressed integration (TCI) system is used to record baseband Hi-Vision signals. The f.m. carrier deviation is 2·5MHz, 8MHz being the sync tips and 10·5MHz peak white. White clip is 240 per cent, dark clip 110 per cent. Azimuth is ±15°. In the SD and SD2 modes NTSC, Y/C or component signals can be handled. With the HD and SD2 modes the VHS f.m. recording system is used, with PCM as an option. The SD mode has no PCM option.

The W-VHS format has been been adopted by Hitachi, Matsushita, Mitsubishi and Sharp.

BBC's DAB TRIALS

The BBC has begun major engineering tests of its Digital Audio Broadcasting system in London, using high-power transmitters. At present a 10kW transmitter at Crystal Palace is being used, but 1kW transmitters at Alexandra Palace, Reigate and Wrotham are to be added shortly. All the transmitters operate at 226MHz. Specially-equipped vehicles are being used for the tests. DAB services are not expected to be launched before 1995.

SATELLITE TV

Our comments about BSkyB's profitability in last month's leader should have mentioned that the figures given relate to operating profit before interest. There is interest on external debt to be taken into account, also notional interest on the money the company has invested in setting up the operation. The latter could be converted to equity. These factors make it difficult to assess the exact situation. It's interesting however that consultants Booze Allen and Hamilton forecast in a recent report that by 1996 BSkyB could have revenues greater than the entire ITV system and be well ahead by 2000.

Philips has developed a set of four new chips that perform all the functions required in a satellite TV receiver, from second i.f. conversion to baseband video demodulation, with improved performance and reliability and a reduced peripheral component count. The four chips carry out the following functions: (1) mixer/oscillator; (2) gain-controlled i.f. amplifier; (3) PLL f.m. demodulator; (4) I2C-bus controlled frequency-synthesis tuning.

Toshiba has brought into production an HEMT (high electron-mobility transistor) with a noise figure of just 0·45dB at 12GHz. The main source of noise in an HEMT is the resistance of the channel layer, which normally consists of gallium arsenide. To reduce the noise Toshiba uses indium-doped gallium arsenide, the doping level being adjusted to create a lattice structure that minimises the resistance. The crystal structure at the source has also been improved, using an aluminium gallium arsenide layer. This results in a 40 per cent higher electron flow. Sensitivity is increased and gate resistance reduced by using the company's electron-beam processing technology to create a T-shaped gate structure with a gate length of only 0·1µm.

MTV has signed a contract to lease transponder 39 (11·658GHz) on Eutelsat II F1 at 13°E. The channel plans to upgrade to the Hot Bird (Eutelsat II F6) when this is brought into operation next autumn (1994).

Pace has developed a tuner for use in its receivers. Tuners had previously been imported from the Far East.

MULTIMEDIA NEWS

The recently agreed Video CD format that puts up to 74 minutes of MPEG-1 video on a compact disc (see September, page 780) is to offer two extra options: (1) two still-picture quality levels, high- and normal-resolution; and (2) recorded codes for playback control.

Philips has announced that its first CD-i movie titles will retail at about £15 each. A new, lower-priced player, Model CDI210, has been released with a suggested price

Next Month in TELEVISION

LOWDOWN ON THE ICC7 CHASSIS

The Ferguson ICC7 has been introduced as an updated replacement for the ICK2 chassis. J. LeJeune describes the technical features, with particular reference to the unusual bits of circuitry that could cause confusion.

SERVICING THE FC08 AND FC28

A large number of these Ferguson-branded, full-size VHS camcorders have recently been released, having been sold off via Thorn Rental outlets. David Woodnott provides a servicing and fault rundown.

TEST REPORT: BECKMAN 9020 SCOPE

David Botto puts the Beckman 9020 20MHz, dual-trace scope through a bench test and finds it well suited to the needs of the modern service department.

MODERN FIELD TIMEBASE CIRCUITS

In Part 12 of his series Eugene Trundle describes the operation of modern field time-base circuits including the thyristor type used in some Thomson chassis.

SERVICING THE GOODMAN CTV9200/SAMSUNG CI125R

These compact 5in. colour sets proved particularly popular with caravan users, incorporating in addition an m.w./f.m. radio. John Riggs lists the various fault conditions that may be encountered.

ADDING A BUBBLEJET PRINTER

Many readers probably use an Amstrad PCW series wordprocessor. The results obtained with earlier versions can be much improved by adding a bubblejet printer. Keith Wevill describes how to go about doing this.

ORDER FORM

To...

(Name of Newsagent)

Please reserve/deliver the December issue of TELEVISION (£2·20), on sale November 17th, and continue every month until further notice.

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of £400: a new games touch pad will cost £25. Kodak has reduced the recommended prices of its Photo CD decks: Model PCD265 is now £149 (down from £299), Model PCD865 is £199 (from £369), Model PCD885 (the portable) is £249 (from £399) and the multi-disc Model PCD5865 is also £249 (previously £429).

Pioneer has launched a new range of four Laser Disc players.

In the USA Panasonic is now supplying its Model FZ1REAL 3DO multimedia players which have a suggested retail price of $700 (about £460). 3DO is the 32-bit competitor to CD-i.

DISPLAY TECHNOLOGY

In mentioning Matsushita's Flat Vision display device last month we referred to "an electron source". In fact in its initial 14in. form the device uses a matrix of 9,746 electron beam sources. Each source scans six lines of two sets of RGB elements. A sophisticated control and deflection system is required.

A device using cold-cathode field emission, invented by the French Atomic Energy Commission, has been licensed to Texas Instruments. The plan is to use it in lap-top computers. A 6in. version less than 2·5mm thick has been demonstrated. The field emission display (FED) uses cold-cathode elements that emit electrons when energised by an electromagnetic field. There's an electron gate for each element, which has a diameter of about 1µm. Since the elements are less than 200µm from the phosphor screen there's no need for electrical focusing. Resolution is determined by the number of cathodes per pixel.

PRODUCT NEWS

The new GoldStar Model RDD10i VCR is of particular interest in incorporating both a VHS and a Video-8 deck. In addition to being able to handle both formats it can transfer recordings from one to the other, with the ability to edit them via a dual remote control unit as you do so. The idea is to appeal to camcorder users. Suggested retail price is £630.

Panasonic has launched a new S-VHS-C camcorder, Model NVS85, whose features include a times ten optical zoom, a times twenty digital zoom, programmed auto-editing, long play operation and VITC. Suggested price is £1,200. Canon has introduced two camcorders with optical image stabilisers: Models UC40Hi and UC5Hi have suggested prices of £1,200 and £1,400 respectively.

Toshiba has launched two new TV receivers, Models 2939DB (68cm screen) and 2539DB (59cm screen), with Dolby Pro-Logic, a Dolby Surround processor and Dolby-3 stereo. Suggested prices are £1,000 and £900 respectively.

The Akura Quartet, with a suggested price of £400, is a combined 14in. TV receiver and stereo CD system.

BUSINESS NEWS

Hitachi is to close its VCR assembly plant in Germany, where production has fallen from a monthly peak of 45,000 in 1989 to 13,000 machines a month this year. Last year Hitachi's consumer products division made a Y42·6bn loss (about £27m), following a Y14·6bn loss in the previous year. Its US VCR plant has been closed, production for the US market being moved to Malaysia. VCR production for European markets will be met by its UK and, if necessary, Malaysian plants.

JVC has revised its profit forecast for the year ending March 1994: instead of breaking even a loss of Y25bn is expected. There are to be staff cuts and the headquarters is to be moved from Tokyo to Yokohama.

Nokia is to move production of its small-screen TV sets to Bochum in Germany, where two new production lines are being set up. Previously it had obtained small-screen sets from Sanyo's Singapore plant. The company says that concentrating production in Germany will cut costs and improve quality.

PUBLICATIONS

HRS has recently published its 1994 Components Catalogue, which has a separate price list to enable the company to issue regular pricing updates throughout the year. A comprehensive range of spares and components is available with same-day despatch, guaranteed next-day delivery and a free fax ordering service. A new Electrical Accessories catalogue was issued in the summer and a new Sound and Security catalogue is to be made available during October. For details contact HRS Electronics, Garretts Green Lane, Birmingham B33 0UE. Telephone 021 789 7171.

The second edition of *Radio! Radio!* by Jonathan Hill, a well illustrated, 244-page (A4 size) history of the British radio receiver, has been published by Sunrise Press, 2-4 Brook Street, Bampton, Devon EX16 9LY (0398 331 532) at £25 including postage.

THE BERLIN CONSUMER ELECTRONICS FAIR

New items on show at the recent Berlin International Consumer Electronics Show included a Philips VCR with a voice-operated remote control unit (the Voice Commander) and a TV receiver range from Grundig featuring a parental lock system. The Voice Commander is to be introduced in the UK shortly at about £99. A full report on the Fair will be included next month.

VIRTUAL REALITY DEVELOPMENTS

A virtual-reality games machine with three-dimensional graphics that can be manipulated and updated in real time is being developed by Nintendo and Silicon Graphics. The new system, called Project Reality, should be available for use in arcades next year. It will use a Silicon Graphics chip set consisting of a 64-bit R4400 microprocessor, a graphics co-processor chip and custom video, audio and graphics chips. A domestic version at about $250 could follow a year later.

SATELLITE STEREO SOUND

BPD Marketing Ltd., PO Box 1104, Glasgow G3 7ER (telephone 0800 626 040) is marketing a device called the StereoSender that enables stereo sound transmissions picked up by a satellite receiver to be conveyed to an f.m. radio receiver or hi-fi tuner. It consists of a scart-to-scart lead which incorporates a small, low-power modulator/transmitter providing an output at 107MHz. The lead replaces the existing satellite receiver-to-TV set scart lead. F.M. receivers anywhere in the house can pick up the 107MHz transmissions. The device is powered by an internal AAA-size battery that gives forty hours operation or alternatively a mains power unit is available. One-off price of the StereoSender is £49·95 plus £2·95 post and packing; the power supply costs £9·95.

Letters

QUESTIONS

Can anyone help to solve a few puzzles? First why do the producers of children's television programmes on saturday mornings put shiny new Japanese TV sets into dull old Bush cabinets? Perhaps if they'd put Bush sets in Bush cabinets fifteen years ago we would have had UK-made Bush sets today. Secondly why, when the same programme is shown a second or third time by ITV or the BBC, is it called a repeat while when Sky does the same thing it may be called an 'encore' performance?

Finally another Sky TV question. If you look at dealer text on the Sky text service one of the first things you'll notice, along with the adverts for all the new channels, is the boast of increased support for authorised Sky agents. Reading this gave us such a warm feeling – to know that, as a small outfit, we had the support and backing of this huge TV programme producer. We'd backed them in the early days: when Sky was making heavy losses, we little chaps battled to sell all the contracts we could. Unfortunately the letter I opened only some minutes after reading the dealer text left us with a chill. As we haven't sold enough contracts, we're not required any more. I wrote to ask whether our agency could be continued but didn't even receive a reply. Is it right that, after supporting Sky when it was struggling, now that it's profitable small dealers are treated in this cavalier way?

Chris Watton,
Boston, Lincs.

SERVICE FEEDBACK

I'd like to make a couple of points in connection with Panasonic equipment mentioned in the VCR Clinic and Camcorner sections last month (October). First the buzzing NVJ47B VCR. The cause of this is excessive mains voltage, the cure being to add an 0·01µF, 50V capacitor (part no. ECUM1H103KBN) across pins 3 and 4 of Q1103 in the power supply. Secondly the cause of no focus or zoom operation with the NVS5B camcorder is a sticky focus motor: a sharp tap on the lens unit can cure the fault but it's best to replace the focus motor (the correct part no. is VEM0413).

Rob Tarrant,
Slough, Berks.

Further to my note on the Samsung SI1240/1260 in the September issue VCR Clinic (page 776), there is now a modification to prevent failure of IC206 in these machines (the fault was no loading motor drive). If there's a black earth lead from the top right-hand side of the power supply PCB to the deck, fit a shorting link from the bottom end of W109 to the bottom end of W110 (to the right of CN102).

Nick Beer,
Bideford, N. Devon.

CD PLAYERS

On reading the CD Player Casebook items in the September issue I was yet again moved to wonder whether I live on a different planet from those who apparently have customers willing to pay to have laser units replaced in Sony, Pioneer, Goodmans etc. machines. Since the trade price of these units is generally in excess of £50, the cost of such a repair has to be about £100. Please, where can I find people willing to pay this sort of price to have a CD player repaired?

In my experience perhaps one customer in ten is willing to have a laser unit replaced – despite the fact that this is, as CD Player Casebook reports, the most common fault.

I wish that other manufacturers would match Philips' prices in this area!

S.R. Hogue,
Redruth, Cornwall.

TESTING TRANSFORMERS

In the September issue Ian Rees described a useful circuit for ringing an inductive device. It's possible however to employ the timebase in the oscilloscope used to display the waveform to do the job. Fig. 1 shows the idea. C2 resonates the transformer or inductor being tested, as in the original circuit, but with coupling to the oscilloscope's timebase via C1. To test a line output transformer, a value of 0·1µF for C1 and about 2µF for C2 will normally be satisfactory. Set the timebase to about 2msec/cm, the Y attenuator to about 0·3V/cm, the sync to +ve internal and adjust for a steady trace. Then follow Ian's instructions.

To test many line output transformers it's necessary only

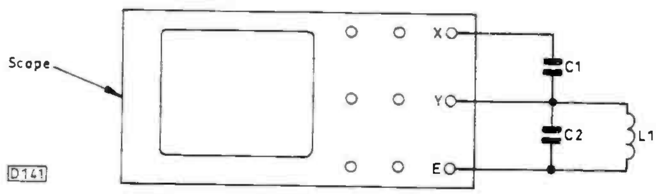

Fig. 1: Use of an oscilloscope to test inductive components.

to disconnect the focus and e.h.t. leads. The value of C2 will need to be changed to test other inductors.

Geoff Lewis, B.A., M.Sc.,
Canterbury, Kent.

SERVICING CAR AUDIO EQUIPMENT

I'd like to add a few words following Alan Bouskill's article on servicing car audio equipment (October).

I've serviced mainly Philips equipment. When ordering items for these radios/cassette players you must in addition to the radio/cassette player model number quote the three following numbers as these indicate the make and model number of the car in which the equipment is fitted. Failure to quote them will result in the wrong item being sent.

The main fault with the Philips P1 and P6 cassette decks is to do with the flywheel – the plastic on the outside of this wheel breaks. It takes five minutes at most to do the job. The good people at SEME can supply this item at £5·91, their part no. being MECHA137B – the Philips part no. is 52880984. It's worth keeping three in stock.

The deck is held in place by three screws. After removing them the deck lifts out. But remember that once the deck is out the earth return is lost – use a crocodile-clip lead when testing out of circuit. Don't forget to clean the heads and roller. The belts fail, but not often.

One fault that foxed me for a bit was a LED readout that was all over the place. The cause turned out to be the flexible PCB cable between the LED and the main PCB – it had become twisted where it's connected to the PCB. All you need to do is to slacken the clamp screws, straighten the cable to make proper contact then tighten the screws.

For checking speed, use a 10kHz prerecorded tape, as you did in the days of spool-to-spool decks – remember?!

Once I spent all morning fitting suppressors on a car to cure interference, then gave up. When the bonnet was closed there was no radio interference. So don't get caught out!

If you meet a Ford radio from somewhere in South America and only one lid is fitted, it's not worth repairing. You would have to unsolder the PCB to do any work on the radio, though the cassette side is not too bad. In 95 per cent of the cases we've had the on/off switch has been the trouble, but replacing it costs more than the radio is worth. You can't even short it out...

B.D. Andrew,
Devizes, Wilts.

CITY AND GUILDS QUALIFICATIONS

I would like to comment on the letter from Di Walster of the City and Guilds of London Institute in the August issue. He had written in reply to an earlier letter concerning training inadequacies, and sang the praises of the C & G 224 course. I too believe that this course is one of the best I've come across, catering for those who have an interest in electronics through to those who would like to pursue a career in this field.

The only inadequacy I've found doesn't lie with the course itself but with the Institute. It's up to the City and Guilds of London Institute to market its courses to employers, letting them know, as BTEC has done, about the courses and the qualifications. BTEC qualifications are regarded as being prestigious: C & G's are considered to be 'Mickey Mouse' qualifications.

I recently applied for a position at a new electronics factory that is to open in this area and was told that my City and Guilds qualifications were not recognised. I wish I had been aware of this before spending a lot of time, effort and money on passing parts I, II and 2 part III of course 224. Would the response have been different if I'd had a BTEC certificate? Come on City and Guilds, get your finger out!

Darren C. Coyle.
Derry, N. Ireland.

SIGNALS FROM TDF1/2

In his October column Roger Bunney suggests that there are now only two radio and no TV channels available from the TDF1/2 satellites. In fact there are three radio channels plus the ARTE and Canal Plus TV channels, the latter often scrambled. The French music channel MCM is also present, though it did go off for a few weeks. Only Supervision has ceased transmission from these satellites and I understand that it may reappear, depending on French government funding for D2-MAC. All these radio and TV channels can be received with modified ex-BSB equipment.

With regard to DMAC, MTV has just started using this system via the Thor satellite, joining CNN, Eurosport, Children's Channel and Filmnet Movies.

Colin McCormick,
Plymouth, Devon.

SCOPE REPAIR

Some weeks ago my scope failed. As it had not long since been repaired I sent it to Hameg at Luton. Shortly afterwards I received a demand for a fee of £30 for investigation plus £11 return carriage if I didn't want the work done. When the estimate arrived it was for over £100 plus VAT, with a £60 labour charge and £30 for parts. I declined and on top of the return carriage charge was asked for £11 for "storage".

In the end I replaced the faulty Y amplifier transistors myself – a matched pair of BF459s obtained from Hameg for £12·92. The repair took me just over an hour. So much for a prospective bill of around £120, though I admit that this is a simplified version of the story. But the moral is to repair your scope yourself if you possibly can, or seek an alternative repair service.

Roger Burchett.
Hythe, Kent.

Help Wanted

Wanted: A.C. adaptor or T03 (small blue plastic impregnated 4V a.c./4V a.c./–12V transformer) for the Mitsubishi Model HS700B VCR. R.G. Coates, 35 Tetbury Hill, Avening, Nr. Tetbury, Glos GL8 8LT. 0453 832 720.

Wanted: Service information/instruction book for the Ferranti Model TP1009. Brian Simms, 63 Kingfisher Road, Worle, Weston-Super-Mare, Avon BS22 8TX.

Wanted: Search tuning module for the Grundig Model 6445GB (GSC200 chassis) or alternatively complete working or non-working set that includes this module. Mr. Ben, 6 Talbot Road, East Ham, London E6 2RZ. 081 471 6348.

Wanted: Used mains transformer (part no. 5213725) or full power panel (REG 594148) for the Hitachi VT63E VCR and serviceable used i.f. and colour decoder panels for the Hitachi CNP190. T.J. Steel, 185 Charter Road, Chippenham, Wilts SN15 2RF.

Wanted: Service information for the Sanyo VCT5300 (excellent picture, no sound even in standby). R. Payne, 13 Molyneux Road, Ashley, New Milton, Hants BH25 5AU. 0425 617 786.

Wanted: Tapes new or used and an instruction manual for the Philips N1700/15. Call Nigel Woolf on 081 572 4326.

Wanted: LOPT and circuit diagram for the Network NWC1402. The original transformer is a Murata type 3Z01, MSHIFAK13, MHF029-18. D. Benyon, Marshland View, St. Anne's Hill, Bude, Cornwall EX23 0LT. 0288 353 373.

Wanted: Mains isolating transformer (at least 500VA) and a variac, both in good working order. Brian Ecclestone, 10 Stone Road, Norton Bridge, Nr. Stone, Staffs ST15 0NS. 0785 760 315.

Wanted: U465B prescaler chip or prescaler module for a Granada Model 514058 (Rediffusion chassis with frequency-synthesis tuning). Chris Kentch, 55 Melrose Avenue, Worthing, Sussex BN13 1NZ. 0903 240 147.

The wires that connect the phono/jack assembly to the r.f. PCB (plug in/out r.f. unit type RU-E3E) in my Canon camcorder have come adrift from the PCB. Can anyone tell me the correct connection sequence? – Canon is unwilling to provide this information. Steve Cocker, PO Box 31, Ampthill Road, Bedford MK42 9QQ.

TELEVISION INDEX & DIRECTORY

and

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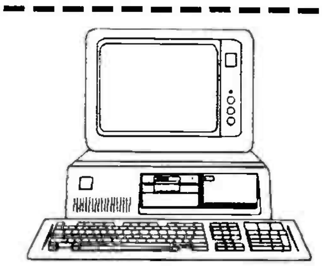


A computerised index to *TELEVISION* magazine covering volumes 38 to 42 (1988 – 1992) is now available. It contains over 3500 references to TV/VCR fault reports and articles, with synopses. It includes a TV/VCR spares guide, an advertisers list and a directory of trade & professional organisations. The software is easy to use and very quick. It runs on any IBM or compatible PC with 512K RAM and a hard disc.

Price: £30 (specify 5.25" or 3.5" format)

Reprints of articles from *TELEVISION* back to 1986 are also available: ordering information is provided with the index, or can be obtained from the address below. Hard copy indexes of *TELEVISION* are available for volumes 38 to 42 at £3.50 each.

Please allow up to 28 days for delivery. All the above prices include UK postage and VAT where applicable. Cheques should be made payable to Video Interface Products.

Video Interface Products Ltd., 1 Vineries Close, Cheltenham GL53 0NU, UK.

Modern TV Receiver Techniques

Part 11: Line Output Stage Operation

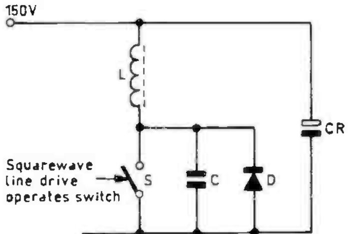
Eugene Trundle

This month we'll examine the operation of the line output stage, whose basic job is to generate a sawtooth current in the line scan coils so that the beams are deflected horizontally across the picture tube's screen. The beams are deflected from the left-hand side to the right-hand side to give the forward line scan: this is followed by a rapid, blanked flyback to the left-hand side ready to trace out the next viewed line. Because of the way in which the flyback is achieved, the line output transformer generates various pulse voltages which are rectified to produce the e.h.t. required by the tube and other supplies.

The line output stage is not just any sort of amplifier. The active device, almost always a transistor though valves, thyristors and gate-controlled switches have been used in the past, operates as a switch, the inductive components in the stage being mainly responsible for generating the sawtooth current waveform. Tuning is used to generate and control the flyback. The line drive waveform controls the output transistor's on/off switching and thus determines the timing of the cycle of operations, keeping them phase synchronised with the transmitted picture signal.

Basic Operation

Fig. 1 shows in most basic form the main elements in the line output stage, the active device (transistor) being shown as a switch. When the switch is closed, capacitor C and diode D are shorted out and the 150V supply is connected across coil L. Now it's a basic law of inductance that when a d.c. voltage is connected across a coil the current flowing through the coil builds up linearly from zero. Fig. 2(a) shows this as a positive-going ramp that starts at time t1, when the switch is closed. After about 26µsec (t2), roughly the time required to deflect the beams from screen centre



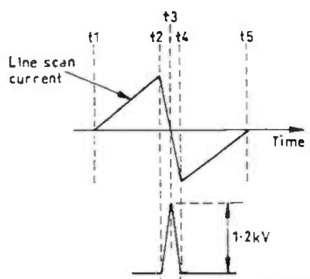


Fig. 1 (left): Theoretical representation of the bare essentials of a TV line output stage.

Fig. 2 (right): Basic line output stage waveforms, (a) the sawtooth scan current and (b) the pulse voltage at the junction of C, D and L (see Fig. 1) when the switch is opened.

