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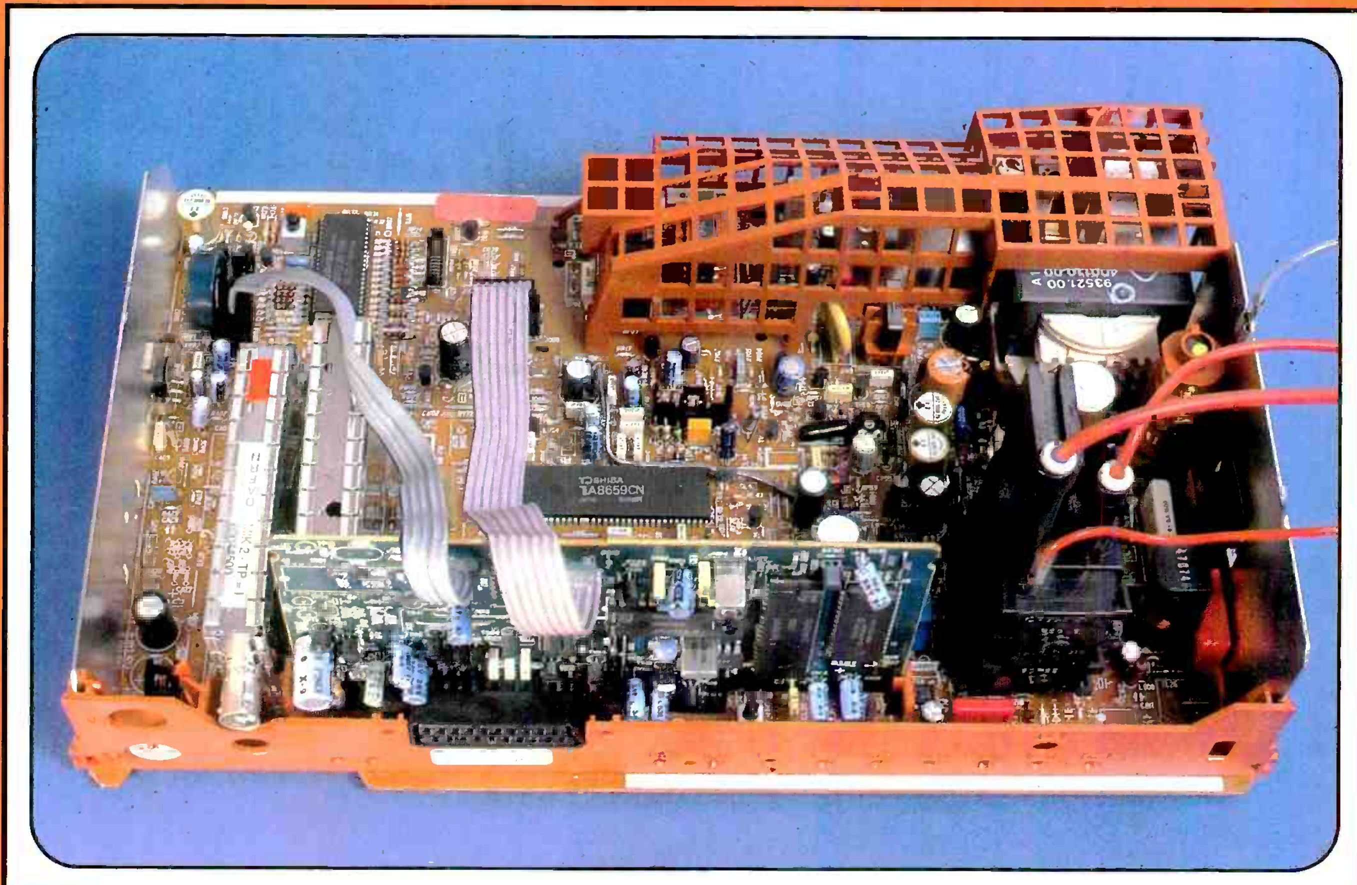
TELEVISION

SERVICING·VIDEO·SATELLITE·DEVELOPMENTS



Inside the Ferguson IKC2 Chassis

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Audio Systems for TV Receivers

Electrolytic capacitor ESR Meter

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TV Fault Finding · VCR Clinic

A REED BUSINESS PUBLICATION

TELEVISION

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BCY72	16p
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BD132	25p
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BDW94	50p
BDY92	100p
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BUT56A	150p
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BUZ71	75p
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OC35	350p
OC36	250p
OC45	50p
OC72	50p
OC200	180p

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T2800M	72p
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VN10KM	60p
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VN88AF	115p
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2N5088	20p
2N5192	50p
2N5241	500p
2N5245	45p
2N5294	30p
2N5296	30p
2N5366	25p
2N5401	12p
2N5448	12p
2N5496	80p
2N6107	40p
2N6292	40p