(the starting point of the cycle) to the right-hand side of the screen, the switch is opened. This action removes the voltage that had been driving current through the coil. While the current had been flowing, a magnetic flux had built up in the coil's ferrite core. This flux is now released: as it collapses, the coil becomes a current generator. The current flows via the large-value capacitor CR, charging the tuning capacitor C with the result that the voltage at its 'upper' plate (the one connected to the coil) rises to a relatively high positive value. When all the energy in coil L has been transferred to capacitor C (time t3) the latter begins to discharge, passing the energy back the other way to L via CR which, as far as the circuit's a.c. operation is concerned, can be

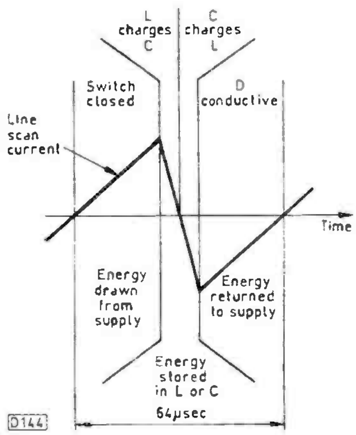
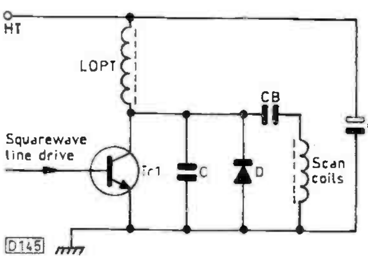


Fig. 3: The switching and energy-interchange phases during one complete cycle of operation of the circuit shown in Fig. 1.

regarded as a short-circuit. At time t4 the capacitor has discharged, having transferred the energy back to the coil. This to-and-fro interchange of energy between L and C, which from the a.c. point of view are in parallel (CR representing a short-circuit), is the normal action of a tuned/resonant/oscillatory circuit. The resonant frequency is determined by the values of L and C. These are selected so that when time t4 is reached, i.e. after a half cycle of oscillation, the sawtooth current has passed through zero to a negative point on the ramp and the beams have been deflected to the left-hand side of the screen ready for the next active line scan.

To complete the oscillatory cycle (the normal resonant circuit action) the voltage at the upper plate of capacitor C would have to move negatively with respect to chassis. It can't do so because of the presence of diode D, which is called the efficiency diode – we'll explain that in a minute. When the voltage at the cathode of D tries to swing negatively it conducts, i.e. switches on, providing a discharge path for the coil. Once again because of the inductance in the circuit there's a gradual, linear current discharge, the enegery being returned to the supply's reservoir capacitor CR. During this discharge, the beams are deflected back towards the centre of the screen (times t4 to t5). At this point the magnetic flux (energy) in L has been dissipated. C is still in its discharged state, being shorted out by diode D. So at time t5, with the beams at screen centre (zero deflection), the switch has to be closed so that the cycle of operation can be repeated. The action of diode D has, with the inductance in the circuit, provided half the scan power while in the process returning the energy (minus inevitable circuit losses) to the reservoir capacitor. No wonder it's called the efficiency diode.

It's important to note that the beam flyback period t2 to t4 is governed by the time-constant of L and C, consisting of



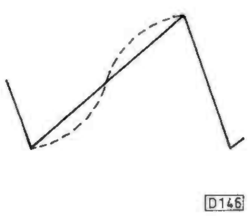


Fig. 4 (left): Basic elements of a practical line output stage. The scan coils are capacitively coupled and the output transformer acts as a loading choke.

Fig. 5 (right): The S-correction effect, shown with broken line, introduced by the coupling capacitor when its value is such that it resonates with the line scan coils at about 5kHz.

one half cycle of oscillation. To achieve a flyback time of 12μsec the duration of one cycle needs to be 24μsec: so the resonant frequency of L and C works out at 41·67kHz.

Fig. 3 illustrates the four phases in the operation of the line output stage.

Now the voltage developed across an inductor is proportional to the rate of change of the current flowing through it. Thus the voltage across L is relatively low during the forward scan period but correspondingly high during the flyback, when the current flow is faster because of the circuit resonance. The voltage developed at the positive plate of capacitor C is shown in Fig. 2(b), typically peaking at 1,200V. Both the line output transistor and the efficiency diode must be capable of withstanding this high reverse voltage.

As we've seen, the circuit action is highly efficient as the energy stored in L is returned to the supply during the first half of the forward scan: indeed with 'perfect' components there would be no net demand on the power supply at all! In practice because of the resistance of the inductor and the losses in the diode, switch and capacitor the circuit takes out a little more than it puts back, while the practice of loading the transformer with rectifier circuits to provide power for other sections of the set increases the stage's current demand. To make up for these losses, the line output transistor is switched on slightly before instead of at the centre of the forward scan.

In a practical circuit L is the primary winding of the line output transformer and the deflection coils are connected across it via a d.c. blocking capacitor, CB, as shown in Fig. 4. This coupling capacitor also provides scan-correction (often referred to as S-correction). Why is this required? If a linear deflection current was used to control the scanning with a relatively flat-faced picture tube the sides of the picture would be stretched out in comparison with the centre section. Hence S-correction: the value of the coupling capacitor is chosen so that it resonantes with the inductance of the scan coils at about 5kHz. This has the effect of adding a sinewave component to the sawtooth current, as shown in Fig. 5. Thus the deflection power is tailored to suit the length of the beam paths as the screen is scanned, correcting the horizontal linearity of the display.

At the line scanning frequency the scan coils behave as an almost perfect inductor, but their small d.c. resistance is in series with the fixed voltage that should be present across the coil. It has the effect of introducing an asymmetric sensitivity loss during the forward scan. To counteract it a further component is added in series with the scan coils – an inductor with a saturable magnetic core, biased by a permanent magnet so that its inductance falls as the scan current

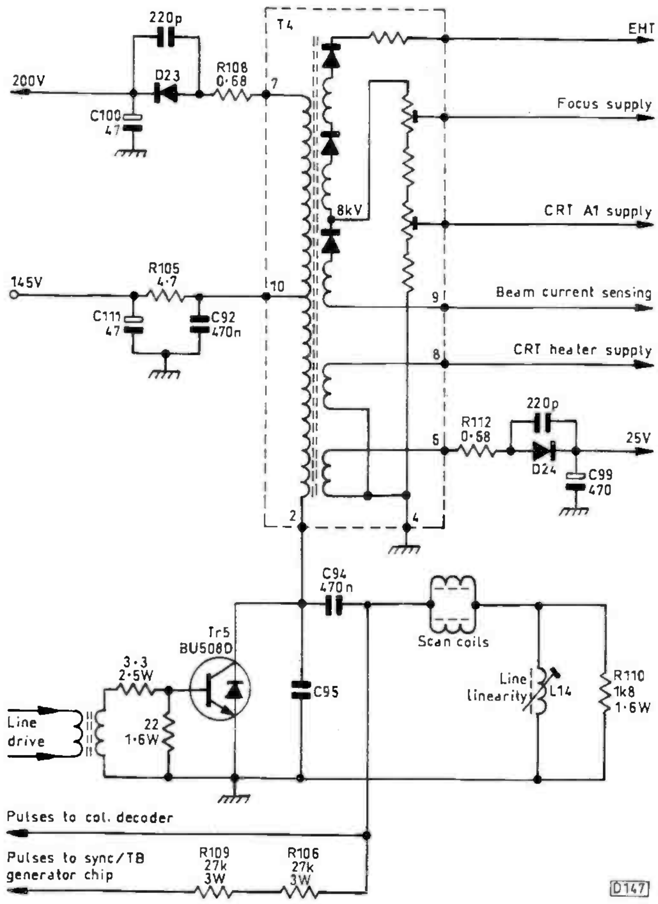


Fig. 6: Practical line output stage circuit used to drive 90° 20 and 22in. tubes. All the components in the broken-line box are encapsulated within the line output transformer T4. The value of the flyback tuning capacitor C95 varies with tube size: it's 10nF with a 22in. tube and 9·1nF with a 20in. tube.

increases. The voltage drop across this inductor, which is known as the linearity coil, varies in the opposite sense to that produced by the resistance of the coils, thus providing an equal-but-opposite cancellation effect. In some TV sets the permanent magnet can be adjusted to trim the linearity correction, though many modern sets use components with such tight tolerances that a sealed linearity-correction coil can be used. With some very small-screen sets the horizontal non-linearity effect is small enough to be ignored.

Practical Line Output Stage

Fig. 6 shows a relatively simple line output stage circuit used with a 90°-deflection tube. Tr5 is the line output transistor, which incorporates the efficiency diode in the same package. The primary winding of the line output transformer T4 is the section between pins 2 and 10, C95 being the flyback tuning capacitor. Scan coil coupling and S-correction are provided by C94, the line linearity coil L14 being connected in series on the chassis side of the scan current path. L14 is damped by R110 to prevent it ringing when the line flyback pulse occurs – the effect of an undamped linearity coil is velocity modulation of the beams at the beginning of their sweeps, showing up as black-and-white vertical striations at the left-hand side of the screen. C92 is the reservoir capacitor, the h.t. feed being via R105. R106 and R109 feed pulses to the second phase-locked loop (APC2) in the sync chip – we dealt with this in last month's instalment. A second pulse feed from the same point goes to the colour decoder chip to provide line blanking, burst gating and PAL switch drive – this particular set doesn't use the sandcastle pulse approach.

Secondary Supplies

So much for the generation and control of the sawtooth scanning current. The rest of the components in this circuit

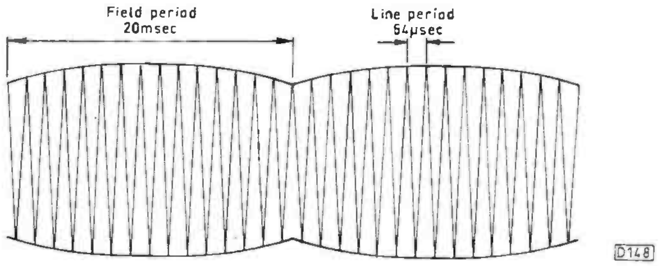


Fig. 7: Use of a parabolic field-frequency waveform to amplitude modulate the line-scan current – not to scale.

are used to harness the energy in the transformer to provide power supplies for other sections of the receiver. The winding between pins 4 and 8 pulse energises the picture tube's heaters at 6·3V r.m.s. The other supplies make use of the transformer as the heart of a d.c.-to-d.c. converter system, by means of secondary windings that provide pulse feeds to diode/capacitor rectifier circuits. Small-value (0·68Ω) resistors in the 25V and 200V supplies provide surge limiting and protection (by going open-circuit) in the event of a short-circuit in one of these supplies.

The most significant supply is obtained from the diode-split winding that starts at pin 9. Although not shown in full detail it consists of several 'cells', each of which consists of an electrically isolated secondary winding, a built-in high-voltage rectifier diode and, as the reservoir capacitor, the carefully contrived capacitance that's present between adjacent, highly-insulated winding layers. These cells are connected in series to form a voltage-multiplier system capable of providing an e.h.t. supply for the tube's final anode of typically 24kV – it may be as high as 30kV in some designs. There's a built-in surge limiter resistor at the output end of the chain of cells. An important part of the e.h.t. multiplier system is the final reservoir capacitor that

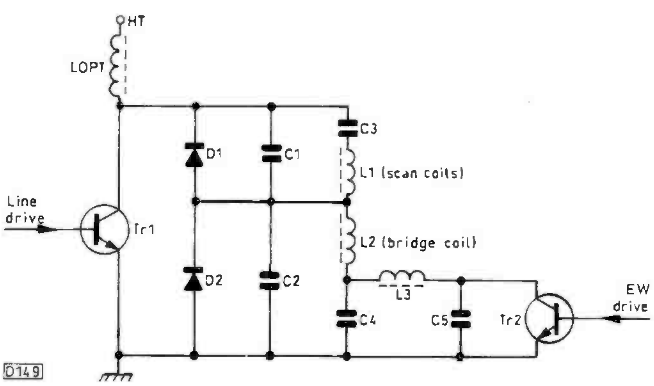


Fig. 8: Basic form of diode modulator. Transistor Tr2 controls its operation.

consists of the capacitance formed by the glass bowl of the tube as the dielectric and its inner and outer conductive coatings as the plates: in a large tube this capacitance can be some 2,500pF, which forms a very effective voltage reservoir at 15·625kHz. A tap a third of the way up the diode-split chain provides about 8kV to a built-in potential-divider chain that contains two presets: the one at the top provides the supply for the tube's focus electrode while the one near the bottom provides its first anode supply of about 800V.

The bottom of the diode-split chain (pin 9) is returned to chassis via a diode/capacitor/resistor network (not shown here). The voltage developed across this network is proportional to the total beam current, since this flows from the tube's cathodes via the e.h.t. connector and the diode-split chain to chassis. Above a certain threshold the voltage at pin 9 reduces the picture brightness and/or contrast via the colour decoder/matrixing chip, limiting the beam current and hence the dissipation in the tube's shadowmask to safe levels.

The winding between pins 10 and 7 of the transformer produces 50-70V pulses that sit on the h.t. voltage present at pin 10. When rectified by D23 and C100 a 200V supply is provided for the RGB output stages that drive the tube's cathodes. Secondary winding 4-6 feeds D24 and C99 which provide a 25V supply for the field timebase. In some designs supplies for the audio output stage and the signal sections of the receiver are also obtained from the line output transformer: in this particular chassis they are obtained from the chopper transformer in the power supply instead. Incidentally there have been one or two designs, the Ferguson TX10 chassis being a well-known example, where the e.h.t. is also obtained from the chopper transformer, the line output transformer then acting mainly as a load for the line output transistor. In earlier designs a separate diode-capacitor multiplier unit (tripler) was fed from a single line output transformer overwiding to provide the e.h.t.

Scan Rectification

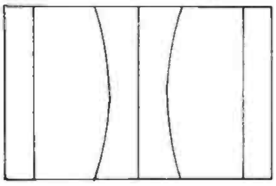
The e.h.t., focus and 200V supplies derived from the transformer are relatively lightly loaded, i.e. no great current demand is placed on them. They can therefore be obtained by rectifying the pulses present during the flyback period (time t2-t4 in Fig. 2), which is about twenty per cent of the scan cycle. Where the current demand is greater, e.g. in a supply for the field timebase or an audio output stage, the phasing of the relevant transformer winding is often arranged so that the rectifier diode conducts during the scan rather than the flyback period. Although the voltage available is much lower, it's present for a longer period (about eighty per cent of the scan/duty cycle). As a result the output regulation is much better. The relatively high peak reverse voltage has to be taken into account in the rectifier diode's specification.

EHT Regulation

The internal impedance of a diode-split e.h.t. supply is typically about 1MΩ. Thus with a total beam current of 1mA, present when a bright picture is being displayed on a 22in. picture tube, the e.h.t. voltage will drop by about 1kV or five per cent. The result of this is some ballooning, i.e. increase in picture size. Compensation can be provided by reducing the line scanning power. Careful choice of the value of the resistor that feeds the line output transformer – R105 in Fig. 6 – gives automatic compensation in the horizontal direction, while deriving the supply for the field output stage from the line output transformer tends to cancel out the ballooning in the vertical plane.

Various 'anti-breathing' arrangements are used in TV receiver design. Most operate via the diode-modulator circuit we'll come to shortly. With any line output stage circuit the picture width and e.h.t. voltage depend on the

D150



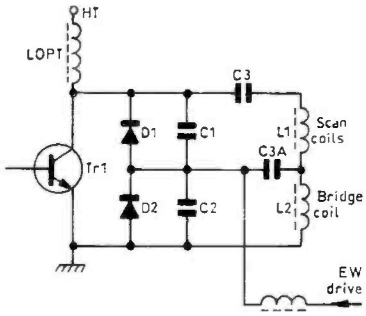


Fig. 9 (left): The inner pincushion distortion (exaggerated) inherent with some tube/yoke designs when simple pincushion-distortion correction is applied.

Fig. 10 (right): Diode-modulator circuit adapted to compensate for inner pincushion distortion.

stage's h.t. supply, so this must be well regulated and set up correctly. In the circuit shown in Fig. 6 the h.t. voltage has to be 119V with a 20in. tube and 145V with a 22in. tube.

Pincushion Distortion

The raster produced on an almost-flat faced picture tube by constant-amplitude scan currents has pincushion distortion at all four sides. This is because of the disparity between the image plane and the screen's profile – see Fig. 4, Part 8 (August). As a general rule the deflection yokes used with modern 90° tubes have built-in correction for both NS (vertical) and EW (horizontal) pincushion distortion while 110° tubes (generally above 22in. screen size) have in-yoke correction for NS distortion but cannot fully compensate for the pincushion effect at the sides of the screen. Thus with these the line scan current has to be amplitude-modulated by a parabolic waveform at field frequency as shown in Fig. 7. With present-day tube designs a modulation depth of about seven per cent is required, the peak-to-peak scan current being typically 4·1A at the top and bottom of the screen and 4·4A towards the centre of the screen, where the deflection power is greatest.

Amplitude modulation of the line scan current can be achieved by including a saturable-reactance transformer in series with the scan coils, but this is expensive. You could put a suitably-shaped ripple on the supply to the line output stage, but the parabola would be superimposed on any secondary supplies derived from the line output transformer. The most widely used solution is to employ a diode-modulator circuit, since this gives full control of the raster shape and scan amplitude while providing a constant load current and flyback time.

The Diode Modulator

Fig. 8 shows the essence of a diode-modulator arrangement. The efficiency diode is split in two, D1 and D2, which perform the same clamping action as before. The flyback tuning capacitor is also split in two, C1 and C2: the upper one tunes the transformer and scan coils (L1) as before while the lower one tunes a bridge coil, L2, via C4 to the same flyback frequency of about 42kHz. C3 is the scan coupling capacitor, which corresponds with CB in Fig. 4. Modulation is achieved by using transistor Tr2, whose conduction governs the scan width, to vary the load across C4.

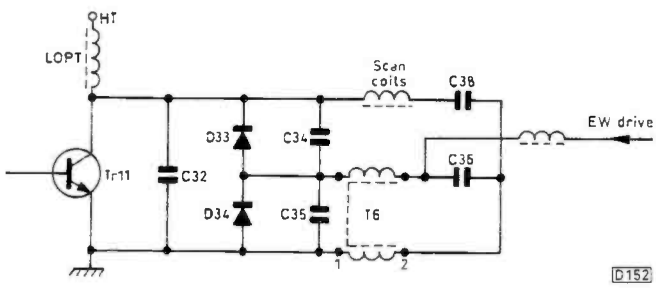
When Tr2 is off, the scan energy is shared between the the two series LC combinations C3/L1 and L2/C4. The charge on C3 and C4 is in the ratio of about 7:1, the scan current being reduced in proportion. When Tr2 is fully conductive, C4 is effectively shorted out and acquires no charge. Thus a greater proportion of the energy is present in C3/L1 and the scan current and picture width are increased. By varying the conduction of Tr2 during the forward scan in a parabolic manner, EW pincushion correction is achieved. The basic picture width can be controlled by varying Tr2's standing bias. Choke L3 and the large-value capacitor C5 filter the line-frequency energy so that it doesn't reach Tr2. And because both sections of the load (L1/C1 and L2/C2) are individually tuned to the flyback frequency the flyback time, and hence the e.h.t. and the other line output transformer-derived supplies, remain constant over the field period despite the line scan current variation.

There are several different versions of the diode-modulator arrangement. Some tube/yoke combinations have a scan-geometry characteristic such that when the line scan current is modulated by a simple parabolic waveform as described above the raster has inner pincushion distortion as shown in Fig. 9. Because of this, the EW-correction system also has to modulate the S-correction. Fig. 10 shows, in skeleton circuit form, how this can be done. There are two coupling/S-correction capacitors, C3 and C3A. C3 is the usual S-correction capacitor, but C3A has an increasing influence as the diode modulator begins to have maximum effect towards the centre of the screen. Critical choice of the value of C3A ensures that the inner curved verticals shown in Fig. 9 are straightened out to give a raster completely free from geometric distortion.

Although all diode modulators work on the same basic principle, in some designs a transformer is used in place of the bridge coil to give better impedance matching and balance. Fig. 11 shows such an arrangement, used by Bang and Olufsen. The EW correction waveform is applied to transformer T6, whose winding 1-2 takes the place of L2 in Figs. 8 and 10. This circuit also provides inner-pincushion distortion correction as just described, the supplementary S-correction capacitor being C36.

Diode Modulator Drive

The parabolic EW drive waveform required is easily obtained by feeding the field-scan sawtooth waveform to a double integrator. By adding a sawtooth component the shape of the parabolic waveform can be tilted in either direction to give keystone-distortion correction if required – this is not generally necessary with modern tube/yoke designs.



D152

Fig. 11: Diode-modulator circuit with a coupling transformer, used to drive a Philips 110° tube.

These EW correction characteristics are adjustable by preset resistors or, in the case of bus-programmable sets, remote control commands to the deflection processor. Very often the EW modulator is used to correct the previously mentioned picture breathing effect: this is done by feeding

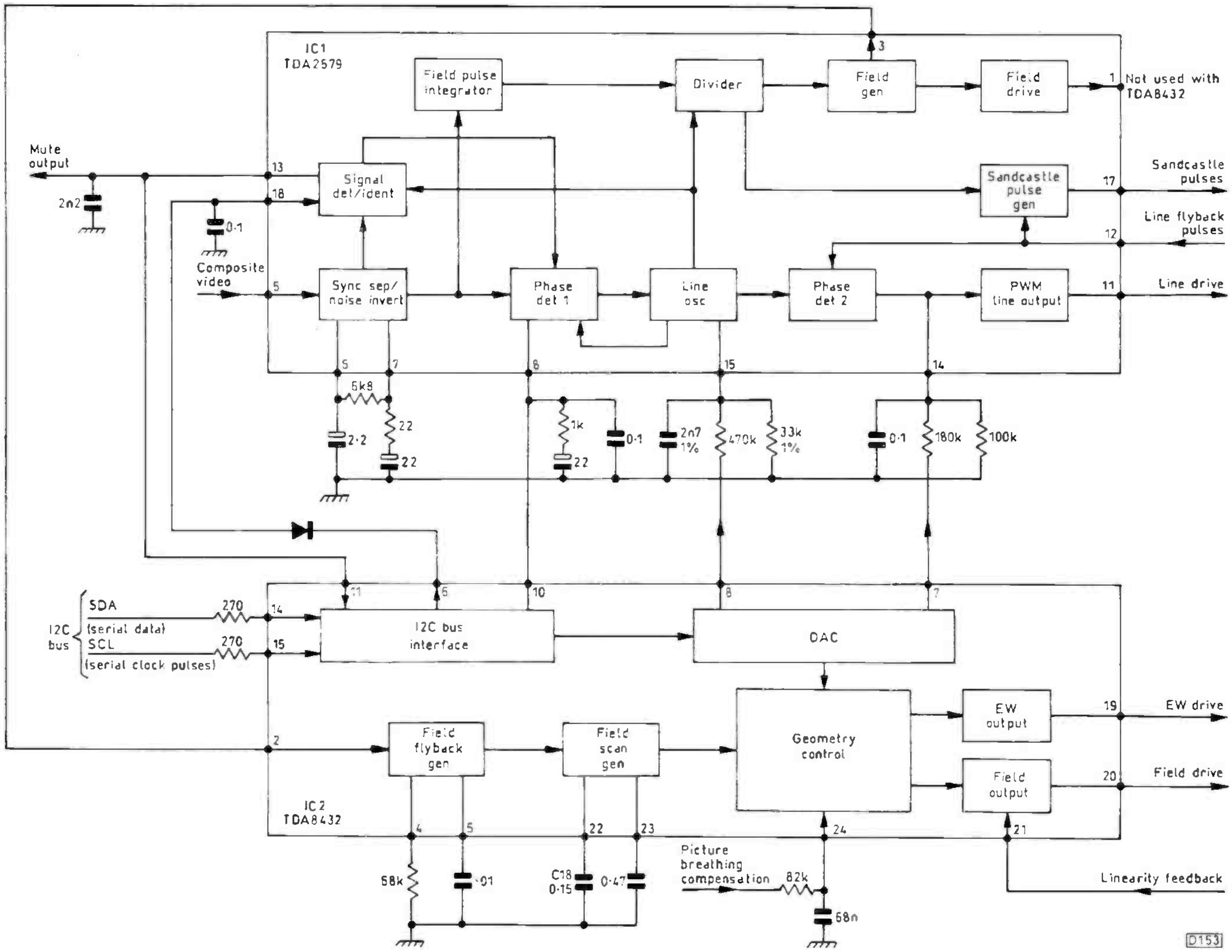


Fig. 12: Bus-controlled deflection system: the lower, deflection processor chip is controlled by the serial data on the SDA line (the other bus line, SCL, carries clock pulses to synchronise the digital data operations). An interesting example of slave-master communication is provided by the mute line that's connected to pin 11 of the TDA8432 chip. When the voltage on this line goes low, signifying loss of the video input to the TDA2579 chip, this fact is signalled back to the main microcomputer control chip via the I2C bus's data line. The circuit shown is used in a Finlux TV chassis.

to the EW modulator's control circuit a voltage that's proportional to beam current.

Deflection Processors

In previous instalments we've encountered several examples of signal-processing and -switching chips that have built-in I2C control-bus interfaces so that their operation can be controlled by the set's microcomputer chip, via commands if necessary from the remote-control system. This technique can also be used in the timebases by incorporating a deflection processor chip that provides an interface and various waveform-shaping operations.

Fig. 12 shows an example, where a TDA8432 deflection processor chip is used in conjunction with the TDA2579 sync/timebase generator chip described last month.

Field sync pulses from the TDA2579 chip enter the deflection processor chip at pin 2. This chip generates a field scan waveform across capacitor C18. It's passed to the geometry control block, whose operation is controlled by the I2C bus via the built-in interface and digital-to-analogue converter (DAC). The output obtained at pin 19 is the field-parabola EW drive, whose amplitude, tilt and bias can all be set by remote control and memorised. This is also the case with the field drive output at pin 20, and the d.c. control voltages at pins 8 and 7. These control the frequency and phase respectively, via pins 15 and 14 of the TDA2579 chip, of the line drive output at pin 11 of this chip. The output at pin 20 of the TDA8432 chip drives the field output stage.

Thus it's possible to adjust and lock all the picture geometry characteristics without having to remove the set's rear cover: the line frequency, line phase/horizontal centring, width, keystone-trapezoid correction, pincushion correction, EW corner correction, S-correction, breathing correction, field shift and height (at both 50 and 60Hz rates) and field linearity can all be set up in this way, saving the need for a dozen or more unreliable preset resistors – and a mirror!

The TDA2579 chip is designed to provide a field drive as well as a line drive output, but in this application the field drive section is not used as the TDA8432 chip takes care of this requirement.

Next Month

Mention of the deflection processor chip has brought us to the field timebase section, which we'll examine thoroughly in the next instalment.

VCR Clinic

Reports from Nick Beer, Richard Newman, Brian Storm, Ian Bowden, Eugene Trundle, Mike Leach, Fauz Ahmed Sumar, John Coombes, Chris Watton, John Hepworth and John Edwards

Panasonic NVG40

This machine had been in several times with the complaint of intermittent loss of sound and counter operation in the playback mode, but the fault wouldn't put in an appearance in the workshop. As the picture apparently remained perfectly o.k., loss of control pulses, at least to the servo, was not the cause. This time however the fault was present, and the customer had been perfectly correct about the symptoms.

There was loss of control pulses at the microcontroller chip IC6001 – in fact there was no activity at the relevant pin. The pulses come from the servo section on the sub main PCB via connection 11, where the pulses were present. The soldering on the wire hoop, so often dry, was fine. From here the pulses pass, via both sides of the PCB, to the base of transistor Q2003. We found that there was no output at the collector of Q2003, though it was not open-circuit. In addition the d.c. conditions around Q2003 and the following transistor Q2004 were correct. Careful checks showed that the pulses at the base of Q2003 were of about 35 per cent lower amplitude than those at pin 11 of the sub main PCB. This disparity was detected across the 10µF, 16V coupling capacitor C2022 which turned out to be low in value. **N.B.**

Panasonic NVJ40

The job card said "no playback for the first half hour, then bad patterning". It turned out to be an accurate description. Checks showed that from cold transistor Q3204, which provides the 'except record 5V' supply to the head amplifier playback circuits, wasn't fully conductive. The supply would gradually increase from about 2V (no picture) to 3V (poor picture with lines across) then 4V (reasonable picture with patterning). After much investigation in the switching and biasing circuits, all to no avail, I finally found that C1127 (330µF) in the power supply was the cause of the trouble. It decouples the 5V feed to the system circuit. **B.S.**

Panasonic NVFS90

This all-singing, all-dancing editing machine would refuse to play back S-VHS recordings after about half an hour. Checks in the S signal channel brought me to IC303 (part no. VEFH05BT) which proved to be heat sensitive. A replacement restored the excellent picture. **B.S.**

Philips VR6760

Distorted sound was the complaint with this machine. When we tried it out we found that the sound was very distorted – it was rather like an output stage with no bias. There was perfect sound however when we checked at the scart socket. This simple test saved us a lot of time. Both linear and hi-fi audio are fed to pins 1 and 3 of the scart socket via a couple of 470Ω resistors. As the sound was o.k. here everything up to this point, including the switching chip IC7061, could be ruled out.

The sound feed to the modulator is via a couple of 100kΩ resistors and a buffer stage with a single transistor, Tr7904. Checks showed that there was a clean signal at one side of the two resistors R3925/6 but a very distorted one at the base of Tr7904. The transistor was o.k. but its 3·3µF coupling capacitor C2917 had a 2kΩ leak. A replacement cured the distortion. **R.N.**

Panasonic NVL20

This fault had been very intermittent and didn't show up in the workshop until it was provoked. The complaint was that the machine would stop during playback or record then power off. We found that pins 14 and 15 of connector P2001 were dry-jointed. These are connections to the capstan motor: when we flexed the joints during playback the capstan motor started to make a knocking noise then stopped, after which the machine tried to unlace then powered off. **I.B.**

Ferguson FV51R

This machine produced no results at all and the BD202 12V regulator transistor TP03 overheated mightily. As the 12V line feeds many circuits it took us a time to find that the u.h.f. tuner was responsible for the trouble, with an internal short-circuit across its 12V supply pin. Meanwhile the BC327 switching transistor TW41 had overheated and gone short-circuit. **E.T.**

Panasonic G Deck

This mechanism often seems to throw up new faults – new to us, anyway! The trouble this time was a very intermittent raucous squeal at the completion of tape threading or during unthreading. It came from the brake pad that operates on the capstan flywheel. Clean the pad or replace the arm. **E.T.**

Sharp VCA140HM

If the complaint with one of these machines is that it scrunches the tape once in a while – you're unlikely to see this actually happening – check whether the movement of the half-load arm is free. It can stick on dry grease. **E.T.**

Nikkai NVR3/Cathay VCR7110

This machine displayed a number of fault symptoms: the front loading, drum rotation and eject were slow and there was no play. We did very little before we obtained a service manual, then found that all the voltages at plug P801 in the power supply were low – this included the ever 5V, ever 12V, ever 5·8V and MTR 12V lines. The cause was a leaky 5·1V zener diode, D812, in the power supply. A replacement restored normal operation. **M.L.**

Samsung VI710

When this machine ejected a cassette it chewed the tape, which of course was not being wound back in. We assumed that the cause of the fault was mechanical and replaced the idler/clutch assembly, then checked the brake and soft-brake assemblies. None of this made any difference. As the subpanel at the back of the deck is prone to dry-joints, causing various symptoms, this was next removed and checked. Once again we drew a blank. Eventually the cause of the trouble turned out to be the BA6209 capstan motor drive chip IC206 – it's on the subpanel we'd just soldered up. A replacement cleared the fault. **M.L.**

Hitachi VT120

The complaint with this machine was low E-E sound. We traced the cause to a leaky 4·7μF, 35V capacitor, C08, in the i.f. block. **M.L.**

Sharp VC585H

There were very smeary, low-gain E-E and recorded pictures. It could have taken some time to get to the bottom of this, but I'd had much the same symptom with a Sharp TV set a couple of years previously and the i.f. units looked alike. When the i.f. module in the VCR was heated with a hairdryer, the fault almost cleared and normal pictures were obtained. The cause of the trouble in the TV set had been a dried up 10μF, 16V electrolytic capacitor. When this same component in the VCR was replaced the fault again cleared. As there are no component reference numbers on the board I can't identify the component in this way. It's easy to find however, being the only red one on the board – all the other ones are blue. **M.L.**

JVC HRDX22

The cause of no E-E and playback sound was traced to dry-joints at several of IC301's pins. A good solder up is all that's required. **M.L.**

Panasonic NVG10

There was no playback colour with this machine. We traced the chroma signal as far as C8002 (0·01μF) which couples the signal to pin 31 (playback chroma input) of the luminance/chrominance pack. There was a signal at one end of C8002 but not at the other. A new capacitor restored the colour. **F.A.S.**

JVC HRD171

Fast forward and rewind were all right but when playback was selected the tape laced up then, within a few seconds, unlaced because there was no drum rotation. After wasting a lot of time we found that the voltage at pin 20 (drum start/stop) of the VC2025 chip IC1 didn't go high when play was selected. Pin 20 was internally shorted to chassis. A complete stator/MDA unit cured the problem. **F.A.S.**

Panasonic NV8600

This old tank sometimes wouldn't complete the threading process and on occasions the functions couldn't be selected as the keys were stiff. We'd have wasted a lot of time if we hadn't noticed the changing intensity of the light from the cassette lamp. The cause of the problem was that the cassette lamp leadouts were intermittently shorting in the holder. Straightening the leadouts provided a complete cure. **F.A.S.**

JVC HRD171

This machine worked in all modes except play, when a cyclical tracking bar would travel from the bottom to the top of the screen with a slur on the sound as the bar passed. A check on the control pulse at pin 6 of IC2 (M51796P) showed that a nice 5·2V peak-to-peak squarewave was present here. It should be passed to pin 20 of the V2023A servo chip IC2 via a 10kΩ resistor but was missing at this point. A voltage check here produced a reading of 5·2V instead of 3·4V: pin 20 had shorted internally to the 5V line. A new chip cured the fault. **F.A.S.**

Panasonic NV333

There were severe tracking bars that couldn't be removed by adjustment of the tracking control – though the control was effective with some tapes. After wasting time cleaning the tape path and adjusting the tape guides we found that the tracking shifter control R2035 was at one end of its travel. Adjusting it with the tracking control at its centre 'click' position provided compatibility with all tapes. **F.A.S.**

JVC HRD171

The complaint with this machine was no functions. It took some time before we realised that the four circuit protectors in the power supply were going open-circuit intermittently – sometimes you would get a voltage reading, sometimes not. **F.A.S.**

Panasonic NVJ45

This machine would cut out after a few seconds in the record mode. A check on the main PCB showed that the delay record 12V (D Rec 12V) supply was missing. The 2SB1321AR transistor Q6203 turned out to be faulty. **J.C.**

Toshiba V83

A faulty cam switch can cause various problems such as fast in play, fast in record/slow in playback, review changes to pause or maybe the arms stop in the half-loaded position. If however the tape loads around the drum at switch on but the machine then returns to standby check for dry-joints at the cam switch sockets on the main PCB, at the cam switch itself and at the pull-up resistors. **J.C.**

Panasonic NVL25

The complaint with this machine was no results. Because of its cause the fault had been present for some time, unnoticed. C1109 (1μF) was open-circuit. As long as the machine remained plugged into the mains supply it was all right. When the mains supply was disconnected then reconnected the power supply wouldn't start up. **J.C.**

Mitsubishi HSB27

This machine worked correctly in all modes except the higher times-nine speed cue mode. We noticed that in this mode the capstan motor was stopping and starting. The cause of the trouble was a worn lower drum assembly – this was making the tape drag. **J.C.**

Hitachi VTM753

There was a cassette jammed in this machine which at switch on just switched off again. We found that the 1·6A fuse F852 was open-circuit. A replacement restored operation but the capstan flywheel made a loud screeching noise and caused considerable tape drag. Lubricating the capstan flywheel spindle put this right. **J.C.**

Mitsubishi HSB27

A worn lower drum assembly can cause many problems such as poor cue and review, picture jumping, poor tracking and no picture. The diagnosis can be confirmed by monitoring the f.m. waveform envelope, which will usually be impossible to set correctly. The fault can give trouble in the SP and LP modes. **J.C.**

Toshiba V312

The complaint was of no results and no display. We were surprised to find that all the voltages in the power supply were at half the correct level. The ZPD3V9 zener diode DP15, which is not shown in the circuit diagram, was short-circuit. It's located beneath the 1·5Ω wirewound resistor RP33. **J.C.**

Matsui VX2000Y

There was no remote control operation. As the handset worked all right with another machine I connected a scope to the output from the IR receiver can. This showed a healthy waveform. I followed the signal along the print and found that it disappeared when it passed (or should have passed) through the hinge-type edge connector. **C.W.**

Grundig VS440

Playback was o.k. but there was no vision in the E-E mode. The tuning worked in that the channel numbers were right, but one of the 12V supplies was missing. Transistor T685 (BC548) was open-circuit. **C.W.**

Matsui VX770/Saisho VR3700

More often than not the deck would load then stop. It wouldn't unload until switched on again. The loading seemed to operate correctly and the drum rotated at the right speed. But when the capstan should have started the machine went into the standby state and didn't unload. This was all caused by the mode switch, which had poor contacts. Replacement is quite easy in these machines. **C.W.**

Hitachi VT120

All functions except play and stop worked perfectly. The play and stop buttons had to be held or pressed repeatedly before they would operate – sometimes. Suspicions that there was something sinister in the system control or timer microcontroller circuit turned out to be unfounded: both switches were faulty. I wonder why? **C.W.**

Samsung SI1260

This machine powered up and the clock and E-E system worked, but there were no motor functions at all. The always 15V rail supplies the motor drive circuits via the 1N4001 diode D212 on the main PCB. It was open-circuit. **C.W.**

Toshiba V209

This machine was dead with the tape still fully loaded. The power supply was in trouble: the switched 9V supply was missing at pin 2 of the power regulator chip, there was around 20V at input pins 1 and 15, and when an on/off signal was received at pin 4 there was still only 2·7V at the output (pin 2). A replacement chip restored the 9V line and full operation. **C.W.**

Hitachi VT120

There were no functions at all, only a clock display that randomly changed from bright to dim and light from the operate LED. Checks in the power supply indicated that the STK5471 regulator chip was faulty. A replacement restored the machine to life. **C.W.**

Amstrad VCR6000

The complaint was of poor playback pictures. It turned out that the heads were faulty, but the symptoms were misleading. Playback of a test tape with colour bars produced a display that was clear but with violently juddering verticals, as though there was a shuddering drum motor or a bent drum motor shaft, while a recording made by the machine could be played back on another good machine at an acceptable level. Quite some time was spent before we got round to trying a new drum: why don't we invest in a head-checking machine? **C.W.**

Hitachi VT130

During playback of this machine's own recordings or prerecorded tapes the picture was covered with a fish-net type of interference irrespective of picture content. The cause of the fault was the HT4757 chip/module on the YC panel. A replacement and a deck service brought a smile to the customer's face – until he received the bill. . **C.W.**

Ferguson 3V58/JVC HRD370

This machine wouldn't respond to remote control commands. We found that D501 on the infra-red receiver panel was open-circuit. **J.H.**

Orion VCP150

The cause of no colour was eventually traced to the fact that the low-pass filter PF4003 was open-circuit. It took us longer than it should to discover this because the filter is shown as PF4002 in the manual. **J.H.**

Ferguson 3V59/JVC HRD180

This machine's drum rotated in the reverse direction. Replacing the VC2023A chip IC2 cured the fault. **J.H.**

Mitsubishi HS306

Poor sound with intermittent failure to record the sound was cured by replacing the REC bias preset VR3A1 **J.H.**

Toshiba V73

The cause of no rewind was traced to the TMP4746 chip IC601. **J.H.**

JVC HRD210

When this machine was plugged in the left-hand spool carrier would rotate for a few seconds then the machine would shut down, with the mode motor running. The cause of the problem was that the mode-motor drive belt was slipping. A new belt cured it. **J.E.**

What a Life!

Donald Bullock

More and more I seem to have the feeling that it's all happened before. It came over me the other day when Walter Wingnut called in with a Brittania 14in. colour portable that was dead. It had a paper label underneath, of all places, with B14M11 printed on it. When I opened the set up it looked very much like a Fidelity chassis, though it was not identical with any one that I knew. To my surprise we had an appropriate circuit diagram, for Model C14R06. I soon spotted a BUT11A, a tiny but tough power transistor, which had bitten the dust. So I replaced it and left the set running.

The Grundig CUC70

I then pulled up and plugged in a Grundig C7410 22in. set that Snoddies had kept for a fortnight before handing it back as unrepairable. It's fitted with the CUC70 chassis. No sound, the ticket said. Unlike Snoddies to pass up an easy buck I thought. Ought to be easy! Then, as I was thinking about it, up came a brilliant clean raster followed by line collapse.

With my understanding of Snoddies growing, I dismantled the set and studied the chassis carefully for dry-joints or other obvious clues that would save me the bother of looking out circuits – or thinking. All the joints were perfect but I did notice that R528, a 10Ω resistor, was a bit hot and bothered. It feeds a BY268 diode, D529, which turned out to be dead short. Replacing both items restored normal operation and I was impressed by the excellent picture.

Back to the Brittania

Meanwhile the Brittania had stopped working, and I found that the BUT11A had passed away at its post. There's a 4·7μF electrolytic capacitor in its base circuit, while its emitter is returned to the negative side of the supply via two resistors, R120 (3·3Ω) and R115 (0·68Ω), which are connected in parallel. When I checked them I found that the value of the electrolytic had fallen to 1μF while both resistors were high – the 0·68Ω one was nearly 4Ω.

I replaced these items and, before switching on, checked some associated ones. Up came a good picture, so I set about tidying up the bench and shelves for a while before boxing the set up. I hate boxing up then unboxing sets that seem to last just long enough to keep me on a loser! After twenty minutes or so it was still behaving, so I boxed it up and put it on soak test.

The Samsung VI626

Next was a Samsung VI626 VCR that was dead. I checked the power pack and found that both the 9V and 5V supplies were missing. A study of the circuit diagram led me to an MC7809C 9V regulator which had voltage at its input but nothing at its output. Fitting a replacement restored both supplies. A quick repair, I thought. But I was wrong: the mechanism was running haywire.

In a case like this, analysing the sequence of events is always a good idea. So I switched on, noticed that the clock and channel numbers lit up, then tried to insert a cassette. The machine wouldn't accept it. A look at the top-deck mechanism showed that the lacing up claws were stuck an inch from the back of their grooves. So I hand turned the loading motor until the claws retracted and fed in the cassette again. As it was accepted the loading motor whirred, the stop button lit up and the claws came to rest in their previous position.

The mechanism was lively but out of sync. I reckoned that the most likely cause of the trouble would be in the cam system. So I turned my attention there and dismantled the mechanism to gain access. Sure enough the walls had broken down. As a result the tape lacing mechanism was not controlled. We keep a stock of the more common cams, and before long I had the recorder behaving properly and delivering excellent results.

Return of Walter Wingnut

It was at this point that Walter Wingnut called in for his Brittania. I glanced at it as he arrived. It was working well and after greeting him I pointed to it and gave him the good news.

"It wasn't easy, Walter, but my cleverness won the day" I said cheerfully. "Twenty five quid to you!"

"A lot of money. I hope it'll last" said Walter. "Chap I bought it off said you mended it for the same trouble a while back."

As he was about to hand me the browns and a blue, the set pinged and died.

Walter stowed his money away. "Didn't make a very good job of it this time either" he said. "You'd better have another try – and I'm not paying more than you said, mind."

So I got no money, had to take Wingnut's abuse, and had to face up to tackling the Brittania yet again.

The Ladies

Then slender old Miss Briske came in, carrying a piece of sheet music and a hot-water bottle. She was followed by Mrs. Ruff, a mouthy roughneck who calls me Mr. Billhook and keeps on about her lodger Old Pukey. She was carrying an old toaster. I didn't feel up to either of them. I had Wingnut's Brittania on my mind and needed some peace while I worried about it. A further visitor, Miss Fussie, then arrived. She also had a hot-water bottle. I was beginning to feel nasty.

Miss Briske put the hot-water bottle down and smiled. "It's jammed solid. Old Mrs. Talbot advised me to see you about it. Would you have a go?"

I looked at her in silence. Then her face lit up. "Do you sing, Mr. Bullock?" she asked.

"Not a lot, Miss Briske" I replied.

"I do Mr. Bullock" she smiled. She closed her eyes and began to warble.

I coughed and Mrs. Rough snorted. "Look Billhook" she rasped, "I'm here to put money in your pocket – if you can spend a minute. Old Pukey's jammed a doughnut in the toaster. I've had a go with a fork, but no good. You're supposed to be the expert."

I turned the toaster upside down and the doughnut fell out. Then, checking that no debris were left inside, I plugged it in and switched on. The workshop quickly filled with dense smoke. As it cleared, I pushed the toaster back to Mrs. Ruff. "No charge" I said wearily.

"Pukey, start packing" she said as she left.

"Leave the door open" I said as the first two ladies departed. Miss Fussie then stepped forward and handed me her hot-water bottle, which was full of water. Two in one day!

"I can't undo it" she said. "Would you undo it and test it please?"

I undid the stopper with my pliers, poured some of the water into my tea mug then studied it carefully. I dipped a finger into the mug and smelled it thoughtfully.

"Absolutely perfect, Miss Fussie" I said. "No charge. Goodbye."

Another go at the Brittania

Time to open up the Brittania again. I studied it afresh. I'd already checked or replaced just about everything that could be the cause of the trouble. Then I noticed that the

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Philips is not a brand in which the Test Case workshop specialises, though we're familiar enough with the company's VCRs – they appear on our benches under so many different aliases. Philips' TV sets are not badged and fostered in the same way, but so long as we have a service manual we're ready to have a go at anything that comes our way, especially in these hard times.

So it was that a set fitted with the Philips 2A chassis arrived on Roger's bench one bright autumn morning. It had come in because of loss of both sound and vision: the screen stayed black and the loudspeaker was silent. At switch-on there was a momentary squeak, followed by a continuous low squawk – discernible when an ear was turned to the chopper transformer. It sounded very much as if the overload protection circuit had come into operation. So Roger's first step was to check for short-circuits in the line output stage. The BU508V transistor measured correctly, as did the two diodes in the EW modulator circuit. The transformer feeds four rectifier diodes: they were checked in turn, likewise the safety resistors that protect them. All were intact.

Since everything seemed to be well in the line output stage, our beady-eyed technician turned his attention to the power supply, starting with checks on all the rectifier diodes fed from the chopper transformer T5663. No short-circuit or leaky readings were obtained. Maybe the cause of the trouble lay on the primary side of the chopper transformer? Ohmmeter checks were carried out on the BUT11 transistor, out of circuit: the readings were correct. There were no discernible dry-joints around the chopper transformer, or anywhere else in the power supply.

Advice was sought from Television Ted, who suggested disconnecting plug M to isolate the line output stage from the power supply then wiring a 60W bulb across the 140V line to act as a dummy load. This, he said, would establish in which department the fault lay. If the bulb lit up, there was probably a fault in the line output stage: if it didn't, the power supply was suspect. Roger did as he was told and the bulb lit up, quite brightly. There seemed to be no doubt then that the fault was beyond the power supply section.

Roger removed the bulb, reconnected plug M and went back into the line output stage with his meter. Many suspect components had already been tested, but each one was checked out again. A new tuning capacitor (C2609) was fitted in case the original one was faulty, and a new BY228 efficiency diode (D6609, part of the EW modulator circuit) was fitted in case the original was breaking down under load. Out came the scan correction/coupling capacitor C2612 to unload the deflection coils, which might have had shorted turns. But each time the set was tried while these tests were being carried out the fault symptoms remained the same. By now Roger had become convinced that the line output transformer had shorted turns. He fitted a replacement, which lay as dormant as the old one.