2N6385	120p
2N6403	160p
3N143	65p
DIODES	
Rectifier Diodes	
BY127	8p
BY133	8p
BY164	40p
BY179	35p
BY184	32p
BY196	20p
BY206	11p
BY207	11p
BY210	22p
BY225	120p
BY227	19p
BY228	28p
BY296	20p
BY298	23p
BY299	22p
BYX10	15p
BYX55/350	30p
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	60p
I.C. SOCKETS	
8PIN	5p
14PIN	6p
16PIN	7p
18PIN	10p
20PIN	12p
22PIN	13p
24PIN	14p
28PIN	16p
40PIN	18p
ZENERS	
400 MW	
BZY88 RANGE	
2V7 to 39V	5p
1.3W	
BZX61 RANGE	
2V7 to 39V	9p
CRYSTALS	
Freq In MHz	
1.0	260p
2.4576	180p
3.276	115p
4.0	110p
4.194	130p
4.43	95p
5.0	130p
6.0	115p
10.0	140p
11.0	250p
12.0	120p
14.756	200p
15.0	160p
18.0	130p
18.432	130p
24.0	250p
48.0	160p
VOLTAGE REGULATORS	
7805	25p
7806	25p
7808	25p
7812	25p
7815	25p
7818	25p
7824	25p
7905	25p
7906	30p
7908	30p
7912	30p
7915	30p
7918	30p
7924	30p
78L05	24p
78L08	24p
78L12	24p
78L15	24p
78L18	24p
78L24	24p
79L05	35p
79L08	35p
79L12	35p
79L15	35p
7818KC	100p
7824KC	100p
LM309K	100p
LM317K	200p
LM317T	100p
LM323K	350p
LM723	35p
78H08KC	800p
78H12KC	700p
79HGKC	800p
VALVES	
DAF96	100p
DY87	80p
EB91	50p
EBF80	60p
EBF89	60p
ECC84	80p
ECH83	100p
ECH84	90p
ECL80	65p
ECL82	80p
ECL84	100p
ECL85	80p
EF85	80p
EF183	75p
EF184	85p
EL34	300p
EL95	85p
EL500	100p

EY86	70p
EY87	70p
EY88	80p
PC97	100p
PCC85	60p
PCF80	100p
PCF801	110p
PCF802	80p
PCF806	115p
PCH200	100p
PCL81	65p
PCL82	80p
PCL84	60p
PCL85	80p
PCL805	80p
PFL200	110p
PL36	120p
PL83	60p
PL84	80p
PL95	180p
PL504	120p
PL508	200p
PL519	430p
PY81	100p
PY88	100p
PY500A	190p
LED's	
3mm	
RED	5p
YELLOW	8p
GREEN	8p
5mm	
RED	5p
YELLOW	8p
GREEN	8p
RECTANG. LED's	
5mm × 2.5mm	
RED	5p
YELLOW	8p
GREEN	8p
LINEAR IC's	
AN203	210p
AN210	165p
AN214Q	170p
AN228	280p
AN240P	130p
AN252	150p
AN259	250p
AN262	140p
AN271	230p
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
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AN3830K	800p
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AN7115	150p
AN7116	90p
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AN7156	240p
AN7168	260p
AN7178	270p
AN7222	180p
AN7254	150p
AN7256	250p
AN7310	90p
AN7311	90p
AN7410	250p
AY3-1015	290p
AY3-1270	800p
AY3-1350	450p
AY3-8910	360p
AY3-8912	400p
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BA313	60p
BA333	100p
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BA402	60p
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BA534	290p
BA536	180p
BA546	180p
BA612	160p
BA656	150p
BA658	380p
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BA685	400p
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BA1360	160p
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BA5204	200p
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BA7022	350p
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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
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HA1394	280p
HA1397	250p
HA1398	240p
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LA1185	150p
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LA2000	150p
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LA4440	230p
LA4445	200p
LA4460	130p
LA4461	130p
LA4500	200p
LA4505	220p
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LINEAR ICs — Cont.

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JAPANESE TRANSISTORS

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2SC3975	275p
2SC3987	100p
2SC3996	1200p
2SC4006	100p
2SC4020	280p
2SC4023	325p
2SC4056	150p
2SC4106	200p
2SC4123	450p
2SC4124	250p
2SC4169	60p
2SC4236	550p
2SC4237	750p
2SC4242	200p
2SC4262	50p
2SC4301	550p
2SD198	180p
2SD199	280p
2SD200	210p
2SD201	260p
2SD257	195p
2SD313	40p
2SD315	75p
2SD325	45p
2SD330	110p
2SD348	460p
2SD357	40p
2SD358	40p
2SD371	240p
2SD380	650p
2SD381	80p
2SD388	170p
2SD389	90p
2SD400	20p
2SD401	50p
2SD402	120p
2SD415	120p
2SD424	400p
2SD426	150p
2SD427	150p
2SD438	45p
2SD467	60p
2SD468	25p
2SD471	75p
2SD525	70p
2SD526	70p
2SD545	60p
2SD549	120p
2SD551	400p
2SD555	500p
2SD560	150p
2SD571	80p
2SD575	530p
2SD600	80p
2SD601	40p
2SD602	60p
2SD612	100p
2SD613	70p
2SD636	50p
2SD637	30p
2SD638	60p
2SD639	60p
2SD640	350p
2SD642	50p
2SD655	60p
2SD661	60p
2SD666	70p
2SD667	50p
2SD668	120p
2SD669	60p
2SD673	250p
2SD676	350p
2SD716	115p
2SD717	180p
2SD718	100p
2SD722	240p
2SD725	350p
2SD734	60p
2SD741	120p
2SD743	130p
2SD756	100p
2SD757	120p
2SD758	140p
2SD762	140p
2SD763	140p
2SD768	180p
2SD772	200p
2SD773	40p
2SD774	60p
2SD777	400p
2SD784	650p