Most of the morning had now passed, and a solution to the puzzle seemed to be as far away as ever. Service Manager began to hover about and ask silly questions, as was his custom when a job got stuck on anyone's bench. At his behest, Uncle Ted was once again called in for consultation. Ted looked at the circuit and asked for the 60W bulb to be reinstated. It glowed as before. When Ted measured the voltage across it he was immediately able to identify the area in which the cause of the fault lay. Furthermore he suggested replacement of a specific component. Sure enough he was right.

Where had Roger gone astray, and what should he have done by way of testing? Had he been wasting his time in the line output stage? Which component finally went into the workshop bin? For the answer, turn to page 55.

Introduction to the Panasonic K Deck

Simon Nash*

Over the past six years Panasonic VCRs have used the G deck. When this was launched it was the first VCR mechanism to use the capstan motor for two purposes: the major one was for tape transport, the secondary one being to move the mechanism between the various mode positions. Because of this dual capstan-motor use, mode selection between certain operations was considered to be rather slow. Later versions (the G2 deck) have an additional review motor to improve the mode-switching time, but this deck is used in only top-of-the-range models. What was needed was a new mechanism with the following features: faster mode switching; easy alignment of the gears; and less gearing.

As a result of advances in the technology, the K deck has been introduced as a replacement for the G deck in the latest series of Panasonic VCRs. UK VCRs that use this new deck, which is sometimes referred to as the Super Drive mechanism, include the NV-SD30/40B and the NV-HD100B.

Improvements

K deck VCRs incorporate many improvements. Amongst other things these make servicing much easier. Some of them can be seen in Figs. 1 and 2, which show top and bottom views of the mechanism respectively. The main ones are as follows:

(1) There's an overall reduction of 51 per cent in the number of mechanical parts. This makes alignment easier. Since fewer spares have to be held in stock, servicing costs are reduced.

(2) A new loading motor moves only the mechanism, leaving the capstan to move the tape.

(3) The main lever assembly is responsible for moving the main mechanical items, i.e. the loading arms, the brakes and the back-tension lever.

(4) Because of the added loading motor the solenoid is no longer required. As a result the mechanism is quieter and quicker.

(5) Circlips are no longer used. Instead, self-locking tabs are used on some gears, e.g. the reel turntables.

(6) There are fewer wire connections: all the sensors are on

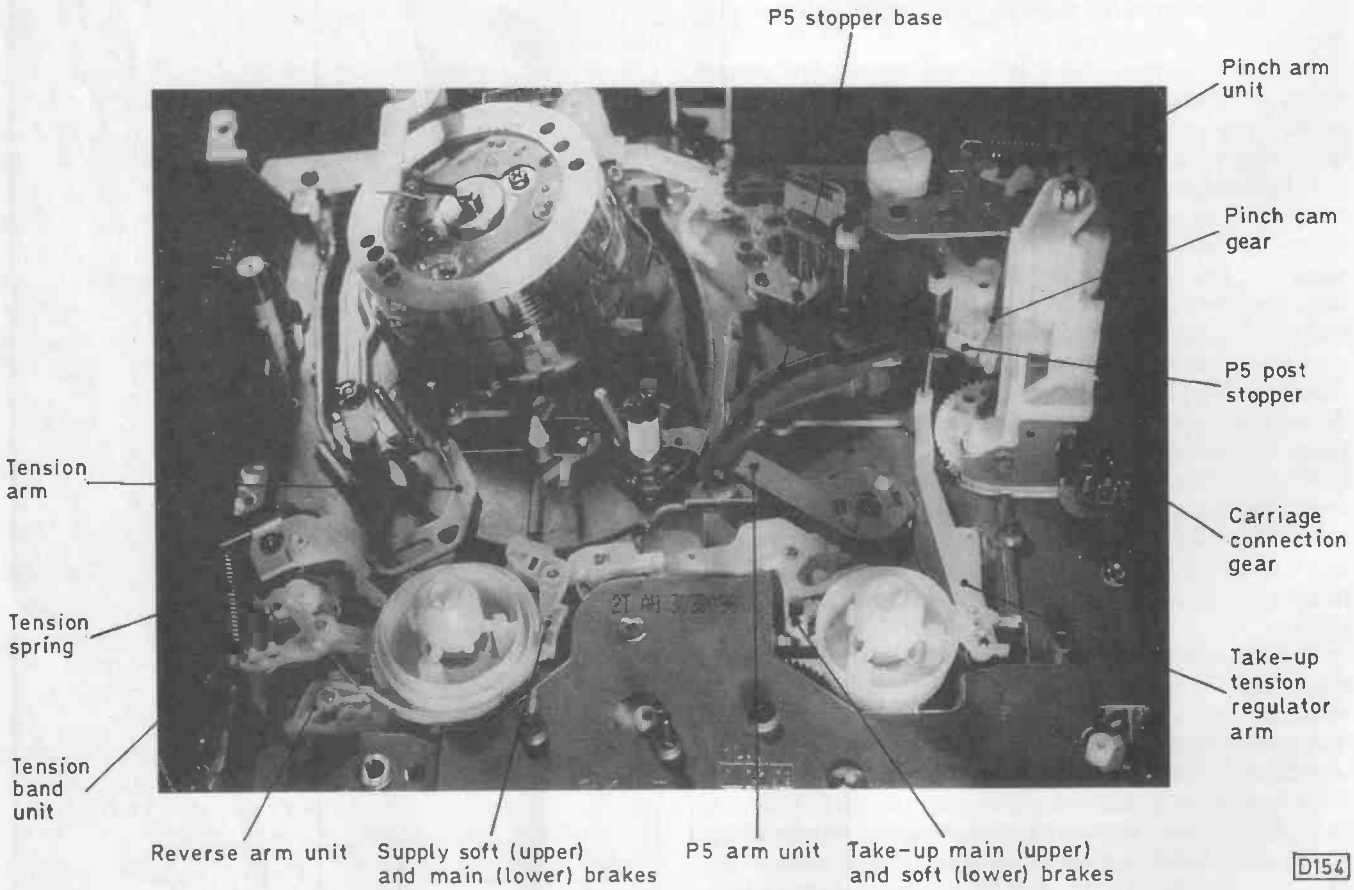

Fig. 1: Top view of the K mechanism.

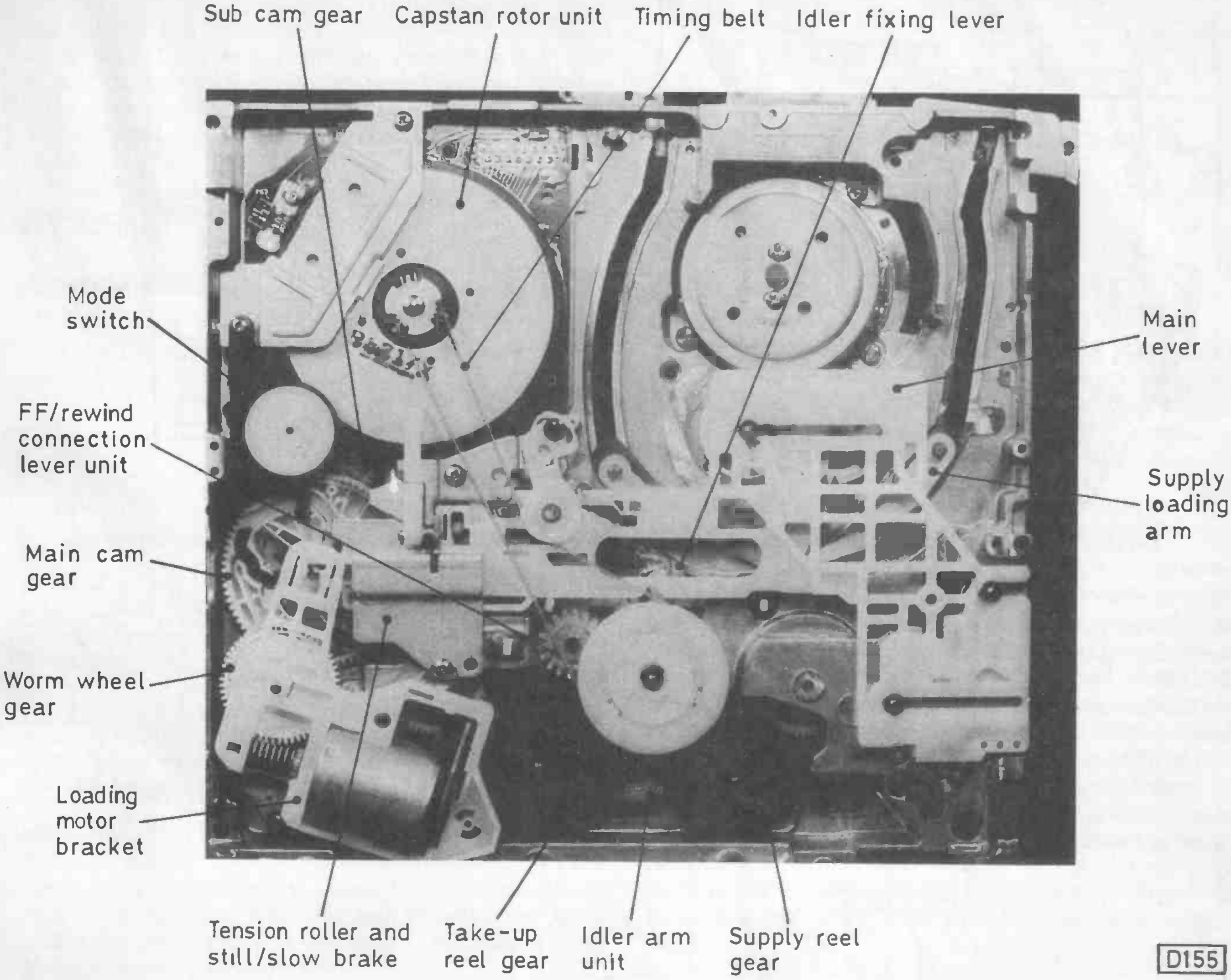

Fig. 2: Bottom view of the K mechanism.

the mechanism-connection PCB, i.e. in one location.

(7) Fewer alignment points. While the G deck has twelve phase alignment points the K deck has only six.

(8) There is no longer need for P5 post height adjustment as it auto-locates at the correct height.

(9) For easy phase alignment a diagram is stamped on the mechanism's plastic chassis.

(10) Seven service modes give the service engineer ready information on a faulty machine. More on these later.

Gearing

The type of gearing used differs from that in the G deck. Fig. 3 illustrates the new tooth arrangement, which is known as 'helical gearing'. It has two advantages. First, as the gear

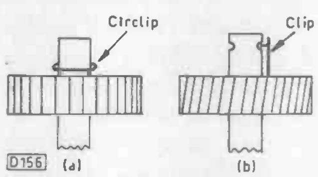

Fig. 3: Difference between the type of gear used in the G mechanism (a) and the helical gears used in the K mechanism (b).

teeth are longer the gears can withstand a greater applied force. Secondly, because the teeth engage and disengage gradually the meshing noise is significantly reduced. These helical gears are used extensively in the area of the play idlers, reel turntables etc.

Fig. 3 also shows the new method of gear fixing. Use of fixing clips instead of circlips makes servicing easier. Care must however be taken not to apply too much force to the clips: when one of them breaks the gear has to be replaced. Two clips, one at either side, are used to fix some of the gears. Should one of these be damaged it's best, in the interests of long-term reliability, to replace the gear.

Servicing

The K deck is not fully serviceable when fitted in the VCR. A servicing position is provided however to enable engineers to gain easy access to carry out repair or alignment as required. To take the deck out, simply remove three large brass screws and disconnect seven connectors. The deck can then be fixed in the service position – see Fig. 4.

Although removal of the deck is simple, if a cassette is jammed in the mechanism access to one of the three screws mentioned above is not possible. The jammed cassette must first be removed therefore. There are two ways of doing this.

The first method involves loading motor rotation, either by hand or by using an external supply – you can connect 4·5V to the motor while it's in circuit without damaging the

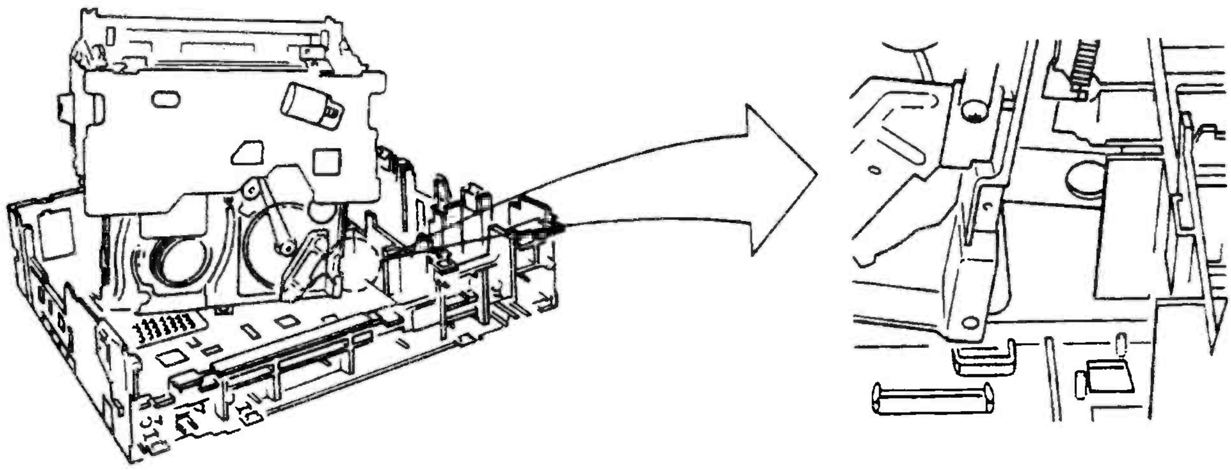

Fig. 4: Service position for the K deck. The mechanism can be easily fixed by standing it up in the main frame as shown.

drive chip. Once the mechanism is in the unloaded state, rotate the capstan motor so that the slack tape is taken up. See Fig. 5.

The second method is to use service mode seven. This mode gives you manual loading-motor drive, using the play and stop keys to control the loading motor. Once the machine is in service mode seven there is also a drive to the capstan motor. This is very useful as the slack tape is automatically taken up. An explanation of the service modes is given below.

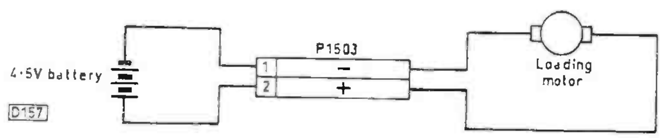

Fig. 5: Battery operation of the loading motor.

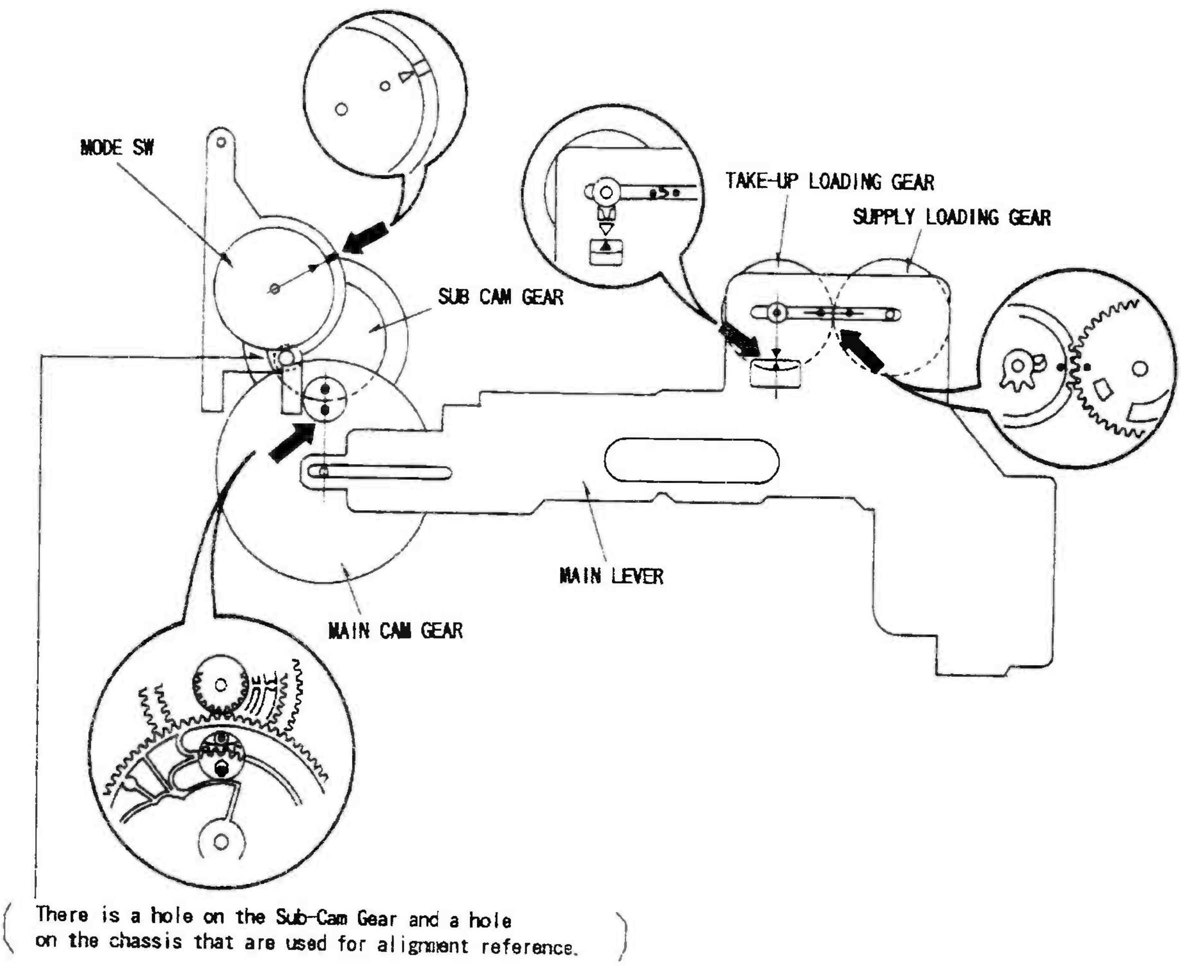

Fig. 6: Gear phase alignment, top view.

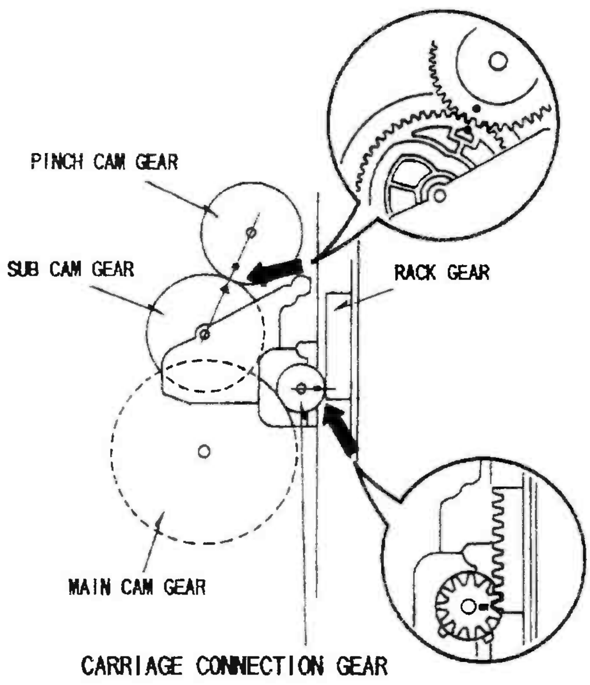

Fig. 7: Gear phase alignment, bottom view.

Alignment

There are two main aspects of alignment: (1) gear phase alignment and (2) main-lever assembly positioning.

Phase alignment of the gears is much easier than with the G mechanism, there being only six points instead of twelve. Figs. 6 and 7 show the phase alignment.

The Main-lever Assembly

Correct positioning of the main-lever assembly is critical for proper operation of the mechanism. Phase alignment of the lever is not difficult but must be correct for the tension posts to locate in their appropriate positions. Fig. 8 shows the post positions for different modes of operation.

As a basic rule when replacing/aligning the main-lever assembly, ensure that the lever is positioned so that it sits as flatly as possible and doesn't feel springy. Poor post positioning is the main cause of incorrect alignmment.

One final point on the main lever. When the mechanism is powered for testing, either from an external supply or in service mode seven, the main lever will flex under load. The reason for this is that under microcontroller chip and mode-switch control the mechanism never reaches the extreme positions that occur with manual operation. To prevent misaligment, make sure that you install the loading-motor bracket and the belt-tension assembly: both of these act as fixing points to hold the main lever in position.

The Service Modes

To make servicing easier with the latest range of Panasonic VCRs the number of service modes has been increased. For access to the service modes turn the shuttle ring to the fast-forward mode then select the eject mode simultaneously. The service mode information will then be displayed for sixty seconds. If you require a continuous service mode, connect a shorting link between TP GROUND and TP SERVICE on the main PCB. Fig. 9 shows a typical service-mode display. The seven modes are as follows:

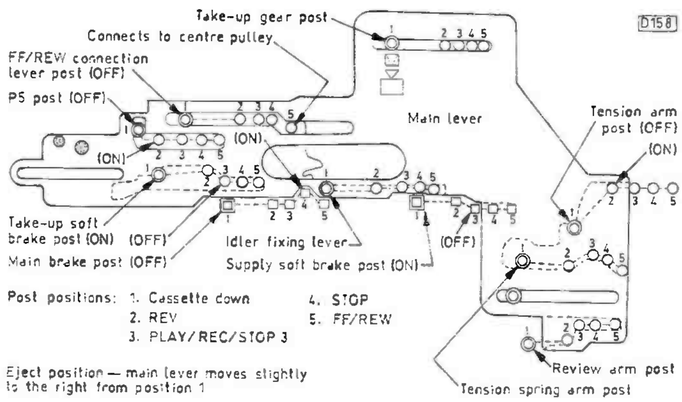

Fig. 8: Post and main-lever position in each mode.

Mode 1: This checks the sensor LED, the supply and take-up phototransistors and the connections to IC6001.

Mode 2: This mode indicates the mechanical position, with a corresponding display.

Mode 3: This checks the mode-switch operation. When the switch is in a position. e.g. play. the display will show '00' irrespective of the mode.

Mode 4: This checks the operation of the key scanning on the front panel. also the data being transmitted from the remote-control unit. A corresponding display is given on the front panel.

Mode 5: This checks and shows whether IC6001 has received a capstan-motor start request.

Mode 6: This checks and shows whether IC6001 has received a drum-motor start request.

Fig. 9: A typical service mode display. The left-hand digit is the service mode number, indicating the operation being checked. The next two digits (03 here) indicate the circuit condition and/or the position of the mechanism.

Mode 7: This mode is used for manual loading-motor drive, as explained earlier, using the stop and play keys. It can be entered in two ways. dependingon whether the machine is an early or later production version – refer to the service manual for full details.

As mentioned above, selection between the various service modes can be achieved by selecting fast forward and eject simultaneously.

Dealer Support

A video tape that shows the dismantling/reassembling procedure is being prepared as an aid to dealers' service departments. There's also a training manual for the K mechanism, part no. VRD9302D101.