2SD736	100p
2SD737	80p
2SD738	100p
2SD739	80p
2SD792	400p
2SD794	100p
2SD795A	140p
2SD811	450p
2SD819	400p
2SD820	450p
2SD821	550p
2SD822	400p
2SD826	100p
2SD836	150p
2SD836A	200p
2SD837	80p
2SD838	400p
2SD841	160p
2SD844	200p
2SD845	250p
2SD850	260p
2SD856	80p
2SD858	250p
2SD863	60p
2SD864	200p
2SD866	120p
2SD866A	140p
2SD868	450p
2SD870	400p
2SD871	450p
2SD879	60p
2SD880	40p
2SD882	80p
2SD892A	100p
2SD894	120p
2SD895	200p
2SD896	200p
2SD898	400p
2SD905	450p
2SD916	130p
2SD917	300p
2SD921	320p
2SD923	360p
2SD946	120p
2SD947	100p
2SD950	300p
2SD951	100p
2SD957A	520p
2SD958	80p
2SD965	100p
2SD970	170p
2SD973	60p
2SD973A	70p
2SD985	120p
2SD986	120p
2SD1012	50p
2SD1020	40p
2SD1021	120p
2SD1022	400p
2SD1024	130p
2SD1030	75p
2SD1031	130p
2SD1037	750p
2SD1046	200p
2SD1047	225p
2SD1051	130p
2SD1060	150p
2SD1062	150p
2SD1063	200p
2SD1064	250p
2SD1065	200p
2SD1066	150p
2SD1071	450p
2SD1072?	300p
2SD1073	350p
2SD1088	150p
2SD1094	520p
2SD1110	225p
2SD1111	60p
2SD1113	225p
2SD1128	200p
2SD1133	100p
2SD1135	150p
2SD1138	80p
2SD1140	40p
2SD1142	350p
2SD1148	175p
2SD1151	50p
2SD1159	90p
2SD1160	150p
2SD1163A	220p
2SD1164	120p
2SD1168	425p
2SD1169	280p
2SD1173	350p
2SD1185	400p
2SD1186	400p
2SD1187	250p
2SD1189	125p
2SD1190	150p
2SD1191	120p
2SD1192	90p
2SD1196	150p
2SD1197	150p
2SD1207	50p
2SD1210	280p
2SD1211	120p
2SD1218	75p
2SD1223	75p
2SD1225	120p
2SD1227	40p
2SD1229	250p
2SD1237	300p
2SD1246	30p
2SD1247	40p
2SD1248	270p
2SD1251	180p
2SD1254	90p
2SD1264	120p
2SD1265	75p
2SD1266	180p
2SD1267	100p
2SD1267A	125p
2SD1271	200p
2SD1272	200p
2SD1273	100p
2SD1274	160p
2SD1275	200p
2SD1276	60p
2SD1277	190p
2SD1279	600p
2SD1288	175p
2SD1289	300p
2SD1291	400p
2SD1292	60p
2SD1297	425p
2SD1302	40p
2SD1308	140p
2SD1309	140p
2SD1310	140p
2SD1313	1000p
2SD1326	200p
2SD1328	60p
2SD1347	70p
2SD1348	85p
2SD1349?	150p
2SD1376	125p
2SD1379	100p
2SD1380	100p
2SD1383	100p
2SD1384	50p
2SD1389	200p
2SD1390	150p
2SD1391	350p
2SD1392	150p
2SD1395	150p
2SD1396	240p
2SD1397	175p
2SD1398	130p
2SD1399	300p

2SD1400	280p
2SD1402	280p
2SD1404	125p
2SD1406	80p
2SD1407	160p
2SD1408	125p
2SD1409	170p
2SD1412	100p
2SD1413	175p
2SD1414	700p
2SD1415	190p
2SD1417	125p
2SD1425	360p
2SD1426	350p
2SD1427	380p
2SD1428	360p
2SD1429	410p
2SD1430	280p
2SD1431	400p
2SD1432	400p
2SD1433	750p
2SD1438	140p
2SD1439	270p
2SD1441	380p
2SD1445	200p
2SD1448	140p
2SD1450	60p
2SD1451	260p
2SD1452	350p
2SD1453	140p
2SD1455	250p
2SD1457	220p
2SD1459	120p
2SD1468	60p
2SD1471	200p
2SD1487	225p
2SD1491	100p
2SD1494	300p
2SD1496	450p
2SD1497	350p
2SD1505	120p
2SD1507	60p
2SD1509	100p
2SD1511	100p
2SD1519	250p
2SD1521	70p
2SD1541	350p
2SD1548	250p
2SD1554	500p
2SD1555	450p
2SD1556	700p
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2SD1565	75p
2SD1571	200p
2SD1577	100p
2SD1576	450p
2SD1577	480p
2SD1579	120p
2SD1589	100p
2SD1590	100p
2SD1591	310p
2SD1593	125p
2SD1597	160p
2SD1604	200p
2SD1608	210p
2SD1609	70p
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2SD1632	500p
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2SD1637	50p
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2SD1640	260p
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2SD1877	250p
2SD1878	300p
2SD1879	275p
2SD1884	300p
2SD1886	450p
2SD1887	450p
2SD1896	300p
2SD1910	280p
2SD1911	400p
2SD1913	50p
2SD1924	60p
2SD1930	75p
2SD1941	500p
2SD1951	280p
2SD1961	50p
2SD1978	50p
2SD1984	150p
2SD2012	50p
2SD2058	50p
2SJ44	425p
2SJ49	425p
2SJ50	425p
2SJ56	700p
2SJ74	60p
2SJ75	280p
2SJ77	220p
2SJ78	350p
2SJ79?	225p
2SJ99	75p
2SJ103	40p
2SJ106	40p
2SJ108	60p
2SJ113	525p
2SJ115	1000p
2SJ116	650p
2SJ117	600p
2SJ118	600p
2SJ119	700p
2SJ120	800p
2SJ161	650p
2SJ162	680p
2SK19	45p
2SK30	50p
2SK33	50p
2SK55	100p
2SK68	100p
2SK68A	100p
2SK105	75p
2SK106	40p
2SK107	40p
2SK109	120p
2SK117	50p
2SK125	1000p
2SK133	650p
2SK134	415p
2SK135	415p
2SK147	160p
2SK150	150p
2SK162	115p
2SK163	40p
2SK168	40p
2SK176	800p
2SK192	45p
2SK195	150p
2SK197	140p

2SK214	170p
2SK216	200p
2SK217	35p
2SK218	400p
2SK240	140p
2SK270	50p
2SK294	350p
2SK310	200p
2SK312	750p
2SK315	70p
2SK320	120p
2SK322	140p
2SK323	130p
2SK358	300p
2SK370	40p
2SK371	40p
2SK386	600p
2SK388	850p
2SK405	450p
2SK413	500p
2SK414	500p
2SK415	500p
2SK429	180p
2SK511	450p
2SK513	325p
2SK517	200p
2SK531	350p
2SK534	700p
2SK537	900p
2SK538	450p
2SK539	1100p
2SK555	400p
2SK556	500p
2SK557	400p
2SK566	475p
2SK695	550p
2SK719	300p
2SK724	600p
2SK725	600p
2SK727	1200p
2SK735	600p
2SK758	300p
2SK787	1100p
2SK794	500p
2SK872	950p
2SK901	500p
2SK1057	600p
2SK1058	800p
2SK45	100p
2SK51	100p
2SK59	100p
2SK73	60p
2SK74	50p
2SK77	50p
2SK81	50p
2SK85	160p
2SK87	45p
2SK88	70p
2SK121	150p
2SK129	175p
2SK165	225p
2SK166	300p

COMPUTER ICs

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
6815	380p
6840	290p
6845	200p
6850	90p
6880A	380p
8085A	300p
8086	500p
8088	480p
8156	300p
81LS95	130p
81LS96	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	60p
75110	70p
75113	100p
75122	110p
75150	95p
75154	100p
75172	700p
75182	95p
75183	95p
75188	55p
75189	55p
75195	185p
75451	40p
75454	65p
75492	55p
8T26	95p
8T28	110p

SIMMS

256Kx9 80	1000p
256Kx9 70	1100p
1MBx9 80	3000p
1MBx9 70	3200p

SIPS

256Kx9 80	1100p
256Kx9 70	1200p
1MBx9 80	3100p
1MBx9 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
4N39	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	[illegible]
BR34 3A 400V	[illegible]
BR36 3A 600V	[illegible]
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	[illegible]
BY179 1.5A 800V	40p

TRIACS

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

THYRISTORS

2N5061 0.8A 60V	[illegible]
C106D 4A 400V	28p
TIC116C 8A 300V	59p
TIC116D 8A 400V	70p
TIC116M 8A 600V	79p
TIC126D 12A 400V	75p
TIC126M 12A 600V	90p
BR103	37p
BR303	[illegible]
BT106	[illegible]
BT116	[illegible]
BT119	[illegible]
TIC44	[illegible]
17088	[illegible]
17089	[illegible]
17127	[illegible]
15 80R	[illegible]
15 85R	[illegible]
SG264	[illegible]
SG613	800p

SERVICE AIDS

SERVISOL PROOUCTS

VIDEO HEAD CLEANER	[illegible]
SWITCH CLEANER	[illegible]
SILICONE GREASE	[illegible]
FREEZE IT	[illegible]
FOAM CLEANER	[illegible]
ANTISTATIC	[illegible]
AEROKLEANE	[illegible]
AERO DUSTER	[illegible]
PLASTIC SEAL	[illegible]
GLASS CLEANER	[illegible]
COLDKLENE	[illegible]

IF YOU PURCHASE MORE THAN ONE SERVISOL PRODUCT P&P WILL BE CHARGED AT 300p

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VS512 515 516 £28.00
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HR3660 HR7600 HR7610 HR7650 HR7700 HRD110 HRD111 HRD120 HRD121 HRD220 HRD225 HRS100 £6.50

FERGUSON 3HSSL PIN

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

FERGUSON

3947 8948 3V42 3V44 3V45 3V46 3V47 3V52 3V54 3V55 3V56 3V57 £15.50
3950 8951 3V64 FV10 FV11 3V65 FV20 FV21 FV22 FV26 £17.00
3V48 £24.50
3V43 3V53 £31.50
8930 8940 3V29 3V30 £7.50
3V41 £24.00
3V00 £10.00
FV31 £22.00
FV37 £38.00

JVC

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

JVC & FERGUSON

3V32 8942 HR7655 £23.00
HRD180 230 3V59 FV12L FV20B FV22 26 30 32 33 £30.50
HRD370 3V58 FV13H HRD430 HRD470 £27.00
HRD530 700 FV14T £33.50
GRC1 GRG2 3V41 £30.00

LOGIK

VR960 £16.00
VR950 £16.00

LOEWE

OC410 420 440 £24.00
OC50 OC55 OC60 OC65 £15.00

LUXOR

9225 £21.50

MATSUI

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

MITSUBISHI

HS303 HS304 HS320 HS700 £19.50
HS306 HS318 HS710 £20.00
HS307 £37.00
HS319 £37.00
HS330 £32.00
HS400 £29.00
HS349 £28.00
HS411 £32.00
HSE30 £28.00
HS338 £28.00
HSE11 £37.00
HS300 HS301 HS302 HS310 £18.50
HS200 £6.50
HS337 HS347 £22.00

NATIONAL PANASONIC 4HSS-3HSSN

NV3000 NV300 NV7200 NV333 NV7500 NV7800 NV7850 NV322 NV332 NV340 NV390 NV2000 NV2010 NV7000 NV8170 NV8200 NV8400 NV8600 NV8610 NV8620 £6.25

NATIONAL

NV777 NV330 £17.00
NV430 AG1000 £11.00
NV280 NV460 470 480 £16.50
NV730 NV770 (4 HEAD) £18.50
NV366 £18.50
NV180 NVD48 £23.00
NV370 NV380 NV100 NV630 £8.50
NV788 £36.00
NV810 NV830 £30.00

NATIONAL Cont.