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ECONOMIC DEVICES 32 TEMPLE STREET, WOLVERHAMPTON, WV2 4AN

15/80H	3.83	2SC1398	0.80	2SD468C	0.00	BB105B	0.24	BD190	0.31	BF959	0.18	BYW56	0.46	M192B1	1.86	SG613	18.79	TA7176P	1.30	TDA1190Z	4.08	TEA1009	1.61
15/85R	3.84	2SC1413A	1.30	2SD476	0.97	BC107B	0.20	BD201	0.40	BF960	0.27	BYX55600	0.20	M21C	1.65	SGSIF344	6.62	TA7193AP	3.36	TDA1200	0.91	TEA1014	1.87
17052	3.85	2SC1509	0.51	2SD525	1.27	BC108	0.15	BD203	0.46	BF966	0.61	CA1310E	0.78	M293	14.63	SKE4F104	0.97	TA7193P	7.09	TDA1270	1.79	TEA1039	2.15
17053	2.38	2SC1520	0.54	2SD551	5.81	BC109A	0.16	BD232	0.28	BF970	0.30	CA3094	3.06	M490	15.30	SKE4F210	0.87	TA7205AP	1.51	TDA1412	0.77	TEA2018A	1.49
17088	2.38	2SC1573	0.36	2SD613	0.63	BC109B	0.15	BD234	0.25	BFR39	0.35	CD4001	0.14	M491	7.94	SKE5F310	1.68	TA7207P	1.68	TDA1506	4.59	TEA2164	2.68
17089	3.39	2SC1573Q	0.26	2SD636	0.14	BC117	0.14	BD237	0.30	BFR41	0.44	CD4011	0.21	M50115AP	3.24	SL1430	1.41	TA7210P	1.50	TDA1510	2.54	TEA2165	6.26
17127	1.77	2SC1675	0.09	2SD637	0.12	BC139	0.33	BD238	0.11	BFR90	0.61	CD4013	0.34	M51102L	1.77	SL1431	1.70	TA7214P	3.74	TDA1512	3.17	TIC106D	0.55
1N4001	0.04	2SC1685	0.17	2SD667	0.26	BC140	0.21	BD239	0.29	BFR90A	0.77	CD4016	0.14	M51231P	2.03	SL1432	2.10	TA7217AP	1.27	TDA1515A	2.54	TIC106M	0.75
1N4002	0.07	2SC1740	0.12	2SD669	0.63	BC141	0.34	BD241	0.41	BFR91	0.43	CD4021	0.43	M51393AP	4.64	SL471	1.70	TA7222	1.24	TDA1516Q	3.56	TIC45	0.59
1N4003	0.05	2SC1741	0.17	2SD669A	0.63	BC147A	0.06	BD243	0.39	BFR96	0.53	CD4052	0.29	M51515L	2.01	SL490	2.31	TA7222AP	1.27	TDA1518Q	3.32	TIL100	0.52
1N4004	0.07	2SC1815	0.14	2SD716	1.46	BC148	0.12	BD243A	0.43	BFW92A	0.48	CD4053	0.20	M51521L	0.54	SN29764AN	1.99	TA7227P	2.29	TDA1670A	2.81	TIP110	0.36
1N4005	0.06	2SC1826	0.72	2SD718	1.45	BC148A	0.06	BD243C	0.44	BFX85	0.55	CD4066	0.30	M5218L	0.48	SN7474N	0.28	TA7230P	1.60	TDA1701	4.86	TIP112	0.00
1N4006	0.06	2SC1827	1.00	2SD734	0.24	BC148B	0.04	BD244A	0.34	BFY50	0.34	CD4069	0.17	M5231L	0.55	SN76013ND	7.99	TA7233P	1.95	TDA1870	3.37	TIP112H	0.58
1N4007	0.06	2SC1845	0.20	2SD752	1.51	BC149	0.04	BD244C	0.42	BFY51	0.34	CD4070	0.21	M53215P	1.48	SN76227N	1.07	TA7240P	2.46	TDA1904	1.21	TIP120	0.57
1N4148	0.04	2SC1846	0.51	2SD774	0.43	BC149C	0.04	BD245C	0.72	BR100	0.17	CNX62A	2.95	M54543L	1.61	SN76666N	1.26	TA7241	2.30	TDA1905	0.94	TIP121	0.42
1N4448	0.06	2SC1923	0.14	2SD787E	0.36	BC157	0.13	BD245C	0.71	BR101	0.98	CR3CM	2.62	M54544L	1.87	SN76705AN	1.70	TA7250	4.03	TDA1908A	1.14	TIP126	0.48
1N5061	0.38	2SC1942	3.33	2SD837	0.90	BC159	0.06	BD278A	0.56	BR103	0.53	CR02AM	2.17	M54548L	3.29	STA341M	2.54	TA7267P	2.02	TDA1940	2.77	TIP132	0.46
1N5402	0.12	2SC1959	0.11	2SD841	1.34	BC161	0.27	BD317	0.87	BR303	1.22	CV12E	2.70	M54644BL	3.30	STA401	2.46	TA7270	1.68	TDA1950	1.86	TIP137	0.48
1N5404	0.13	2SC1969	2.46	2SD856	0.94	BC167	0.42	BD318	1.10	BRX44	1.02	CX109	7.05	M54648L	6.62	STA441C	2.80	TA7270P	1.73	TDA2002	0.85	TIP2955	0.83
1N5406	0.12	2SC1983	1.78	2SD869	3.28	BC171B	0.14	BD380	0.34	BRY56	0.43	DTA124EF	0.13	M54898AP	20.45	STK0029	5.88	TA7271P	1.76	TDA2004	1.27	TIP29C	0.30
1N5408	0.12	2SC2001	0.14	2SD870	3.81	BC177	0.14	BD433	0.29	BSS38	0.23	DTA144EF	0.17	M58485P	5.95	STK0039	7.11	TA7273	3.21	TDA2005	1.36	TIP29E	0.46
1N914	0.04	2SC2073	0.51	2SD871	5.08	BC178	0.11	BD434	0.34	BT120	1.28	ER1400	2.15	MB3730	2.38	STK0040	7.40	TA7274P	2.72	TDA2006	1.06	TIP3055	0.77
1S1555	0.22	2SC2078	0.77	2SD880	0.48	BC182L	0.06	BD435	0.38	BT129	3.26	HA11235	1.95	MB3731	2.20	STK0059	9.75	TA7280	2.11	TDA2009	2.29	TIP30C	0.17
1S2076	0.29	2SC2141	1.48	2SD882	0.43	BC182LB	0.06	BD436	0.32	BT139600	1.14	HA11244	3.83	MB3732	2.88	STK025	9.61	TA7299	2.34	TDA2020	3.72	TIP31A	0.32
2N2219A	0.27	2SC2166	1.27	2SD898B	4.23	BC184	0.09	BD437	0.32	BT151 500R	1.10	HA1124A	1.21	MC13002P	5.74	STK3042	6.90	TA7313AP	0.62	TDA2030H	0.61	TIP31B	0.30
2N2222	0.22	2SC2168	0.85	2SD904	5.95	BC184L	0.04	BD438	0.31	BT151800	1.15	HA11423	2.02	MC1310P	0.85	STK3062	8.88	TA7317P	0.93	TDA2030V	1.05	TIP31C	0.44
2N2905	0.21	2SC2236	0.25	2SD973	0.38	BC184LC	0.10	BD441	0.34	BU205	1.07	HA11440	2.92	MC1327AP	1.62	STK4131	7.79	TA7325P	0.45	TDA2170	2.55	TIP32A	0.39
2N2926G	0.37	2SC2271	0.22	74LS00	0.21	BC204	0.14	BD442	0.29	BU208A	1.16	HA1166X	3.43	MC1330AIP	1.26	STK4141	9.31	TA7343AP	0.72	TDA2270	1.68	TIP32C	0.38
2N3053	0.36	2SC2274	0.22	7805	0.28	BC207B	0.23	BD510	1.34	BU208D	1.53	HA11713	1.24	MC1350P	1.82	STK4142	8.21	TA7358P	0.78	TDA2530	3.76	TIP33A	0.92
2N3054	0.98	2SC2274K	0.22	7808	0.30	BC212B	0.06	BD529	0.97	BU326A	1.36	HA11741	6.77	MC1352P	1.45	STK4162M	9.51	TA75358P	0.68	TDA2540	0.88	TIP33C	0.80
2N3055	0.77	2SC2314	0.33	7812	0.30	BC212L	0.06	BD530	1.10	BU406	0.68	HA11745	5.10	MC1358P	1.59	STK4171	10.50	TA7607AP	2.62	TDA2541	0.72	TIP34	0.00
2N3442	1.00	2SC2335	1.43	7815	0.30	BC213	0.11	BD535	0.43	BU406D	1.02	HA13001	1.72	MC14528BCP	1.70	STK4181	12.85	TA7609P	1.95	TDA2560	4.46	TIP34C	0.89
2N3702	0.11	2SC2458	0.12	7818	0.41	BC214L	0.09	BD536	0.48	BU407	0.53	HA13108	3.56	MDA2062	2.21	STK4181A	12.46	TA7630P	1.87	TDA2576A	5.95	TIP41A	0.38
2N3704	0.14	2SC2482	0.34	7905	0.34	BC237	0.10	BD675	0.30	BU407D	0.97	HA13118	1.87	MJ2955	0.97	STK4332	5.54	TA7640AP	0.98	TDA2577A	4.25	TIP41C	0.37
2N3773	1.27	2SC2547E	0.24	7912	0.43	BC237B	0.05	BD677	0.32	BU426A	0.96	HA13119	2.03	MJ802	2.37	STK4352	1.70	TA7676P	4.25	TDA2578A	2.55	TIP42A	0.39
2N3819	0.34	2SC2565	8.46	AA119	0.36	BC238	0.11	BD707	0.51	BU426E	2.13	HA13403	4.66	MJE13005	0.85	STK437	8.30	TA7680AP	3.81	TDA2581	5.75	TIP42C	0.37
2N3904	0.11	2SC2570A	0.29	AA143	0.13	BC238B	0.05	BD839	0.51	BU500	1.32	HA1377	2.42	MJE2955	0.68	STK4392	5.92	TA7698AP	5.93	TDA2581Q	10.15	TIP47	0.51
2N4444	3.22	2SC2577	1.46	AC127	0.11	BC239	0.04	BD901	0.51	BU508A	0.95	HA1388	2.63	MJE3055	0.51	STK441	11.81	TA7705P	1.68	TDA2582	1.95	TIPL791A	1.24
2N6292	0.62	2SC2581	3.05	AC141K	0.46	BC252B	0.07	BD902	0.51	BU508AF	1.27	HA1389	2.52	MJE340	0.50	STK459	11.17	TA7769P	1.43	TDA2591	1.15	TIS43	0.66
2SA1015	0.10	2SC2632	0.43	AC176K	0.30	BC300	0.48	BD911	0.65	BU508D	1.27	HA1392	1.61	ML923	14.26	STK461	10.49	TA8205	3.89	TDA2593	0.75	TL011CP	1.36
2SA1016	0.17	2SC2655	0.25	AC187	0.16	BC301	0.28	BD912	0.63	BU508DF	1.87	HA1397	2.63	MN1405VKF	11.08	STK4843	11.10	TA8210H	4.74	TDA2594	2.74	TL071CP	0.38
2SA1020	0.43	2SC2671	0.68	AC187K	0.33	BC302	0.36	BDV65B	1.16	BU508V	1.43	HA1398	2.33	MN1435VX	14.35	STK5211	15.78	TA8215	4.57	TDA2595	2.41	TL494	1.61
2SA1020Y	0.43	2SC2688	0.30	AC188	0.36	BC303	0.22	BDW84C	1.28	BU526	1.41	HA1452	4.86	MN1435VXB	10.66	STK5322	6.35	TA8691N	6.67	TDA2600	3.08	TMP47C432AP	11.24
2SA1095	7.44	2SC2785	0.12	AC188K	0.82	BC307	0.06	BDW93C	0.59	BU536	1.60	HM5232	10.36	MN650	2.50	STK5325	5.37	TA626	1.05	TDA2611A	0.64	TMP47C434N-3555	17.87
2SA1102	2.54	2SC2791	5.44	AD149	0.52	BC307A	0.06	BDW94C	0.46	BU608	1.44	HM5251	9.52	MPSA42	0.23	STK532E	6.20	TBA120	0.53	TDA2611AQ	2.03	UC3844	1.78
2SA1143	0.17	2SC3150	1.44	AD161	1.02	BC307B	0.06	BDX32	1.70	BU705	1.61	HM7103	14.07	MPSA56	0.12	STK5331	3.02	TBA120AS	0.90	TDA2640	4.13	UPA81C	0.94

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2SA1175	0.25	2SC3153	2.37	AD162	0.96	BC308	0.06	BDY20	2.13	BU806	0.82	ICH28I	0.26	MPSA93	0.09	STK5332	2.74	TBA120S	0.89	TDA2652	14.32	UPC1181H	6.80
2SA1186	3.73	2SC3156	4.22	AF124	0.77	BC308A	0.09	BF115	0.41	BU806A	0.80	KA2101	0.83	MR854	0.14	STK5333	4.28	TBA120T	0.51	TDA2653A	3.26	UPC1182H	5.95
2SA1208	0.34	2SC3182	3.25	AF127	0.59	BC308C	0.06	BF179	0.31	BU807	0.51	KBL08	0.47	MSM5840H	15.36	STK5372	3.40	TBA120U	0.39	TDA2680	5.10	UPC1185H	10.20
2SA1265	1.95	2SC3225	0.50	AF139	0.29	BC327	0.10	BF184	0.41	BU826A	1.59	KSR1004	0.09	MVS240	0.53	STK5421	2.60	TBA2800	1.62	TDA3190	1.27	UPC1188	3.83
2SA1286	0.39	2SC3795	1.95	AF239	0.43	BC327B	0.17	BF185	0.29	BU908	1.17	L200CV	1.13	NE545B	3.20	STK5422	6.38	TBA395	0.68	TDA3190P	1.36	UPC1212C	0.83
2SA473	0.71	2SC380	0.12	AF279	0.34	BC328	0.07	BF194	0.22	BUK444	2.38	LA1201	0.56	NE555	0.21	STK5451	5.27	TBA520	0.85	TDA3300B	20.88	UPC1228HA	0.56
2SA562	0.17	2SC388A	0.59	AL102	5.08	BC337	0.09	BF196	0.15	BUT11	0.77	LA1230	1.95	NE555N	0.37	STK5466	4.71	TBA540	1.97	TDA3330	10.78	UPC1230	2.21
2SA634	0.54	2SC458	0.10	AN3821K	7.23	BC337L	0.22	BF197	0.34	BUT11A	0.85	LA1385	1.65	NE592	1.85	STK5471	4.51	TBA540Q	0.77	TDA3541	0.95	UPC1230H	2.80
2SA639S	0.83	2SC536	0.09	AN5265	1.75	BC338	0.06	BF198	0.17	BUT11AF	0.85	LA3161	0.40	NE646N	2.63	STK5476	5.00	TBA560C	2.02	TDA3560	3.65	UPC1278H	2.66
2SA673	0.09	2SC710	0.12	AN5435	1.45	BC368	0.25	BF199	0.04	BUT12A	0.85	LA4140	0.37	NP1106	11.86	STK5481	6.12	TBA570A	1.77	TDA3561A	3.31	UPC1318	2.96
2SA684	0.43	2SC867A	5.25	AN5512	2.14	BC369	0.17	BF200	0.39	BUT56A	1.19	LA4182	1.75	OA47	0.25	STK5482	4.06	TBA651	1.01	TDA3562A	4.21	UPC1335V	3.91
2SA733	0.17	2SC945	0.12	AN5515	2.33	BC372	0.47	BF240	0.11	BUW11	0.99	LA4192	1.14	OA90	0.59	STK6962	2.59	TBA750Q	5.10	TDA3565	2.29	UPC1351C	1.70
2SA769	1.27	2SD1051	0.48	AN5521	2.14	BC546A	0.06	BF244	0.30	BUW11A	0.90	LA4220	1.29	OA91	0.15	STK7216	5.53	TBA800	0.51	TDA3566	3.40	UPC1353	1.34
2SA798	0.41	2SD1128	1.02	AN5612	2.97	BC547	0.11	BF245A	0.19	BUW41B	1.02	LA4251	2.29	R2540	2.98	STK7226	8.14	TBA810P	1.66	TDA3571B	3.08	UPC1363C	1.06
2SA872	0.14	2SD1138	0.94	AN5900	1.27	BC547A	0.04	BF245B	0.41	BUW81A	2.29	LA4270	2.73	R2540X	1.92	STK7308	4.99	TBA810S	0.66	TDA3576	11.90	UPC1363CA	2.13
2SA872A	0.20	2SD1207	0.35	AN6310	4.69	BC547B	0.11	BF255	0.11	BUW84	1.11	LA4282	2.37	R2M	0.77	STK7348	4.67	TBA820	0.85	TDA3640	4.75	UPC1365C	1.70
2SA940	0.82	2SD1265	0.77	AN6326	3.61	BC548A	0.29	BF256	0.24	BUX84	0.44	LA4422	1.27	R3297	4.27	STK7356	5.57	TBA820L	0.55	TDA3650	9.83	UPC1378H	1.19
2SA952	0.17	2SD1273	0.82	AN6341	2.29	BC548B	0.18	BF256LC	1.40	BUX85	0.60	LA4440	1.68	R4050	2.38	STK7358	5.46	TBA820M	0.34	TDA3653AQ	1.92	UPC1391H	0.52
2SA958	1.44	2SD1275	0.88	AN6610	0.93	BC548C	0.12	BF257	0.36	BUZ71	0.52	LA4445	1.29	R4051	2.95	STR1096	4.67	TBA920	0.51	TDA3653B	1.86	UPC1394	1.23
2SA966Y	0.41	2SD1276	0.85	AN6671K	5.35	BC549	0.06	BF258	0.04	BY127	0.15	LA4460	1.48	RB156	2.07	STR40090	6.80	TBA950	1.68	TDA3654	1.66	UPC1420CA	6.60
2SA970	0.19	2SD1279	7.62	AN7158	2.73	BC556B	0.06	BF259	0.31	BY133	0.08	LA4461	1.48	RGP15	0.41	STR4090	16.36	TBA970	4.08	TDA3810	2.55	UPC1488H	1.28
2SA984	0.27	2SD1292	0.41	AN7161	3.56	BC557	0.07	BF324	0.12	BY164	0.67	LA4475	2.29	RGP15J	0.35	STR4211	4.72	TCA270S	1.03	TDA4420	1.27	UPC2002	2.08
2SB1010	0.34	2SD1308	0.77	AN7171K	4.37	BC557B	0.06	BF337	0.34	BY179	0.80	LA4476	2.29	RGP30M	0.30	STR440	6.38	TCA440	1.95	TDA4427	1.89	UPC324C	1.74
2SB546	0.53	2SD1397	1.89	BA145	0.11	BC557C	0.11	BF338	0.43	BY184	0.39	LA4500	2.17	RM11C	0.68	STR441	6.27	TCA660B	0.43	TDA4442	3.49	UPC4558C	0.51
2SB633	0.93	2SD1398	2.13	BA156	0.06	BC558B	0.06	BF355	0.48	BY206	0.13	LA4505	1.79	S2000AF	1.19	STR451	14.69	TCA800Q	1.65	TDA4500	3.79	UPC574	1.07
2SB643S	0.20	2SD1426	2.54	BA157	0.07	BC559	0.11	BF392	0.23	BY207	0.18	LA4508	2.29	S2055AF	1.81	STR50020	9.02	TCA910	1.21	TDA4501	5.08	UPC580C	2.55
2SB644	0.34	2SD1427	2.89	BA158	0.07	BC560C	0.21	BF393	0.17	BY210400	0.19	LA4520	1.11	S2530A	1.98	STR50103	5.92	TCA940	3.40	TDA4503	3.38	UPD1937C	3.15
2SB688	1.28	2SD1432	4.88	BA159	0.25	BC635	0.19	BF422	0.19	BY224600	5.10	LA4700	3.81	SAA1004	1.14	STR54041	6.75	TD3F900H	6.57	TDA4505E	4.64	X0065CE	2.20
2SB772	0.43	2SD1439	3.05	BA317	0.19	BC637	0.15	BF423	0.14	BY226	0.16	LA5112	5.89	SAA1121	11.22	STR5412	8.27	TDA1004A	3.40	TDA4600	1.70	X2402	4.62
2SB772Q	0.43	2SD1453	1.87	BA318	0.04	BC639	0.14	BF435	1.97	BY227	0.14	LA5512	0.61	SAA1174	5.10	STR58041	6.35	TDA1011	1.27	TDA4600/2	2.14	ZPY120	9.17
2SB793	0.31	2SD1497-02	7.05	BA5102A	1.46	BC640	0.06	BF450	0.19	BY228	0.38	LA7223	2.54	SAA1250	2.92	STR6020	10.15	TDA1011A	1.47	TDA46002D	3.54	ZTX650	0.51
2SB819	0.48	2SD1497-06	7.06	BA536	1.14	BC879	0.39	BF458	0.30	BY229	1.64	LA7520	2.75	SAA1251	5.74	STR6020KIT	11.23	TDA1013A	1.45	TDA4600F	1.70	ZTX753	1.01
2SB861	0.97	2SD1541	4.66	BA5406	2.12	BC880	0.38	BF459	0.29	BY229600	0.84	LA7800	1.44	SAA1351	8.23	T6064V	2.63	TDA1015	0.99	TDA4601	1.56		
2SB891	0.43	2SD1555	2.80	BA6109	1.85	BCY70	0.07	BF469	0.34	BY229800	1.02	LA7801	1.27	SAA3027P	7.62	T6076V	3.34	TDA1020	1.27	TDA4601D	2.42		
2SC1008	0.17	2SD1577	4.33	BA6209	1.31	BD131	0.28	BF470	0.33	BY238	0.31	LA7820	2.03	SAA5010	4.60	T9013V	5.23	TDA1035SB	4.15	TDA4605	3.64		
2SC1061	0.83	2SD1649	2.03	BA6219	1.45	BD132	0.21	BF480	0.67	BY255	0.14	LA7830	1.27	SAA5012	3.31	T9034V	1.45	TDA1035T	1.87	TDA4950	1.09		
2SC1096	0.50	2SD1650	2.47	BA6222	1.61	BD135	0.33	BF493S	0.34	BY298	0.15	LM1303N	0.88	SAA5030	6.42	T9035V	1.50	TDA1037	8.50	TDA7240A	2.36		
2SC1114	1.16	2SD1876	4.88	BA656N	0.84	BD136	0.20	BF597	0.16	BY299	0.12	LM1877	1.45	SAA5050	4.68	T9038V	6.09	TDA1044	1.43	TDA7270S	8.17		
2SC1162	0.31	2SD1877	2.12	BA718	0.77	BD137	0.45	BF757	0.43	BY476A	0.68	LM317T	0.52	SAB3013	5.81	T9053V	0.92	TDA1060	1.58	TDA8140	2.38		
2SC1213	0.14	2SD1911	5.06	BAS11	0.32	BD139	0.29	BF758	0.32	BYD14J	0.31	LM324N	0.35	SAB3021	6.15	T9054V	1.65	TDA1082	4.25	TDA8153	5.10		
2SC124	0.44	2SD234	0.89	BAV18	0.07	BD140	0.24	BF759	0.36	BYD33G	0.68	LM339N	0.15	SAB3035	6.35	T9064	1.20	TDA1083	1.19	TDA8170	2.58		
2SC1306	1.16	2SD313	0.56	BAV20	0.26	BD168	0.76	BF760	0.24	BYD33J	0.27	LM358	0.23	SAF1032P	5.50	T9065V	4.66	TDA1151	0.51	TDA8180	5.35		
2SC1318	0.10	2SD350A	1.23	BAV21	0.19	BD175	0.29	BF762	0.29	BYV10−40	2.20	LM358N	0.42	SAF1039	2.44	TA7063P	1.14	TDA1170	1.59	TDA8190	3.30		
2SC1364	0.29	2SD401	3.46	BAW62	0.17	BD179	0.34	BF869	0.25	BYV95C	0.44	LM380N	0.82	SDA2112	11.00	TA7122BP	0.63	TDA1170N	1.38	TDA9503	2.13		
2SC1384	0.34	2SD438	0.34	BAX14	0.28	BD189	0.41	BF870	0.23	BYV96D	0.27	LM393N	0.27	SG264A	10.62	TA7146P	7.70	TDA1170S	1.16	TEA1002	4.98		

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Satellite Scene

Contributions from Steve Beeching, T.Eng., Chris Watton, D.J. Long, David Finan and Brian Storm

This month mainly modifications to provide additional features.