NV850 NV950 £35.00
NV870 NV890 NV970 £39.00
NVG33 NVG46 NVL23 NVL25 NVL28 £38.00
NVG30 NVG31 NVG40 NVG130
NVJ30 NVL20 £20.00
NVG10 NVG11 NVG12 NVG14 NVG16
NVG120 NV250 NV280 NV450 NV465 £16.50
NVG18 £25.00
NVG20 NVG21 NVG22 NVG25 NVG28
NVG200 NVD48 £25.00
NVG50 NVG300 £30.00
NVG45 NVG46 £30.00
NVH70 £50.00
NV688 £25.50
NV600 £23.00
AG 6800 6810 £39.00
AG 6100 6200 6300 £32.00
NVH65 £50.00
NVG7 NVG9 NV230 £18.00
NV780 £36.00
NVG15 NVG400 £48.00
NVM7 NVMC20 NVF70 £52.00

N.E.C.

N9011 N9012 N9013E N9014E N9014G N9015 N9016 N9016A N902A N9033 N9034 N9054 N9063 N9065 N9066 N906A £20.00
N911A N915A N916A N917 £27.00
PCV754 PV2300 PV2400 PV760 PV794 PV770 PV774 PVC763E £18.00
N380 N381 N830 N831 N832 N833 N834 N835 N836 £7.00
82611AH1 (for model DX3000) £45.00
N895 £31.50

NORDMENDE

460 9 460 V100 V140 V200 V250 V304 V341 V450 V550 £7.00
V1001 V1005 V1015 V1025 V1035 V1041 V1055 V1065 V1105 V2005 £18.00
V110 V333 £20.00
V101 V102 V103 V112 V141 V142 V200 V300 V3005 V300 V301 V302 V350 V500 £7.00
V1205 V1215 V1235 V1245 £20.00
V1305 £33.50
V380 £27.00
V502 V503 V5005 £37.00

ORION

VH3 VH555 VH600 VH700 VH844 VH900 VH1000 (ALL MODELS) £13.00
VH1 VH2A £7.00

PHILIPS

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

RANK

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

SAISHO

VR100 VR605 VR705 VR805 VR905 VR1000 VR1100 VR1200 VR1600 £12.50
VR3300X VR3600X VR3650 VR3800 £14.00
VR3200 VR3500 £15.00
VR2000 VR3300 VR3600 £16.00

SALORA

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

SAMSUNG

SVX301 VB90C VB910 VVT510 VT320 VT5600 VX510 VX511 VX520 VX616 VX626 VX627 VX717 SV716 717 SVX303 305 VB510 520 610 616 617 619 620 626 627 629 710 971 VI520 616 621 626 900 810 VX617 619 629 710 712 VX720 730 970 971 972 £19.00
VB770 VI730 770 VK8220 VX750 770 8225 £21.00

SANYO

VTC5000 VTC5400 VTC6000 VTC6500 VPR5000 VTC1500 VTCM10 VTCM11 VTCM20 VTCM21 VTCM25 VTC2000 VTC5100 VTC5150 VTC5300 VTC5400 VTC5350 VTC5370 VTCNX10 VTCNX15 VTCNX20 VTCNX30 VPR5800 £18.50
VTC5500 VTC5550 VTC9100 VTC9300 VTC9350 VTC9355 VTC9455 VTC9500 £19.00
VHR1110 VHR1150 VHR1300 VHR1700 VHR2300 £16.00
VHR3200 VHR3270 VHR3100 VHR3150 VHR3300 VHR3400 VHR3310 VHRD500 £18.00
VHR1100 VHR1200 £18.00
VHR1500 VHR2500 £28.00
VHR2700 £24.50

SHARP

VC390 VC393 VC496 £30.00
VC488 £48.00
VC779 £20.00
VC789 VC790 £32.00
VC300 VC381 VC383 VC386 VC387 VC388 VC482 VC483 VC486 VC3300 VC8381 VC9100 VC9300 VC9500 VC9700 VC9400 VC9600 VC200 220 384 385 471 477 481 £13.00
VC582 VC583 VC651 VC681 VC750 VC780 VC781 VC683 VC684 402 500 571 573 581 584 585 600 682 685 693 VC700 777 7810 782 7872 783 8481 £13.00
VC6000 VC6200 VC6300 VC7300 VC7700 VC7750 VC8000 VC8300 £20.00
VC793 £36.00
VC473 785 786 £25.00
VC699 VC4501 VCA602 £29.00

SONY

DSR 19R (FOR SLT 9ME) £39.00
DSR 21R (FOR SLC8 C9) £30.00
DSR 35R (FOR C20 C30 C40 SLF1UB SLF1E 2 PIN SLC24PS SLC33E SLC44PS SLF30PF SLF60PS SLK85 SLT20ME SLT30ME) £15.00
DSR 43R (FOR SLC7 RANGE SL5000 SL5100 SL3000 3 PIN SLC6E SL36ES SL37E £13.00
SL3000 8000 8080 SLC5E SLT7ME £16.00
SLV201 202 £29.50
SLK95 SLT50ME £29.00

TOSHIBA

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

TRIUMPH

VR9500 VR9501 VR9525 £13.00

THOMSON

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

VCR PINCHROLLERS

AKAI

VS9300 VS9500 VS9700 VS9800 VP7100 VP77 £2.50
VS1 VS2 VS3 VS4 VS5 VS6 VS9 VS10 VS8 VS15 £2.50
VS105 VS112 VS115 VS116 VS126 VS244 VS245 VS247 VS248 VS515 VS516 VS205 £2.50
VS201 VS301 VS303 VS304 VS603 VS606 VS607 VP58 P82 £2.50
VS125 VS155 VS165 VS220 VS240 VS250 VS512 VSX9 £2.50

AMSTRAD

VCR4500 VCR4600 VCR4600 VCR6000 VCR6100 VCR9000 £2.50
VCR5200 £2.50
VCR7000 £2.50
TVR1 £2.50

AIWA

AV66, AV77 £2.50
G700 G900 £2.50

ALBA

VCR3000X VCR4000 £2.50
VCR5000 VCR6000 £2.50

AUTHENTIC

N850 £2.50

BLAUPUNKT

RTV100 200 202 222 224 301 306 307 RTV309 311 312 315 316 317 319 320 328 RTV404 414 434 444 478 707 RTX100 £2.50
RTV211 214 321 322 348 RTX250 260 £2.50
RTV324 325 £2.50
RTV330 454 520 530 535 560 660 670 RTV720 730 740 800 810 900 910 920 £2.50

DECCA

VCR8300 £2.50
VRH8495DK (Pressure Roller Assembly) £6.25

FERGUSON

3V00 3V16 3V22 3V23 3V24 3292 8900 8901 8902 8903 8904 8906 8909 8912 8922 8923 8924 8925 8929 3V29 3V30 3V31 3V32 8930 £2.50
8931 8940 8941 8942 3V35 3V36 3V38 3V39 3V42 3V43 3V44 3V45 3V48 3V53 3V54 3V55 3V56 3V57 3V58 3V59 3V64 3V65 FV10 FV11 FV12 FV14 3V49 8943 8944 8945 8947 8948 8950 8951 FV13H FV20B FV21R FV22L FV26D FV30B FV32L FV33H FV39S VC141L £2.50

FISHER

FVHP420 FVHP520 FVHP530 £2.50
FVHP615 FVHP710 FVHP715 FVHP716 FVHP722 FVHP725 FVHP830 FVH618 FVH620 FVH622 FVH622 FVH711 FVH720 FVH721 FVH722 FVH725 FVH730 FVH840 £2.50
FVHP905 FVHP970 FVHP980 FVHP990 FVHP5000 FVHP5005 FVHP5050 FVHP5075 FVHP5100 FVHP905 FVHP906 FVHP908 FVHP910 FVHP911 FVHP915 FVHP916 FVHP918 FVHP975 £2.50
VBR330 VBS3500 VBS7000 VBS7500 VBS7600 VBS9500 VBS9900 £2.50

FIDELITY

HQS200 VCR100 VCR600 VCR6100 £2.50
VTR1000 £2.50

FIJITSU

HS760 VX715 VX720D £2.50

FUNAI

V1 V2 VCR4000 VCR4500 VCR4530 VCR4600 VCR4800 VCR5200 VCR5400 VCR5840 VCR5843 VCR6000 VCR6600 VCR6800 VCR6803 £2.50
VIP1000 VIP1400 VIP3000 £2.50

GEC

V4004 £2.50

GRANADA

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

GRUNDIG

BARCELONA MADRID MVS500 MVS550 MVS600 MVS620 660 SE5110 SE5140 SE6100 SE6160 TVR4500 VS500 VS505 VS510 VS520 VS521 VS530 VS540 VS550 VS600 VS610 VS620 VS630 VS640 VS660 VS680 VS5180 VS5480 £2.50
MVS400 MVS440 VS400 VS410 VS440 VS460 £2.50
VS120 £2.50
VS150 £2.50

GOLDSTAR

GHV1221 GHV1232 GHV1240 GHV1241 GHV1242 GHV1243 GHV1244 GHV1245 GHV1246 GHV51 GHV8210 GHV8215 GHVP1240 GHVP1241 GHVP1247 GHVP1248 GHVP1290 GHVP1291 GHVP1295 GHVP1296 VCP4100 GHV51 GHV8000 GHV8200 VCP4000 VCP4130 VCP4200 VCP4300 VCP4301 VCP4305 VCP4306 VCP4311 VCP4315 VCP4316 VCP4320 VCP4321 VCP4325 VCP4326 £2.50