Grundig GRD2000

Our Darron was thinking about updating his satellite system. He had a Grundig STR22 stereo receiver and wanted a VideoCrypt decoder. A customer of ours was having some trouble with his receiver – intermittent tuning drift and decoding. He decided to update to an STR1 so we took his GRD2000, which has a VideoCrypt decoder, in part exchange. After some time had been spent testing it the picture took a turn for the worse: white areas went spotty. It looked as though the video heads were down – but this was a satellite receiver! A new tuner kit cured the fault, which was due to restricted bandwidth. Then for some days Darron had problems with the VideoCrypt decoder section breaking down to produce a noisy picture. Various cures were tried – cleaning the connector contacts and checking for dry-joints. A permanent solution was achieved when Darron went over all the i.c. pins with a hot-air pencil. No wonder the previous owner had got fed up with it!

Once the receiver's operation had been stabilised there was a request for polar switching. Darron was unable to get the horizontal channels. His STR22 had been used with a magnetic polariser, having an extra wire to the dish to switch the polarisation. But the GDR2000 is designed for use with the Marconi LNB, whose polarisation is switched by the supply voltage. So it was a case of "dad, can you design some sort of adaptor circuit?" "No." "But you could always send it to *Television*."

So here's the circuit (see Fig. 1) to convert the dual-voltage LNB supply to rotate a magnetic polariser. A transistor within the receiver switches between 12/13V and 17/18V to change the polarisation at the LNB. The circuit must sense this without contributing any significant loading. A 15V zener diode, D1, is used as the d.c. level sensing device. When the supply voltage exceeds 15V, D1, Tr1 and

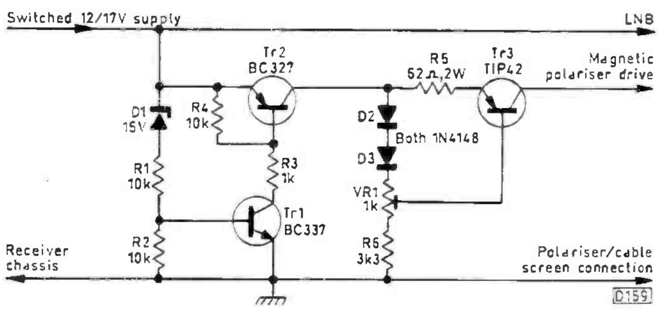


Fig. 1: Circuit for providing magnetic polariser switching with the Grundig GRD2000 satellite receiver.

Tr2 switch on supplying power to Tr3 which acts as a constant-current source. VR1 adjusts the current, which can be varied between 40mA and about 90mA. This allows for cable loss and provides fine adjustment for reception of horizontally-polarised signals.

There's nothing special about this circuit. Other transistors could be used, provided that the one in the Tr2 position has a collector current rating of 200mA and the one in the Tr3 position is a power device – it warms up a bit. The value of R5 is not critical, but it does serve to provide current stabilisation as Tr3 warms up.

Darron built the circuit on a piece of Veroboard and used some sticky-backed strip to fit it in the receiver. He also added an ICPF20 circuit protector in the supply, muttering something about having used my designs before. **S.B.**

Amstrad SRX200

The circuit shown in Fig. 2 enables the remote control system to provide a simple form of channel stepping with this model – Fig. 3 shows how it can be added to the receiver. As more and more channels have become available from Astra, the ability to step through them has become more desirable.

One could buy one of the excellent upgrade kits or memory extensions, but this circuit provides a simple, cheap solution. Note that the TV/SAT key is used, so this function will no longer be available when the receiver has been modified.

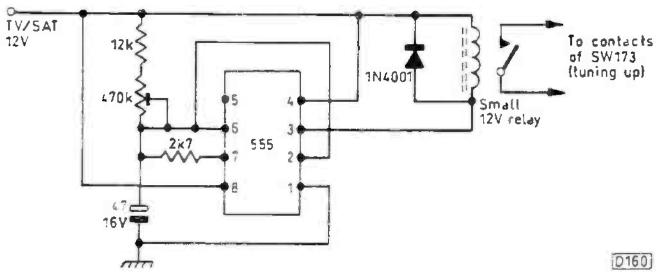


Fig. 2: Circuit for providing simple channel stepping with the Amstrad SRX200 receiver.

The circuit can be built up on a small piece of Veroboard – about fifteen by fifteen holes. The relay came from the audio panel of an Hitachi VCR. Most of the components were obtained from my scrap box, but even if you have to buy them all the cost shouldn't exceed a couple of quid.

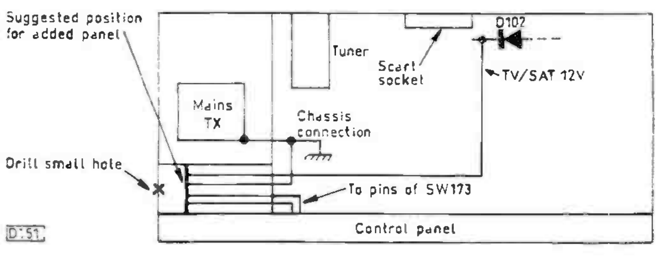


Fig. 3: Connection points and suggested position for the circuit shown in Fig. 2. A small hole in the case will enable the step speed to be adjusted easily. If a scart lead is used the control wire at pin 8 must be removed.

The basic idea is to pulse the tuning button every two-three or so seconds: the period can be varied to suit personal preferences – anything from half a second to half a minute. You might think that a pulse is not required as simply shorting the button connection would do. But although this will start the operation it won't stop it, as only one button can be pressed at a time. So the short-duration pulse is used to step the tuning, the long off period allowing another button to be pressed to stop it. When the TV/SAT button on the handset is pressed the tuning will continue to scan the channels until told to stop.

I've not provided a board layout as the component positioning is not critical. **C.W.**

Amstrad SRX100

I was asked to look at a satellite installation that was used in an office to receive only Sky News. The problem was that every so often the service would fail, usually overnight, the

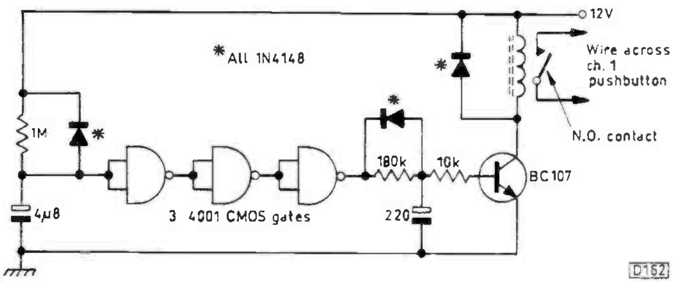


Fig. 4: Circuit to select channel one on powering the Amstrad SRX100. A small RS DIL relay with a normally-open contact was used: wire the contact across the channel 1 pushbutton.

maintenance man finding that the receiver was in standby. The cause of the problem was short mains failures. As these receivers run up into standby, a small Veroboard circuit (see Fig. 4) was added to select channel one after the initial synthesiser chip resetting. It was fitted in the receiver using the mains transformer fixing screw. **D.J.L.**

Amstrad SRX100/200

One of the limitations of these receivers is the fact that they can select only the following audio subcarriers: 7·02MHz (AU3, L), 7·2MHz (AU4, R), 7·38MHz (AU5, L) and 7·56MHz (AU6, R). AU1 has 7·02/7·2MHz combined and AU2 7·38/7·56MHz combined. Quite a few radio stations now broadcast using 7·74MHz and 7·92MHz subcarriers. The following modification enables these to be received.

The SRX100 and SRX200 use two crystal oscillators to obtain the four signals listed above. Their outputs are fed to a f.e.t. mixer stage that provides difference frequencies of 10·52MHz and 10·7MHz which are passed to a dual f.m. demodulator. For AU1 and AU2 both demodulator outputs are available at the output sockets or added together to give the r.f. modulator a mono signal. For AU3-6 the output from only one demodulator is selected and fed to the output sockets or r.f. modulator.

The modification involves fitting an additional crystal oscillator so that the 7·74MHz and 7·92MHz channels can be obtained. Selection of these extra channels is achieved by using the TV/SAT touch button at the front of the receiver or on the remote control handset. Fig. 5 shows the circuit, which was built on a small piece of Veroboard. Use screened cable for the leads to and from L308. Connect the screen to pin 7 of the 74HC00N chip in the receiver (IC301). The 18·432MHz crystal can be obtained from Maplin. All resistors are 5%, 0·25W types.

To carry out the modification, proceed as follows. Remove the receiver's cover (three screws secure it to the

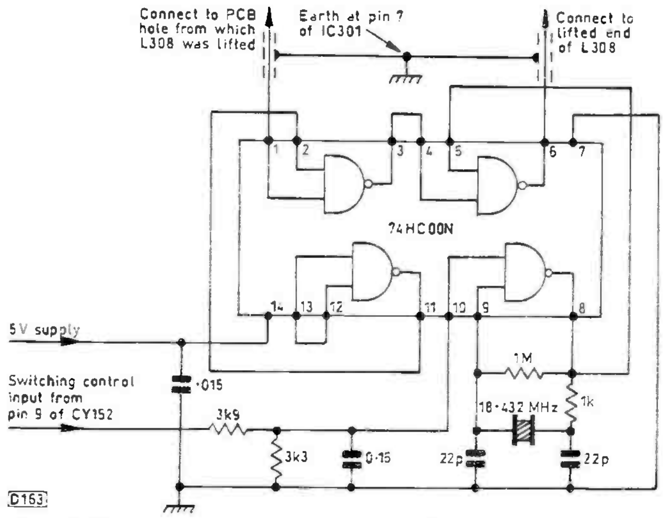


Fig. 5: Circuit to enable extra sound channels to be received with the Amstrad Models SRX100 and SRX200.

base). Find the 74HC00N chip, which is at approximately the centre of the PCB. Lift one end of L308 (next to pin 7 of the 74HC00N chip). Connect a screened lead from pin 1 of the 74HC00N chip on the modification board to the hole vacated by the lifted end of L308, with the screen connected to pin 7 (next to the L308 hole) of the 74HC00N chip in the receiver. Connect a screened lead from pin 6 of the 74HC00N chip on the modification board to the lifted end of L308, with the screen earthed as before. Take a 5V feed from pin 14 of the 74HC00N chip in the receiver to the modification board. Finally connect the switching control input to the modification panel (input end of the 3·9kΩ resistor) to pin 9 of CY152 (socket on the front vertical panel).

Once this has been done the extra two channels can be obtained by pressing the remote control unit's TV/SAT button (LED lights). AU1 and AU2 give 7·74MHz and 7·92MHz in the stereo mode, AU3/5 give 7·74MHz while AU4/6 give 7·92MHz. Pressing the TV/SAT button again returns the receiver to normal operation – when switched on the receiver operates in this mode.

Extra channels that can be received include Supergold (transponder 12), BBC Radio 1 and 5 (transponder 23) CNN Radio (transponder 28), Radio 538 (transponder 8), RTL-4 (transponder 13) and Asda f.m. (transponder 16), also numerous foreign language broadcasts via other transponders.

The crystal frequency should ideally be 18·44MHz, but such crystals are not readily available. Although the 18·432MHz Maplin crystal is 8kHz low it can be used since the f.m. demodulator's ceramic filters have a passband of 30kHz, which is well outside the minor frequency difference.

If you want to continue to use the TV/SAT button to control the TV receiver's switching, the wire going to pin 9 of socket CY152 will need to be removed and a switch fitted instead to provide manual selection of the additional audio channels. **D.F.**

Panasonic TUSD200

This Pace manufactured satellite receiver displayed a menu and produced good sound, but there was no picture. When I removed the board for examination I saw a small blue capacitor, C313, that was tacked on the bottom. One leg was dry. Resoldering this restored normal operation. **B.S.**

TV Fault Finding

Reports from Philip Blundell, AMIEIE, Brian Storm, Denis Foley, Terry Lamoon, Richard Flowerday, Richard Newman, John C. Priest, John Hepworth Mike Leach and John Edwards

Philips FL1.1 Chassis

Causes of the no results symptom with these sets can be many and varied, but if the set is in standby and when you switch it on via the remote control handset the mute, stereo and standby LEDs light up try checking the resistance between the 141V line and chassis. If you are lucky you will get a low-resistance reading because C2504 is leaky (my circuit says it's 2404, but the PCB is marked 2504). It's a blue, disc-ceramic capacitor similar to the type used in the 2A and CP90 chassis: the value varies between models but is around 1nF.

Handle the PCBs carefully when they are in the slides: if they are left hanging out too far without support cracks can occur at the edges of the large signal panel.

Faults we've had so far include a 'dead' set with all the front LEDs on, caused by lack of the POR signal because of an open-circuit in the track from the collector of Tr7272 to the small-signal panel jumper, and intermittent low width with no EW correction because of a crack in the track between R3608 and R3607. **P.B.**

Philips G110 Nicam Chassis

If you get one of these sets with short-circuit chopper and line output transistors, remove and inspect C2546 (8·2nF, 2kV). Replace it if there is any evidence of heat stress. **P.B.**

Philips GR2.1AA Chassis

This was a saga worthy of Noggin the Nog (remember him?), caused I suspect by lightning damage. At switch on I had e.h.t. but no sound, nothing on the screen and a flashing standby LED. The flashing LED indicates that a microcomputer error message is being generated. The manual gives the possible cause as an internal fault in the microcomputer chip, but I was not convinced about this as the set could be switched to standby and the LED's flash rate changed when a remote control command was given, indicating that the chip was at least partly working. Checks on the supply lines, the reset pulses, the brightness, contrast and beam limiter signals showed that these were all o.k., but the sandcastle pulse was wrong. A new TDA2579B sync/timebase generator chip corrected this. The LED stopped flashing and a blank raster appeared – still no sound. As a picture and sound were produced when external signals were applied, attention was turned to the i.f. (mono sound) module. A new TDA2549 brought back the picture while a new TDA3827 restored the sound. Thank goodness the teletext still worked! **P.B.**

Panasonic TX15M1T (Z4 Chassis)

The fault symptom was loss of sync. In this chassis the sync separator is on the teletext board. A check here showed that its video input was missing. It should come from the SAA5243 text processor chip IC3501, but didn't. So this many-legged beast was replaced. Unfortunately the fault remained as before. Checks on the serial clock and data lines showed that the pulses were of rather lower than normal amplitude. When pins 2 and 3 of the MAB8461-PW216 text control chip IC3507 were disconnected they were restored to a decent level. A new MAB8461-PW216 chip produced a nicely locked picture. I've since had this same fault with a **TX25X1** (Alpha 4 chassis). **B.S.**

Panasonic TX28A2X (Alpha 3 Chassis)

This set generated little green and red 'glitches' across the screen at irregular intervals. Perfect results were obtained with a text display, so the RGB output stages were ruled out. Eventually, and not surprisingly in this chassis, the cause of the trouble turned out to be a leaky ceramic capacitor, C649 (120pF). It's connected between pin 3 (R – Y input) of the picture transient improvement chip IC302 and chassis. **B.S.**

Panasonic TX28A1 (Alpha 2 Chassis)

This set would shut down after about twenty minutes and not come to life again unless pins 3 and 4 of the ON3105 optocoupler D811 were linked together. The set would then work perfectly. D811 is used as an isolator to couple the power-on signal to the live side of the power supply. In the fault condition this signal didn't get there. A new ON3105 put matters right. **B.S.**

Panasonic TX28A2 (Alpha 3 Chassis)

Poor teletext performance was the problem here: lines of text would be missing, or jumbled letters would come and go at random. The obvious suspect in this chassis is a small, yellow ceramic capacitor. And so it proved to be. C3507 was guilty as charged (or rather not as it was leaky!). It's connected to pin 9 of IC3501, the value being 100pF. **B.S.**

Philips CP110 Chassis

Sound was o.k. but there was no vision for the first ten minutes after switching on. In the fault condition e.h.t. was present and the tube's heaters were alight, but a check at the c.r.t. cathodes showed that the tube was cut off. A fruitless search in the luminance-chroma circuits and the microcomputer section got us nowhere. We eventually found that there was excessive ripple on the l.t. and h.t. supplies when the fault was present. Further investigation in the power supply lead us to the CNX62A optocoupler Tr7670 which turned out to be the culprit. **D.F.**

Hitachi NP81CQ Chassis

Excessive brightness occurred very intermittently with one of these sets - the fault was so intermittent that it sometimes didn't show up for several weeks. We eventually found that the 5·1V zener diode ZD802 on the tube base was the cause – it would sometimes 'zener' at 3V, thus overdriving the tube. **D.F.**

Philips G90AE Chassis

Intermittent tuning drift was the problem with this set. I started by changing the tuner unit, then the microcomputer chip. As this made no difference it was time to think about the fault. A check on the varicap voltage showed that it varied when it shouldn't. Why don't I check the obvious things first? The ZTK33B regulator D6770 was the cause of the problem. **D.F.**

Akura CX26

As this was the first 21in. Akura set I'd seen I took the back off and had a good look. The layout is quite tidy, with no real surprises. "Intermittently switches off" said the fault report. So I put the set, displaying a good picture, on the test bench. After about twenty minuts it started to cut out. I noticed that there was a severe line foldover as the set went off, so I concentrated on the line output stage. Some careful 'technical tapping' here narrowed the cause of the fault to the line scan coil plug which, on close inspection, turned out to be very badly soldered. Desoldering all the pins, cleaning and then resoldering them provided a complete cure. It wouldn't surprise me to see more of these sets with this particular problem. **T.L.**

Toshiba 175T9B

All that I could see when this set was switched on was about two inches of field scan lines. The rest of the screen was blank. I removed the back and had a tap around the field timebase area. Up came the full picture. On closer inspection I found a perfect dry-joint on C306, which is connected to pin 3 of the TDA2579-N6 sync/timebase generator chip Q340. After resoldering this joint I was rewarded with full scanning. **T.L.**

Matsui 1466

This set was completely dead. When I looked at it I found that it has a standard TDA4601-type power supply. Checks showed that the BU208 chopper transistor was short-circuit while the fuse was blackened. I replaced these items then checked the 270kΩ resistor associated with the TDA4601 chip. As usual it had gone high in value. After fitting a replacement I switched on and up came the picture. A nice, easy repair I thought. But the picture then slowly collapsed to a bright line. Checks showed that the 25V supply to the field timebase was o.k. but the 9V supply slowly disappeared due to the regulator breaking down. I replaced it and, with crossed fingers, switched on. This time the picture remained. **T.L.**

Akura CX26

We've repaired several of these sets with intermittent faults ranging from text problems to intermittently dead. The cause is usually dry or poorly soldered joints on the digital signals board, particularly where the top of the board is linked through to the bottom. The most common cause of problems is J746, which is a wire link under IC703. It becomes dry-jointed, the result being intermittent line drive. IC703 has to be removed to resolder the through-board links beneath it. Take every precaution against static when you do this – these chips are very sensitive to it. **R.F.**

Philips G110 Chassis

The owner of this Nicam set came to me with a tale of woe: it had apparently been elsewhere for six months and been returned as not worth repair because of major failure in the power supply. The set was very dead indeed. Anyone who has worked on these sets will know that they use surface-mounted components in the power supply, and that the print doesn't take kindly to rough handling. Fortunately the state of the print wasn't too bad, but much work had been done in this area.

I decided to start at the beginning and fit the recommended power supply kit. When this had been done a dummy load was fitted in place of the feed to the line output stage and the set was connected to a variac. At around 110V the power supply started up then faded away again. I soon discovered that the voltage provided by the mains bridge rectifier was low. This was because the wrong degaussing thermistor had been fitted – one section is used as a surge limiter.

When the correct type had been fitted the power supply started up but wouldn't regulate as the mains input was increased. Checks around the optocoupler revealed that Tr7652 (BC857C) was open-circuit. After fitting a replacement the power supply stabilised but the set-h.t. control was at one end of its travel. I checked the comparator circuit but everything here was o.k. Eventually I found that R3652 (220Ω) had almost doubled in value, affecting the operation of Tr7654 (BC817) and thus the current flowing through the optocoupler. A new chip resistor put this right and the set was returned to its delighted owner. **R.N.**

Philips GR1-AX Chassis

Here's a good one! This 14in. portable came in dead. Checks showed that the line output transistor was short-circuit, so a replacement was fitted. As there were no other obvious problems the set was then powered up. An odd squeak came from the line output transformer and the set promptly went dead. The line output transistor had failed again. I looked suspiciously at the line output transformer – I've had quite a few fail in this chassis. After fitting a new transistor and transformer the set worked. Feeling confident, I picked up the telephone to give the customer an estimate. But before I'd finished dialling the set had once more gone dead.

With a sinking feeling I found that yet another line output transistor had failed. Checks were made on various components in the line output stage, but the set could be kept on for only about two minutes otherwise the output transistor would fail. Scope checks showed that the line drive waveform at pin 27 of the TDA8305 sync/timebase generator chip IC7020 was very spiky and of incorrect shape. The chip itself was o.k., as were C2519 and C2059 in the output coupling circuit (to the line driver stage). It turned out that the faulty component was the small 3·3μH choke L5519, which is in series with the output from the chip. It presumably had a shorted turn. Anyway a choke salvaged from a scrap chassis restored the drive waveform to its normal shape and the set then ran with no further problems. **R.N.**

Philips CP110 Chassis

This set had a dead power supply. There was 300V at the collector of the BUT11AF chopper transistor but the start-up voltage at pin 9 of the TEA1039 chopper control chip was low at barely 1·2V. This voltage, which should be about 11V, can be checked only at switch on. It comes from the junction of C2656 (150μF) and C2661 (2,200μF) which are connected in series across the 300V supply. The chip was checked by substitution and proved to be o.k. I noticed that the 300V supply decayed very quickly at switch off, which provided the clue. C2656 was virtually open-circuit, a replacement restoring normal operation. **R.N.**

Mitsubishi CT25M1 (M1 Chassis)

Intermittent loss of sound and picture – just a blank screen – is a fault we've had several times with sets that use the M1 chassis. It may at first look like a fault in the tuner/i.f. section but the thing to do is to look for a video input and output at the AV analogue switch chip IC2A2. If there's no output with either an off-air or scart input suspect this chip, type M5132P, part no. 260P543050. If there's an output with a scart input but not an off-air signal suspect the JC501-QR transistor Q2A2 (part no. 266P064010) which drives IC2A2. If there's loss of the picture but the sound is o.k. check the JC501-QR video amplifier transistor Q104. Where the fault is very intermittent, replace all three devices. **J.C.P.**

Hinari CT15 and TVA1

The main PCBs used in these sets are almost identical, the differences between them being mainly in the front control panel (selector board). Both sets have remote control: the TVA1 also has a built-in LED clock display and a timer. The **Sentra Model GX9000** uses the same main PCB.

A common problem with these sets is intermittent failure to come out of the standby mode. The basic circuit diagram shows the mains on/off switch as being on the power panel (mains fuse and filter board). It's actually on the front panel (selector board), feeding a small mains transformer, rectifier and 5V regulator. These supply the SAA1290 tuning and analogue control chip IC001 and a pair of transistors (Q010 and Q011) that form a latch to drive relay T003 which in turn supplies 240V a.c. to the power supply on the main PCB.

If the set fails to come on, first check the mains input fuse F801 on the small mains input board and for 240V a.c. at points 83 and 84 on the main board (brown and blue wires). Listen to hear whether the mains on/off relay clicks when the standby button is pressed. If it doesn't operate, check the 5V supply on the front panel PCB, transistors Q010/011, the relay contacts and the relay itself. If the mains supply is present at the main board, check R801 and the bridge rectifier D801.