HINARI

V20H VXL10 VXL11 VXL19 VXL5 VXL6 VXL7 VXL8 VXL9 VXL90 £2.50
VXL2 VXL3 £2.50
VXL4 VXL20 VXL35 £2.50

HITACHI

VT11 VT14 VT16 VT17 VT19 VT33 VT330 VT34 VT35 VT38 VT39 VT52 VT6500 VT680 VT6800 VT7 VT7000 VT8000 VT8500 VT9700 VT9900 VT61 VT62 VT63 VT64 VT65 VT86 VT88 VT110 VT122 VT120 VT128 VT130 VT135 VT138 VT150 VT168 VT220 VM200 VM500 VM600 VT100 VT111 VT113 VT115 VT118 VT125 VT145 VT175 VT225 VT250 VT255 VT258 VT260 VT400 VT405 VT410 VT413 VT414 VT415 VT418 VT420 VT425 VT426 VT428 VT430 VT431 VT435 VT438 VT450 VT498 CT510 VT518 VT520 VT525 VT526 VT530 VT535 VT536 VT540 VT545 VT546 VT548 VT570 VT575 VT576 VT580 VT588 VT640 VT8 VT85 VT86 VT88 VTL30 VTM625 VTM626 VTM630 VTM636 VTM640 VTM645 VTM646 £2.50
VTS80 VTS85 £2.50
VT3000 5000 VT8000 VT9300 VT9500 £2.50

ITT

VR3605 VR3905 VR3935 VR3985 VR3986 VR3993 VR3994 VP3826 VR3906 VR3916 VR3926 VR3946 VR3948 VR3976 VR3995 VR3997 VR6948 £2.50
VR3913 VR3914 VR3943 VR3954 VR3963 VR3984 £2.50
VR3907 £2.50
VR3912 £2.50
VR3917 VR3833 £2.50
VR3929 VR3968 (PRESSURE ROLLER ASSEMBLY) £6.25

JVC

HR2000 HR3300 HR3330 HR3360 HR3660 HR4100 HR7700 HR7200 HR7300 HR7350 HR7600 HR7610 HR7650 HR7655 HRD110 HRD111 HRD120 HRD121 HRD140 HRD150 HRD160 HRD225 HRD455 HRD565 HRD725 HRD157 HRD158 HRD170 HRD180 HRD210 HRD230 HRD250 HRD257 HRD300 HRD320 HRD370 HRD400 HRD430 HRD470 HRD530 HRD566 HRD700 HRD750 HRD755 HRD950 HRP50 HRS5000 HRS5500 £2.50

MATSUI

VX850 £2.50

MITSUBISHI

HS200 HS300 HS301 HS302 HS303 HS304 HS310 HS320 HS700 HS330 HS306 HS307 HS337 HS338 HS349 HS400 HS411 HS412 HS421 HS710 HSB10 HSB20 HSB30 HSE10 HSE20 HSE30 HSE70 £2.50

NATIONAL

NV100 NV180 NV300 NV333 NV340 NV366 NV600 NV688 NV777 NV788 AG6010 AG6015 AG6100 AG6200 AG6400 AG6810 NV3321 NV230 NV370 NV430 NV460 NV730 NV810 NV830 NV850 NV870 NV890 NV2000 NV2010 NV3000 NV7000 NV7200 NV7800 NV8600 NV8610 NV8620 NVG14 AG1000 AG1200 AG1500 AG2100 AG2100 AG2200 NV260 NV280 NV380 NV450 NV465 NV470 NV480 NV630 NV650 NV770 NV780 NV8050 NV8150 NV8200 NV8300 NV8400 NVG15 NVG30 NVG400 NVH70 NVG130 NVG7 NVG19 NVG12 NVG18 NVG9 NVG10 NVG11 NVG120 NVG16 NVG21 NVG25 NVH65 NVG33 NVG46 NVG50 NVG300 NVF65 NVF70 NVFS1 NVFS100 NVH75 NVJ30 NVL20 NVL23 NVL25 NVL28 NVD48 NVD80 NVG21 NVG45 £2.50

NEC

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

ORION

VH1 VH2 VC150 VC180 VH1000 VH200 VH201 VH205 VH212 VH250 VH254 VH288 VH3 VH300 VH303 VH3030 VH312 VH33 VH3312 VH404 VH704 VH708 VH712 VH770 VH780 VR2948 VH300 VH3050 VH2308 VH2400 VH2600 VH2700 VH4300 VXL20 VXL25 VXL30 Etc £2.50

PHILIPS

VR6460 VR6920 £2.50
VR2020 VR2021 VR2022 VR2023 VR2024 £3.20
VR6711 £2.50
VR6540 £2.50
DV856 VR6485 VR6585 VR6589 VR6880 VR6948 £2.50
VR445 VR6442 VR6542 VR6843 VR6943 £2.50
DV464 VR2324 VR2300 VR2334 VR2340 VR2350 VR2414 VR2480 VR2486 VR2489 VR2490 VR2498 VR6462 VR6463 VR64664 VR6560 VR6660 VR6860 VR6861 VR6862 VR6863 £2.50

Pressure Roller Assembly

DV186 DV190 DV286 DV486 DV471 DV582 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 VR86B1 63SB7 68SB4 71SB4 72SB8 92SB31 £6.25

SANYO

VHR1100 VHR1300 VHR1500 VHR2300 VHR1150 VHR1200 VHR2100 VHR2500 VHR2700 VTC5000 VTC5150 VTC5500 VTC9300 VTCM10 VTCM20 VTC5150 VTC5350 VTC5400 VTC6000 VTC6500 VTC9100 VPR5800 VTCM11 VTCM21 VTCM31 VTCM50 £2.50
VHR3100 VHR3300 VHR3310 VHR3700 VHRD500 VHRD700 £2.50
VTC3000 £2.50

SHARP

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

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SONY FLYBACK TRANSFORMERS

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

FLYBACK TRANSFORMERS

FERGUSON

00D-4208-001	TX9	£14.00
00D-4-208-002	TX9	£14.00
00D-4-235 002-01G	TX90	£14.00
00D-4-247-001	TX90	£14.00
00D-4-247-001 HT1	TX90	£14.00
06D-3-093-001	TX100	£14.00
(110) 06D-3-087-001	TX100	£14.00
(110) 06D-3-084-001	TX100	£14.00
06D-3-086-001	TX100	£14.00