If 310V d.c. is present at pin 1 of the STR5412 regulator chip, check the start-up resistors R802/3 (both 100kΩ, 0·5W). Replace them if they have gone high in value. If they measure o.k., try shunting the pair with a single 470kΩ resistor. Where the fault has been intermittent this will probably restore normal operation, but the STR5412 should be replaced and the start-up circuit should be restored to its original state, i.e. fit a new pair of 100kΩ, 0·5W resistors in positions R802/3 and discard the 470kΩ resistor. **J.C.P.**

Toshiba 202T5B

The picture and sound were o.k. but the teletext display was very poor – it was illegible and all blue in colour. In addition the clock in the top right-hand corner wasn't running. I can't pretend that finding the cause was simple: we had to resort to chip substitution. The culprits were the two TMM2114AP-15 chips IC9 and IC10. Replacing them restored normal text. **M.L.**

Tatung 170 Chassis

One of these sets suffered from many very intermittent faults. The sync, brightness level, sound, tuning and various other things were affected. I've known the teletext panel to be responsible for intermittent faults in this chassis, so I resoldered the plug and socket on the text PCB. This made no difference at all – in fact the trouble was even worse. The faults were now much more intermittent and could be rectified by only slight pressure on any part of the main panel. After much panel flexing, prodding, soldering and tapping the cause of the fault was traced to the soldered rivets that connect the outer chassis to the main board. After desoldering, tightening and resoldering these rivets the intermittent faults had been cleared. **M.L.**

Sharp C095

We seem to be getting a lot of amnesia trouble lately with TV sets. This one regained its memory when R1072 (33kΩ) had been replaced. **J.H.**

Alba CTV743

The problems here were no sound and field collapse. R435, a 2Ω safety resistor, was open-circuit because D406 was short-circuit. **J.H.**

Mitsubishi CT2627

This set suffered from varying height and sometimes total field collapse. After much time had been spent soldering and tapping around in the field timebase a complete cure was achieved by replacing C412 and C413. **J.H.**

Loewe C8000

There was an ear-piercing whistle and we found that the h.t. was high and couldn't be controlled. C638 was leaky, a replacement providing a cure and relief for the ears. **J.H.**

NordMende F8 Chassis

A previous engineer had condemned the tube because the blue component of the picture was smeary. It read o.k. on the Dynascan however. So I began to carry out comparison checks in the RGB output stages and found that RV43 had gone high in value. A replacement restored a good picture for the set's age. **J.H.**

Ferguson 16A2 (TX90 Chassis)

This set was dead though the power supply was working. The cause of the fault was absence of the 150V h.t. supply because of an open-circuit between pins 6 and 9 of the line output transformer. A new transformer brought the set to life, but though stations could be searched for and found the set wouldn't memorise them. The M293B1 chip IC902 had failed. All was well when this chip had been replaced. **J.E.**

Samsung CI348Z

The complaint with this 14in. portable was no sound. We found that there were no voltages at any of the TDA2006 audio output chip's pins. There should be an 18V supply at pin 5. This comes via the standby relay, which provides a 125V supply via separate contacts. The 125V supply was present and correct of course but the 18V supply was present at only one contact. When we removed the relay and took the cover off we found that the contacts were very pitted. Redressing them carefully with a nail file restored normal operation and sound. **J.E.**

The one that beats us all

Roy Baines

We can deal with the Yakahami that rolls every Wednesday half way through Neighbours, can fix the one that records in monochrome when started by the remote control unit but works correctly when the on-board controls are used, and can bluff our way around the one that usually works all right but sometimes doesn't. The one that beats us all is the all-singing, all-dancing and never makes the tea when you want it customer.

One can only assume that the research and development department responsible for this model didn't invest enough, certainly not in standardisation. They all seem to differ and function in their own unique way. There are however some basic types. The ones I generally come across are as follows.

Type One

The first functions at peak performance in the sort of dwelling with which we're all too familiar. Approach is usually via the back gate, which is normally obscured by a rust highlighted Ford Cortina with fur seats, a whip aerial, hanging dice and a rear window sticker proudly proclaiming that they've fed the lions at Longleat. The back gate swings on one hinge but is held back by either a bike wheel or an expired lawnmower. The back door is fitted with hardboard so that the glass can be kept in safe custody.

After freeing yourself from the hanging-bead curtain that separates the kitchen from the lounge you finally encounter the customer. Sitting on a patched PVC couch wearing a string vest and braces, he clutches a Guinness bottle in one hand and the *Racing Times* in the other. He grunts something to the effect that the TV is u/s, and gestures at it with the fag hanging from the corner of his mouth.

Now you have to try to get to it. It's flanked on one side by a gold-flaked glass cocktail cabinet with authentic Sellotaped glass doors and a built-in clock with its hands missing, topped off with a Spanish flamenco dancer and various artifacts from a holiday in Majorca. On the other side there's a nondescript midi hi-fi system complete with cracked plastic lid and pile upon pile of Pickwick, Music for Pleasure and Columbia (remember them?) LPs made by pop stars now drawing their pensions. Under the TV there's a vast collection of shoes, always totalling an odd number. Perched on the top of the set, surrounded by pools coupons, fag coupons, broken jewellry and piles of unopened envelopes, you spot the customer's pride and joy – a copy of the *CB User's Guide*.

Why didn't you spot that clue to start off with? Why didn't you strike up a conversation initially to try to find out the nature of the problem? Why did you wait until you'd moved everything out, taken the back off and started the 'tap, tap please go wrong' session before being told by the customer, as he stands up and adjusts his lower clothing to a more suitable level, that the problem shows up only when he "10-4's his Good Buddy" on the CB? Back on, tools packed and out the door, leaving a call-out bill you know you've as much chance of getting paid as receiving those Hinari spares you've got on order. We never learn.

Type Two

This is the most normal of the various types: not too bothered when you call, reasonably understanding about your charges but always forgets having called you when you knock at the door. They are usually fairly talkative about things while you are working, coming out with such gems as "did you have to go to school to learn that?", "I wouldn't know where to start" and, after peering in the back, "and they call it wireless" or "is it just the valve?".

They then go on to tell you that their first set was a Bush, or was it a Murphy, that they had for thirty two years and never had a thing go wrong with it – it's still going strong in the spare room. You are asked if you are new to the job and, not listening to your answer, are then for no apparent reason told where they used to live. In my particular town the whole population at one time or another must have lived in Gladstone Street and were the first to have a television. It must have been one heck of a big house. When the repair is completed the bill is paid and everyone is happy.

Type Three

We now come to the Half Crown end of the market – stockbrokers, bank managers, yuppies etc. The Nicam, S-VHS and camcorder crowd. I often wonder who makes the most money out of camcorders – the manufacturers or Jeremy Beadle. When the door is answered you are normally left with the impression that you should have gone round to the back.

Wishing that you'd brought a machete to fight back the tufted Wilton, you find the entertainment corner, with either Queen Anne or black ash furnishing, both as easily marked, and switch on the grand's worth of equipment. You then stand and wait for a fault to show as Type Three has disappeared to the phone to arrange another dinner party or weekend trip, letting the other end know that he can't talk too long because "some chap has arrived to fix the box".

So you try all the functions, flicking the channels back and forth, in and out of the text mode, up and down with the sound. You take off the back, check for drys, solder here and there. Then Type Three reappears and matter-of-factly tells you that it's the video that is the problem. Before you get the chance to ask what this is he's back on the phone.

After finding the elusive problem you decide that it's a workshop job. You wait for the phone call to finish to say so and are greeted with "we've had it for only six months, it shouldn't have gone wrong already". Before you get back to the shop he's been on that wretched phone again, saying that the engineer didn't know what he was doing and that he wants a replacement as he paid £1,000 for his package. Why is it always £1,000? My answer to these is that "if you didn't expect it to go wrong why did you take out an extended warranty?" They can't answer that one – try it!

In Conclusion

When it comes to customers there are many types and variations. This brief, light-hearted survey should have shown that you're not the only one to come across these strange beings. Although life in our trade would be much easier without the customers, they do provide first-class entertainment. And, let's face it – to someone else we're the customers.

Long-distance Television

Roger Bunney

Judging by reports that have come in from around the UK August was a very active month for Sporadic E reception. This is abnormal – August usually sees a decaying end to the SpE season – but is welcome news in view of the otherwise indifferent results this year. The report is particularly interesting in featuring Band III and transatlantic SpE reception. There's a pretty full log, as follows:

5/8/93	PTT (Switzerland) chs. E2, 3; ARD (Germany) ch. E2; TVE (Spain) E3.
7/8/93	DR (Denmark) E3; TVE E2.
8/8/93	DR E3; CIS R2; +PTT E2; TVP (Poland) R2; NRK (Norway) E2, 3; MTV (Hungary) R1.
9/8/93	NRK E3; DR E3.
10/8/93	DR E3; NRK E3; SVT (Sweden) E2, 3; +PTT E2, 3; TVE E2, 3.
11/8/93	NRK E2, 3; DR E3; SVT E3.
12/8/93	CIS R1; TVE E2, 3; +PTT E2, 3.
13/8/93	TVE E2-4; NRK E2; +PTT E2, 3.
14/8/93	RAI (Italy) IA; TVE E2-4; CIS R1; CST (Czechoslovakia – either CTV or ST) R1.
15/8/93	+PTT E2, 3; NRK E2, 3; CST R1; RAI IA, B; TVA (Italy) IA; JRT (Yugoslavia) E4; TVE E4.
17/8/93	DR E3; +PTT E2.
21/8/93	RAI IA; TVE E3.
22/8/93	A very good day! NRK E2-4; SVT E2-4; DR E3-5; CIS R1-4; TVP R1-3; TVE E2, 3; CST R2; RTSH (Albania) IC; RUV (Iceland) E3, 4, 6, 7; unidentified Canadian/US ch. A2, 3 signals at 1310 local time.
23/8/93	TVE E2, 3.
24/8/93	RTP (Portugal) E2; TVE E2-4; TVE-2 E2.
25/8/93	CST R1; TVP R1; CIS R1, 2.
26/8/93	NRK E2-4; CST R1, 2; CIS R2.
27/8/93	TVE E2; DR E3.
29/8/93	TVE E3; DR E3; SVT E2.
30/8/93	RAI IA, B; TVA IA; ORF (Austria) E4; CST R1, 2; ARD E2; CIS R1; NRK E2, 3; Canal+ L2; TVE E2-4; +PTT E2.
31/8/93	DR E3.

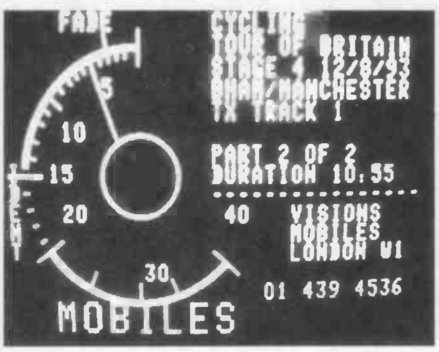
The excellent RUV loggings on the 22nd were by Simon Hamer in Powys: the signals consisted of teletext pages.

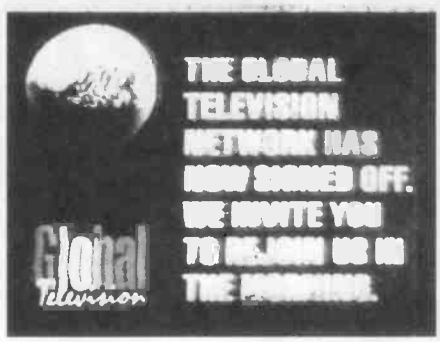
Meteor scatter (MS) propagation was active mid-month, peaking on the 13th with Band I and the occasional Band III pings. Tropospheric reception had its moments, with Band III/u.h.f. reception from the Benelux countries on the 14th and from France, Germany and the Benelux countries during the 17-19th, improving towards the 19th with Swiss reception as well. Roger Fussell (Torpoint) received Spanish ch. E5, E34 and E37 signals. Settled high pressure over the 29th-31st produced another boost, with reception from France and the Benelux countries and RTE (Ireland) chs. D, E, F, G, I and E43. The new DX flavour of the month is 'ZUID HOLLAND TV' on ch. E49 from Rotterdam, seen twice by Tim Anderson – it's only a 10kW e.r.p. transmitter.

Towards the end of the month I departed to Cornwall on holiday. On my return I noticed an obvious reduction in the level of my satellite signals: a family of spiders had taken up residence in the scalar rings of the feedhorn assembly!

News Items

Portugal: New identifications for the first and second TV services are Canal 1 and TV2 respectively.
Switzerland: A new channel, S-Plus, should now be on air.
Germany: The following transmitter e.r.p. increases have been notified: Chemitz ch. E8 500kW, Leipzig ch. E9 500kW, Dresden ch. E10 500kW, Schwerin ch. E11 500kW, Dequede ch. E12 2kW (all MDR-1), Hohbeck ch. E51 100kW (ORB-1). In addition Ochsenkopf ch. E4 (BR-1) is now vertical only.
Russia: The current electronic test pattern, type G204, has the facility for individual identification letters to be included.
France: TF1 is to launch a news channel next spring. The planned educational channel should also start next year, using ARTE network transmitters (formerly the La Cinq network) during the daytime hours.
Israel: It looks increasingly unlikely that the second TV channel will go on air this November as planned. The problems are to do with government financial and programme-making requirements.
Sri Lanka: Our correspondent Bandula Gunasekera reports that East-West TV is now on air. The initial service, provided by a 1kW transmitter atop the Star Building,





Left: A satellite TV OB sports feed via Eutelsat II F1 at 13°E. Photographed by John Locker, Mersyside. Centre: CKCO-TV, Kitchener, Ontario close-down colour bars, ch. A2 – a possible for double-hop reception in the UK! Right: Goodnight from Global TV, Ontario, ch. A7. Our thanks to Andrew Sykes of Halifax, Yorkshire for these last two shots, taken during a holiday in August.

Bambalapitiya, covers a twenty mile radius around Colombo. It's to be extended throughout the country during 1994. Channel allocations are E31, E32, E33 and E58.

Satellite TV

MTV has taken the last transponder aboard the ex-BSB satellite Marco Polo 1, now named Thor and restationed at 0·8°W. The satellite also offers CNN, Eurosport, Filmnet. Discovery and The Childrens' Channel, beaming its output towards Scandinavia

According to media reports the European Space Agency satellite Olympus has been shut down: at the time of writing this (early September) a carrier can be received from the craft but no programming has been seen for some weeks.

MCM-Euromusic is once more available from TDF at 19°W: Eurocrypt scrambling should be in use by the time that this is read.

Dutch Regional Channels

The following is a list of proposed channels for regional broadcasting in Holland.

Site	*Ch.*	*Pol.*	*E.R.P.*
Goes	E7	H	30kW
Dan Helder	E10	H	1kW
Franeker	E22	H	30kW
Eys	E22	H	10kW
Lelystad	E23	H	100kW
Franeker	E25	H	300kW
Franeker	E28	H	300kW
Amsterdam	E34	H	200kW
Markelo	E36	H	20kW
Groningen	E36	H	20kW
Ameland	E40	V	1kW
Gennup	E40	H	30kW
Roosendaal	E48	H	30kW
Brielle	E49	H	100kW
Roosendaal	E51	H	30kW
Ameland	E52	V	1kW
Brielle	E52	H	100kW
Roosendaal	E54	H	30kW
Alkmaar	E55	H	100kW
Lopik	E57	H	1,000kW
Ameland	E58	V	1kW
Arnhem	E58	H	32kW
Mierlo	E60	H	30kW

Wartime TV Reception in the UK

Andrew Emmerson of the 405-Alive group has recently been carrying out research into whether the German TV transmissions from the Eiffel Tower, Paris during the occupation were monitored in the UK for military intelligence purposes, in particular by the Post Office or any other government department, at a south coast receiving site. There was a TV receiving station at Beachy Head (we ran an article on the subject in the September 1983 issue) but it's thought that this was in operation for only a short time, on an experimental basis. The Paris transmissions were at 46MHz (ch. F1), with 441 lines. During the war there were claims that the transmissions were received at Alexandra Palace and Bulford Camp, Dorset. Several correspondents have mentioned a GPO repeater station at St. Margaret's Bay, near Dover.

The use of a very long coaxial cable link to London is most unlikely at that time. Equalised, balanced pairs were normally used for long-distance video transmission before the war, though there were several coaxial circuits around London to feed live OB signals to Alexandra Palace. Andrew and other researchers feel that reception of the Paris TV transmissions was not undertaken seriously on the south coast, and that there was almost certainly no relay back to London.

If any reader can shed any light on this subject, please write in. All letters will be passed on to Andrew.

Book Review

A Basic Guide to Colour TV and VCRs, by David Botto. Published by Electronics Australia.

David Botto will be well known to readers of this magazine as a technical writer who adopts a down-to-earth approach to his subject matter. This new 90-page paperback book of his was originally published as two series of articles in *Electronics Australia*. Its aim is to help newcomers and the relatively inexperienced to gain a sound knowledge of colour television, colour receivers, video recording and VCRs. The CTV part contains a clear account of PAL colour decoder operation while the video recorder section deals with signal processing, servo operation and system control. The book provides a basic introduction to these subjects and is a sound starting point for more detailed studies. Readers in the UK can obtain it by ordering from the Federal Publishing Co., Mail Order Department, PO Box 199, Alexandra, 2015, NSW, Australia. Enclose payment for Australian $10 in favour of *Electronics Australia* – the price includes postage and handling.

Service Briefs from Toshiba

As a follow-up to last month's briefs, the notes below provide additional information on various Toshiba TV models and a section on VCRs, again based on information published in Toshiba's *Technical Bulletins*.

TELEVISION

Models 2505DBT/2805DBT

Motorboating noise can be heard from all speakers in the standby mode – this fault is very intermittent: Cause is poor earth contact of the black anodised heatsink for IC609 and IC610 (which is incorrectly identified as IC601 on the underside of the PCB). The heatsink is earthed only by the location pin at the opposite end to the earth tag. Move the green earth wire fitted between socket M002A pin C and M002B pin C to fit between M002A pin C and the adjacent, surrounding area of already tinned earth print, after shortening the wire to approximately 3cm.

Low level of hum in the left-hand surround speaker in all modes, noticeable when Dolby Surround is slected and the volume is set low (two segments of the volume scale): Cause of the problem is that earth loops induce hum in the surround sound amplifier IC610. Carry out the action described above in connection with motorboating. Then add a PVC covered wire between pin C of M002A and pin C of M001A. In the unlikely event that the hum is still present, remove link JP403 adjacent to the Dolby PCB (near R676).

Very quiet ticking noise comes from the right-hand surround speaker. Present only when using Dolby Surround and noticeable only when the surround speakers go quiet with no signal: Cause is pick-up from the I2C data bus at pin 1 of IC611. Remove R610 (68kΩ) and jumper link J109 which is under the heatsink for IC611/IC608. Refit R610 in the J109 position. Fit a wire link in the position previously occupied by R610. To gain access to jumper J109 it's advisable to remove the heatsink and chips.

Blank raster and no sound. No response to remote control commands. No SDA and SCL outputs from the CX80424 microcontroller chip ICA01, both lines being stuck at 2V d.c.: The TA78L009AP 9V regulator QV22 for the TA8777N AV switch chip ICV01 on the back terminal PCB has become unsoldered. Resolder and ensure that the back terminal cover plate isn't pressing on QV22.

If failure of the TDA2030A chips (part no. 23319009) used in positions IC608/609/610/611 is experienced, check the speaker wiring as shorts here will damage them. A short-circuited TDA2030A will in some cases damage the chopper transformer T803, giving the dead set (current trip) condition.

Models 2527DB/2927BB/3327DB

Stuck in standby: The SFRN5A circuit protector ZP82 is open-circuit, possibly because the surround sound output chip ICS01 is faulty. Replace ZP82 (part no. 23144450) and if necessary ICS01 (part no. B0376856). If ICS01 has failed it's very important to replace the following four diodes (all type 1N4148, part no. 23115599) which may well have been damaged: DS01/2/3/7.

Model 215T8B

Low brilliance/contrast/poor focus – looks as if the c.r.t. has lost emission: The 3Ω resistor R920 in the c.r.t.'s heater supply tends to go high in value (may rise to 6Ω).

VCRs

Model V77B

Tuning drift or no tuning at all: Replace the 0·1µF capacitor connected across C025 in the VT line to the tuner. It tends to become leaky. Note that it's not shown in the circuit diagram (use the V83B service manual).

Model V83B

No playback colour: Can be caused by IC401, type BA72675, part no. 70119508.

Model V93B

Fuses F802 (1·25A) and F803 (1·6A) blow intermittently when the unit is switched from standby to on: Replace the ERC04-02F bridge rectifier diode D802, part no. 23118485, which can go open-circuit intermittently.

Models V110B and V210B

Mains transformer is noisy in standby: Fit a self-adhesive spacer, part no. 70050434, to the transformer so that it projects from the coil former through the plastic inner case to the cabinet. The cause of the problem is that the transformer's magnetic field resonates the VCR's cabinet: pressure on the right-hand side of the cabinet reduces the noise.

Fuse FP01 (630mA) fails for no apparent reason: Replace the 0·1µF mains filter capacitor CP01 with a 4,700pF capacitor that has a working voltage rating of 275V a.c. Quote RIFACAP as the part number. Cause of the problem is spikes on the mains supply or a poor quality wall socket.

Patterning on the screen in the standby mode/distorted playback and E-E pictures/no playback colour/an off-tune effect with playback and E-E signals/static interference even in standby (Model V210B)/no functions, machine laced up, crazy display – no data at IW18 from the KDB microcomputer chip: Replace the 2·7V zener diode DT53, part no. 70010160, in the Video +5V supply regulator circuit. The diode goes leaky, the fault symptoms varying with the output voltage from the regulator. Note that the circuit was altered in later production: refer to the service data for Models V211B/V411B for the later version.

Tuning drift or failure to tune in the higher channels: Replace the ZTK33B 33V regulator DP04, part no. 70010628, in the power supply.

Failure of the r.f. modulator: This is usually caused by customer misuse, the result being broken channel adjustment resistors.

For some faults with these models a full micro reset may be necessary to remove information memorised under the fault condition, otherwise the repaired unit may not operate correctly. Full reset is achieved by pressing and holding the timer and '–' buttons while applying a.c. power.

Note that two different drum assemblies have been used in Model V210B. Complete assemblies are interchangeable but parts of them, i.e. the upper drum, are not. If the letter M follows the model number on the rear label and the upper drum carries the letters MF, use complete drum assembly part no. 70030922 (upper drum part no. 70030918, lower drum part no. 70030921). If there are no extra letters use complete drum assembly part no. 70050148 (upper drum part no. 70030006, lower drum part no. 70030618).

Models V212B, V312B and V412B

Dead with no display, all power supply output voltages being at about half the correct figure, e.g. the 14V line being at 6-7V: Replace the ZPD3V9 zener diode DP15 which is short-circuit. Note that this zener diode is not shown on the circuit diagram. It's located under the 1·5Ω cement wire-wound resistor RP33 (difficult to see) on the component side of the power supply PCB.

No mechanical operation: Cam gear ref. B710, part no. 70011070, is probably jammed with stripped teeth. Replace this item (see pages 2-22 and 2-23 in the service manual for the correct assembly and alignment) and also the supply soft brake lever (an improved type, coloured black, comes with the replacement cam gear).

Failure to erase the previous sound track and slight coloured patterning on recorded pictures: The bias oscillator is inoperative – the symptom can be very intermittent. Improving the connection between the full-width erase head and its connecting cable will usually provide a cure.

Erasure of sound on prerecorded tapes and own recordings: Though the erase off command from the microcomputer chip is o.k. the bias oscillator continues to run in the playback mode because CL05 (0·01μF) in the oscillator stage is open-circuit. Replace it.

The cassette loads and the drum rotates but the machine won't play, going to standby. The cassette is then ejected but without the tape being reloaded into it: Resolder dry-joints at pins 8, 9 and 10 of connector BT06 – the +5V supply to the logic/servo chip IT01 is missing.

Slow rewind and fast forward: The MPS750 transistors TP81 and TP83, part no. 70010939, in the power supply are both leaky base-to-collector. As a result the power supply is not providing the capstan +14V and +18V supplies at pin 3 (UCAPST) of connector BP03. Replace TP81 and TP83, which are surface-mounted devices.

Intermittent poor playback (loss of output from one head) in the SP mode. Tapping the head preamplifier unit may clear the fault: Replace the surface-mounted capacitors CQ05 and/or CQ06, part no. 70040991. They go open-circuit (normally cracked). The wire-ended type can be used.

Model V300B

Dew sensor operates mistakenly, '- d -' appearing in the display: Resolder dry-joints at the connections on the loading-motor PCB.

Models V300B and V500B

Warble on sound: Replace the TD6361N servo chip IC501. Part no. is B0272617 with the V300B and B0272616 with the V500B.

Intermittent audio recording: Replace the lead between the ACE head and the full-erase head with new type, part no. 70160889.

Model V411B

Drum fails to rotate, just twitching when the tape is being loaded: Check that the capstan CTL drive is present at pin 3 of plug 152 on the capstan motor PCB. If this is o.k., replace the whole drum assembly, part no. 70050435.

The machine goes into a lock-up condition or ejects the tape if rewind or fast forward is used for approximately one minute or more in the LP mode only and play instead of stop is then pressed: An improvement is needed in the logic/servo chip circuit – add an extra transistor between pins 8 and 12 of IT01. Details are available from Technical Advice on 0276 694 555.

Model V610B

Faint white flashing lines are present across the screen with E-E pictures, playback of prerecorded tapes being o.k. Symptom is like that produced by poor aerial connections and is present only on channels above 45: Data bus noise is being picked in the Matsushita tuner. Replace with an Alps tuner, part no. 70121102.

Machine is dead with no Ever +6·5V supply: IC811's load coil L814 has shorted turns and is overheating. Replace coil, part no. 23103961, or the PCB if this has burnt.

Model V711B

Intermittently snowy picture, symptom looks like that produced by faulty heads: Resolder dry-joints at the lower end of the head connections on the lower drum.

Popping noise with Nicam reception: Replace the 6MHz filter ZD02, type TCF1073, with improved type TCF1083 (part no. 23303054).

Noises (popping, crackling) with hi-fi playback: F.M. envelope is poor because of incorrect entry S-guide setting or incorrect head switching position. Adjust as necessary using an alignment tape.

Servo Chip IC501

In Model DV90B this is type TD6361-C5, part no. B0272638; in Model V93B it's type TD6361-D5, part no. B0272628; in Model V300B it's type TD6361N-E5, part no. B0272617; in Model V500B it's type TD6361N-A6, part no. B0272616. It is not possible to interchange these chips.

Personal Digital Assistants

George Cole

The growing market for desktop, laptop, notebook and palmtop computers has been joined by a new machine, the Personal Digital Assistant (PDA). These are small portable computers that use a touch screen and an electronic pen or stylus instead of a keyboard or mouse. The term PDA covers a wide range of machines however, from upmarket electronic organisers to hand-held communications devices that offer fax, cellular and electronic mail (E-mail) facilities.

The first PDAs are being aimed at the mobile business user, but manufacturers hope and expect that they will establish a position in the consumer electronics market. The idea is that the PDA will help us to cope with the massive amount of information we use in our everyday lives, such as addresses, telephone numbers, details of meetings and appointments and diary dates. Many of the world's largest computer, consumer electronics and communications companies have jumped aboard the PDA bandwagon, and a number of models are to be launched in the UK later this year. One of these is Apple's Newton MessagePad.

The Apple MessagePad

Newton is the name that has been given to a technology developed by Apple Computer. It uses artificial intelligence to sort, store, organise and transmit information. The technology has been licensed to Matsushita, Motorola, Sharp and Siemens, and a number of business and consumer electronic products, such as telephones, faxes and VCRs, are expected to use it. Newton will make these products 'smarter' and easier to use. For example a VCR could have a touch screen and stylus, enabling you to enter programmes to be recorded by name: you could write say 'Coronation Street' and the machine would set its timer automatically to record the programme.

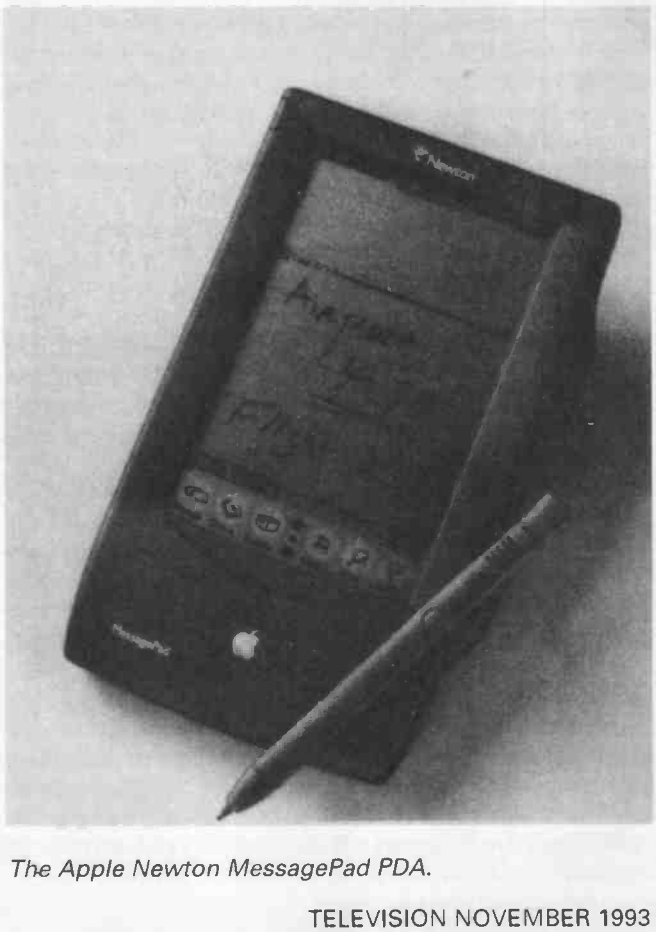
The first Newton product, which was launched in the USA on August 3rd, is the MessagePad, a hand-held device that weighs just 400g and measures 185 x 114 x 19mm. Power can come from the mains supply, four AAA batteries or a Nicad pack. A lithium battery preserves the stored data when the batteries are being charged. Apple says that alkaline batteries will provide enough power for two weeks' use, while a Nicam battery should last for about a week. Normal use is defined as six hours' operation per day.

The heart of the MessagePad is the powerful 32-bit ARM610 RISC (Reduced Instruction Set Computer) processor chip, which is being manufactured by VLSI, GEC Plessey Semiconductors and Sharp. It has 366,000 transistors packed inside a 144-pin package that's just 1·4mm thick. ARM is actually a consortium of companies set up by Acorn Computers, Apple Computer and VLSI in November 1990 to build on the work done by Acorn during the development of its Archimedes range of computers. These machines are mainly used in schools, and also employ 32-bit RISC processors. ARM's aim is to develop a family of RISC processors for various applications, one of them being the 3DO interactive multimedia player. RISC processors are faster and more power efficient than conventional microprocessors such as Intel's 80386 and 80486, which are known as Complex Instruction Set Computer (CISC) devices. This means that in comparison with RISC devices they use large numbers of instructions to carry out various processes. Newton requires a powerful processor that won't drain battery power, and the ARM610 fits the bill. This processor also switches off when MessagePad's operating system is idle. The ARM610 runs at 20MHz and is comparable with a 486 processor. On the storage side the MessagePad has 640Kbytes of RAM and 4Mbytes of ROM.

MessagePad is operated by a touch screen and stylus (see accompanying photograph). Beneath the touch screen there's a 336 x 240 pixel LCD screen produced by Sharp. The touch screen is a three-layer sandwich that consists of a mylar sheet with a transparent metal coating on its underside, a gel containing small plastic balls, and a glass plate with a transparent metal coating on its top side. When the stylus is pressed against the touch screen the plastic balls are pushed aside and the two metal coatings come into contact. Special software detects the resulting electrical resistance and calculates which pixels need to be switched on in the LCD screen to display the jottings.

MessagePad uses handwriting recognition software that can handle printed or cursive writing. Before you can use MessagePad you have to train it to recognise your writing. The unit uses a writing game to help it to do this. If MessagePad isn't sure about a word, it guesses. If the word is the wrong one you can select alternatives from a list. If the word isn't on the list you can use a built-in electronic keypad, tapping out the required word with the stylus.

MessagePad is the first commercial device to recognise



The Apple Newton MessagePad PDA.

cursive handwriting, which is an impressive feat. Apple cautions however that while a third of users will have few problems with their handwriting another third will require some training and the final third will need hours of training before Newton can understand their writing. Apple plans to offer free training sessions for owners who are struggling to cope with MessagePad.

You can draw diagrams on your MessagePad, which will smarten them up automatically. Words are erased simply by scribbling through them, while pages are scrolled through.

Newton intelligence is able to organise your information. For example you can write a message and then ask MessagePad to fax it to your colleague John – simply by writing "fax John". If it knows of more than one John, MessagePad will display a list of names that can be selected by pointing the stylus at them. Once the correct John has been identified MessagePad will type your scrawled message, generate a cover sheet and fax the contents. MessagePad will also automatically store names and telephone numbers in an address book, and appointments in a diary.

MessagePad uses PCMCIA (Personal Computer Memory Card Industry Association) cards which slot into the top. They are roughly the size of a credit card: MessagePad uses type II cards, which are 5mm thick. The cards can provide extra RAM (1 or 2Mbytes), ROM software such as guides and games, and extra features – a fax modem for example. Type III cards are 10·5mm thick and can include a miniature hard-disc drive. Future Newton designs may make use of them.

Features

MessagePad's strongest selling point is likely to be its communications features, which allow the user to send (and in some cases receive) information from a variety of sources. The simplest communication facility is an infra-red system that enables one MessagePad to beam information to another one.

The MessagePad can be connected to a printer or an Apple Macintosh or PC/Windows computer via a special connecting kit, while an optional fax/modem can be used to send (but not receive) faxes or to transmit and receive data. Also promised are paging and cellular communications add-ons.

Later this year Apple will start a Newton Electronic mail (E-mail) service in the USA, also an on-line system that will provide a variety of services. It sounds good – until you add up the cost of buying all the peripherals and subscriptions to the various services. One thing is for sure: keeping in touch whilst on the move is not going to be cheap. What's more European paging and wireless communications systems are in a state of flux. MessagePad will not be able to offer such facilities here until many issues have been resolved.

Apple says that it has many more Newton products in the pipeline. There are plans to introduce an optional keyboard for wordprocessing and a CD-ROM add-on.

As things stand, MessagePad is an interesting piece of technology that should appeal to many business users. But even Apple admits that it will have to become much cheaper before it can be a viable proposition in the consumer market. Meanwhile other companies are introducing PDAs.

Other PDAs

Apple isn't the first company to launch a PDA. That honour goes to Alan Sugar, whose Amstrad company introduced PenPad last March. It's a sophisticated electronic organiser with a pen interface. PenPad can't recognise cursive writing however: you have to print each letter in a separate box. Its communications facilities are limited but include an optional fax/modem. At £299 however PenPad is very appealing. It's much easier to use than electronic organisers that have a tiny keyboard.

Casio and Tandy have introduced a similar PDA called Zoomer. It costs $699 in the USA (about £460).

EO, a consortium of companies that includes AT&T, Matsushita and Olivetti, has launched the Personal Communicator in the USA. There are two A4-sized models at $1,999 (£1,300) and $2,999 (£1,999). The more expensive version includes a built-in cellular phone, a fax/modem and a voice annotation system.

IBM, Microsoft and Hewlett-Packard are also understood to be developing a range of PDAs.

Apple hopes that Newton will become the world standard for PDAs, allowing all such machines to communicate with one another. But the present mishmash of incompatible communications standards and a confusing choice of PDAs won't make this an easy task.

ANSWER TO TEST CASE 371

While all switch-mode power supply circuits work on the same principle of chopping the rectified mains input energy into pulses, there is a great deal of variation in circuit details between different makes and models. The test procedure and checks carried out by Roger in his attempts to track down the cause of the trouble would have probably been successful with many other chassis, but not with the Philips 2A and kindred chassis from this manufacturer.

When Ted measured the voltage across the 60W bulb he found that it was well in excess of the correct 140V. Application of this voltage to the line output stage resulted in higher than normal voltages being generated on all the LOPT-derived lines. One of these is sampled by the protection circuit, which triggers the crowbar thyristor Thy6698 in the event of excessive voltages in the line output stage. With the link between the power supply and the line output stage broken by disconnecting plug M, over-voltage protection was lost. That was why the power supply worked with a bulb as its load, even though it was producing much higher than normal outputs. With the line output stage connected, the initial squeak was produced as the power supply ran up to normal output, the following squawk occurring as the power supply changed to low-frequency operation under the influence of the damping action of thyristor Thy6698.

As Ted had suspected, the cause of the trouble was the CNX62 optocoupler, circuit reference 7668, which seemed to have gone partially open-circuit inside. It provides feedback regulation coupling between the secondary and primary sides of the supply. With a new CNX62 installed the set sprang to life, leaving Roger to set it up and puzzle about how much time to enter on the job card. . .

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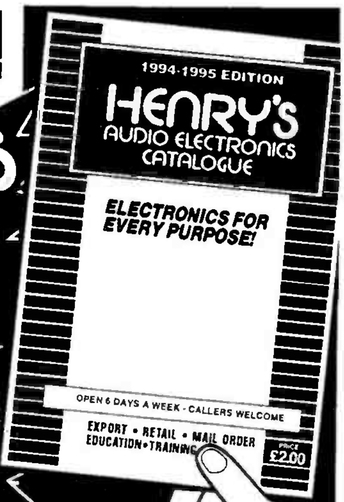

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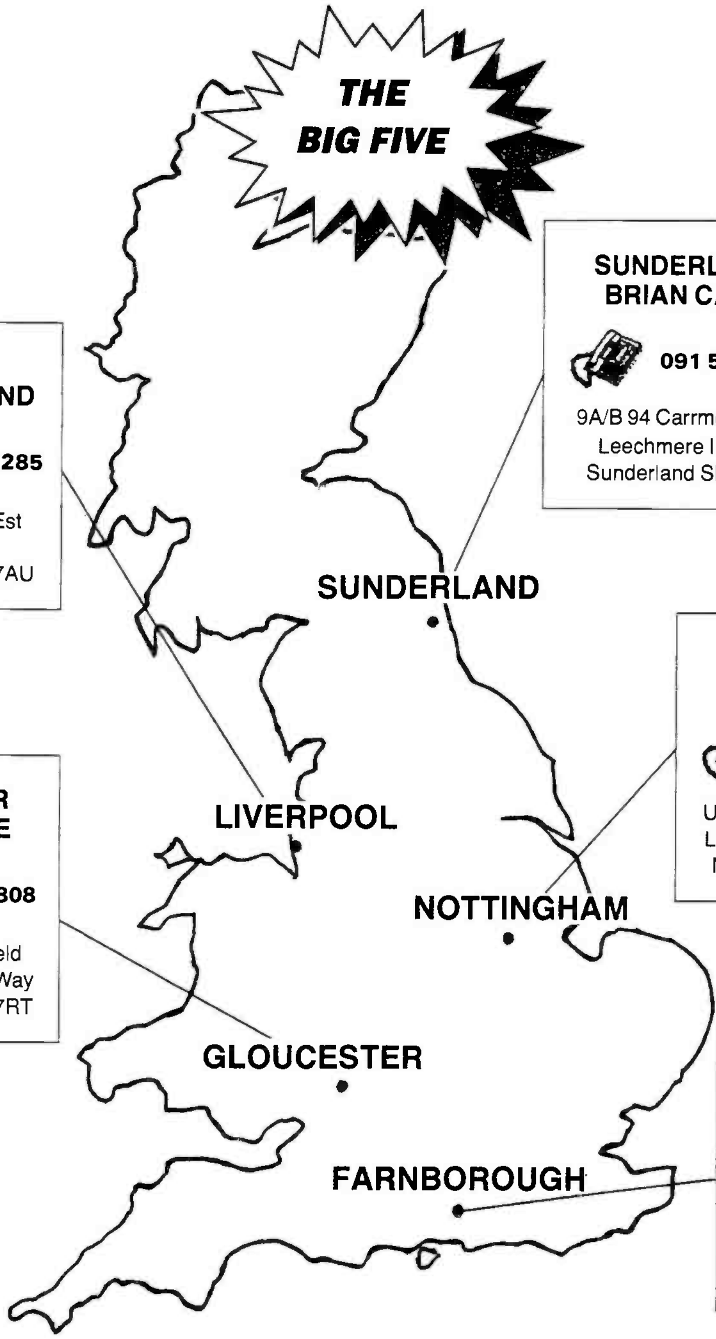

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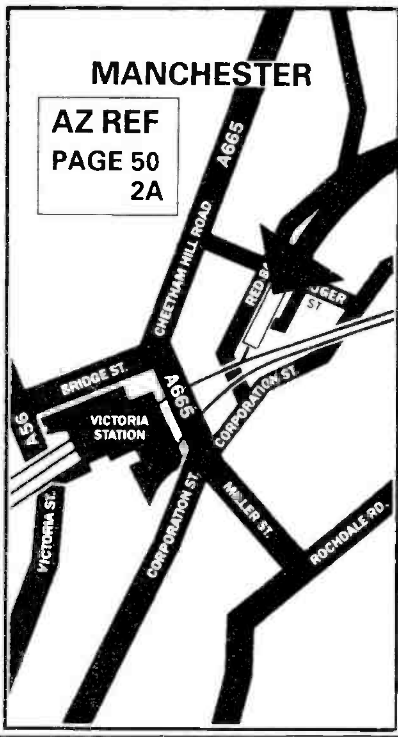

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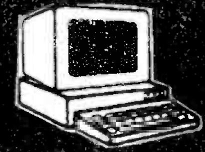

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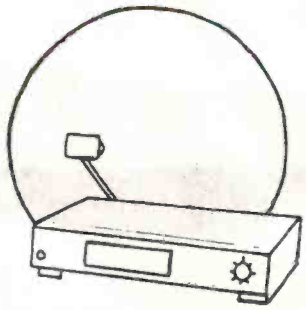

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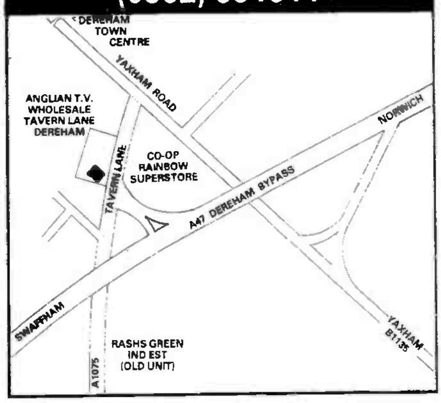

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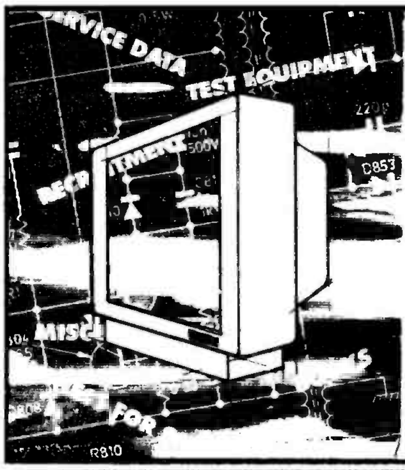

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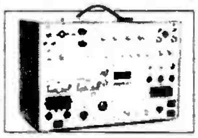

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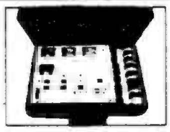

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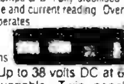

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BD139	30p
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TDA1150	50p
TDA1151	30p
TDA1154	50p
TDA1170S	£1.00
TDA1180	£2.00
TDA1190	£1.00
TDA1200	75p
TDA1270	£1.50
TDA1327A	69p
TDA1365	£3.00
TDA1512	£2.00
TDA1540P	£3.00
TDA1670A	£2.00
TDA1908A	£1.00
TDA2002	£1.00
TDA2003	25p
TDA2004	£2.00
TDA2006	£1
TDA2008	£2.00
TDA2010	£1.00
TDA2020	£1.00
TDA2030	£2.00
TDA2140	£3.50
TDA2160	£1.00
TDA2320	50p
TDA2545A	£1.00
TDA2600	£3.00
TDA2640	£2.00
TDA2522	£5.00
TDA2530	£1.50
TDA2532	£1.00
TDA2540	80p
TDA2541	£1.00
TDA2542	£1.00
TDA2545	£2.00
TDA2546	£2.00
TDA2556	£1.00
TDA2560	75p

TDA3565	£3.00
TDA2575A	£1.00
TDA2577A	£2.00
TDA2578A	£2.00
TDA2579A	£2.00
TDA2581	£2.00
TDA2591	£1.00
TDA2593	£3.00
TDA2560	50p
TDA2556	£1.50
TDA2600	£3.00
TDA2611A	£1.00
TDA2611AO	£1.00
TDA3651A	£1.00
TDA2653	£4.00
TDA2640	£2.00
TDA2593	£1.00
TDA3047	£1.00
TDA3048	£3.00
TDA3083	£2.00
TDA3190	£1.00
TDA3300B	£5.00
TDA3301	£3.00
TDA3505	£3.00
TDA3506	£3.00
TDA3561	£3.00
TDA3560	£4.00
TDA3561A	£3.00
TDA3566	£3.50
TDA3564	£4.00
TDA3565	£3.00
TDA3571A	£2.75
TDA3581	£3.00
TDA3590	£3.00
TDA3591	£1.00
TDA3592A	£3.00
TDA3650	£7.00
TDA3651	£3.00
TDA3651AQ	£3.50
TDA3652	£3.50
TDA3653AO	£2.00
TDA3654	£2.00
TDA3654Q	£2.00
TDA3710	£3.50
TDA3800	£4.00
TDA3180	£2.00
TDA4260	50p
TDA4501	£3.00
TDA4505NE	£3.00
TDA4420	£2.00
TDA4439	£2.00
TDA4600	£3.00
TDA4601	£2.00
TDA8190	£3.00
TDA8703	£3.00
TDA8349	£3.00
TDA9403	£1.50
TDA9503	£3.00
TDB2033	£1.00
TDD1610S	50p
TD6306P	£2.00
TDA1060	£3.00
TEA1009	50p
TEA1039	£2.00
TEA1060	£2.00
TEA2017	£2.00
TEA2029C	£3
TEA5114	£1.00
TDA3300B	£6.00
SIL4516	50p
SN16861NG	50p
SN16862AN	£1.00
SN16964AN	50p
SN29764AN	£1.00
UA721	40p
UA7300	40p
MPS43A	25p
MJ13005	30p
MJE51T	25p
MJE340	28p
MJE660	25p
MJE661	25p
MJE3055	£1.00
MJE2801	30p
MJE2955	50p
MJE13005	50p

Transistors

A1222	25p			BF181	20p
A1223	25p			BF182	20p
A1233	25p			BF185	20p
AC106	25p			BF194	10p
AC121	25p			BF195	10p
AC124	25p			BF196	10p
AC128	25p			BF197	12p
AC137	25p			BF198	10p
AC151	25p			BF199	10p
AC131	25p			BF200	20p
AC138	25p			BF222	10p
AC152	25p			BF224	15p
AC153K	25p			BF238	20p
AC142K	25p			BF240	16p
AC169	25p			BF244	40p
AC176	25p			BF245b	20p
AC178K	25p			BF255	20p
AC179	25p			BF256	20p
AC186	25p			BF257	20p
AC188	25p			BF258	25p
ACY21	25p			BF262	15p
AD143	50p			BF263p	25p
AD149	50p			BF264	15p
AF17A	25p			BF271	10p
AF139	25p			BF273	10p
AF181	£1.00			BF274	10p
AF239	25p			BF324	25p
AF367	25p			BF337	50p
AL102	£1.75			BF355	30p
BLY49	50p			BF362	20p
BF115	20p			BF363	15p
BF121	20p			BF367	15p
BF127	20p			BF391	15p
BF137	20p			BF394	10p
BF157	20p			BF419	30p
BF160	20p			BF422	15p
BF161	20p			BF423	15p
BF164	60p			BF448	30p
BF179	30p			BF470	30p
BF180	20p			BF471	30p
				BF597T	10p
				BF694	10p

Thorn Transformers

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

I.C.s

MA721PC	£1.00	UPD114LC-2	£1.00
M50430-8505P	£1.00	MN1250BJC	£1.00
TD6359P	£1.00	M50441-5505P	£1.00
M58657P	£1.00	M491BB1	£4.00
PCD8572	£1.00	HA513385	£1.00
HD741IC86P	£1.00	14DN 728A	£4.00