GRUNDIG

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

PHILIPS

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

ITT

	CVC20	£11.50
	CVC25	£11.50
	CVC30	£11.50

HITACHI

2432981	CPT 1444	£15.00
2434274	CPT 2174 CPT2176	£18.00
	CPT 2178	
OUTPUT TV MODULE	HM6251 (REF 2370551)	£5.50
	HM6232	£5.50

IDLERS & PULLEYS REPLACEMENTS

AKAI

VS1-2 VS4-5 VS15	FF-REW IDLER	M1327773	£4.50
VS3 6 12 56 58 59			
VS1-2 VS4-5 VS15	T-UP IDLER	BV327815	£6.00
VS3 6 12 58 59			
V9700	IDLER	BV321979	£6.00
VS125 126 155	IDLER ASSY	MZ366960J2	£11.00
VS165 240 244 245 247 248 250 512 515 516			
VS22 38 105 112 115 116. 205 220			
VP7100 VS9300	T-UP IDLER	PU47752	£4.50
VS9500 VS9800			
VP7100 VS9300	UNLOADING	PU46381	£4.00
VS9500 VS9800	IDLER		
VP7100 VS9300	REW IDLER	PU46380	£6.00
VS9500 VS9800			
VP77 VS10	REEL IDLER	BV327815	£3.00
VP88	IDLER	BV336067	£5.00
VS1 3 4 9 12	REEL TABLE	BR347731	£5.50
VS15. 58			
VS23 35 37 53. 55	CLUTCH	ML373043	£13.00
VS66. 75 VSA77			
VS9700	FF IDLER	BV321761	£3.20
VS9700	REW IDLER	VV321762	£4.25

AMSTRAD

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

FERGUSON

3V00 3V01 3V16	T-UP IDLER	PU47752	£4.50
3V22 3292 8900 8901 8904 8906			
3V16 3V22 8902	T-UP IDLER	PU49280	£5.50
8903 8909 8912 8922			
3V23 3V29 3V30	REEL IDLER	PU48967	£2.50
3V31 3V32 3V35 8923 8924 8929 8930 8931 8940 8941 8942			
3V23 3V31	ROLLER ASSY	PU49042A	£4.00
3V29 3V30 3V31	T-UP IDLER	51402	£1.25
3V32 3V35 3V36 3V38 3V39 3V49 8930 8931 8940 8941 8942			
3V29 3V30 3V31	T-UP CLUTCH	PU51380	£2.25
3V32 8930 8931 8940 8941 8942			
3V35 3V36 3V38	REEL IDLER	PU55374	£2.85
3V39 3V49. 8943 8944			
3V35 3V36 3V38	T-UP CLUTCH	PU55373	£2.00
3V39 3V49 8943 8944			
3V58 3V59 3V64	IDLER ARM	PU58645	£2.25
3V65 FV10 FV11 FV12 FV13 FV14 FV20 FV21 FV22 FV26			
FV30 FV32 FV33 8950 VC141L			
3V42 3V43	CLUTCH ASSY	PU55822	£13.50
3V42 3V44 3V45	CLUTCH ASSY	PU57658	£11.50
3V48 3V53 3V54 3V55 3V57 8947 8948			
3V42 3V43 3V44	T-UP CLUTCH	PU56043-1-4	£2.80
3V45 3V48 3V53 3V54 3V55 3V56 3V57 8947 8948			
3V42 3V43 3V44	SUPPORT CLUTCH	PU56044-1-5	£2.80
3V45 3V48 3V53 3V54 3V55 3V56 3V57 8947 8948			
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FIDELITY CTV140 ....1.50
FIDELITY CTV14R 3.95
FIDELITY CTV14S 3.95
GRUNDIG CUC731 ....3.50
G11 STANDARD 1.35
G11 REMOTE 1.75
ITT TX SERIES 4.95
MATSUI 2190 ....5.95
KT3 REMOTE 1.75
KT4/CTX REMOTE 1.75
SAISHO FST2130 ....5.95
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SONY KV1612 REMOTE 3.95
SONY KV2022 REMOTE 3.95
TATUNG 140 ....2.50
TATUNG 161 ....1.50
TATUNG 165 REMOTE 1.75
THORN UNIVERSAL 1.00
TX9/10 STANDARD 1.00
TX9/10 REMOTE 1.75
TX90/100 STANDARD 1.50
TX90/100 REMOTE 1.75

EXTENDED RANGE OF VIDEO & AUDIO HEADS RING OR WRITE FOR DETAILD

TRANSISTORS
BC307 10
BC327 10
BC337 10
BC547 10
BC548 10
BC639 20
BC640 20
BD238 40
BF458 35
BF460 95
BF871 70
BU208A 1.45
BU208D 1.95
BU280 ....3.30
BU426A 1.45
BU500 ....2.00
BU508A 1.50
BU508AF 1.95
BU508D 1.95
BU508DF 2.50
BU508V 2.75
BU526 ....1.95
BU536 ....2.25
BU807 ....1.75
BU908 ....2.95
BUK44/500B 3.30
BUT11AF 2.75
BUT12A 1.50
BUT56A 2.75
BUX84 80
R4050 ....2.95
R4051 ....2.50
T9053V 3.50
T9054V 3.50
T9064V 1.95
TIP29E (TO168V) 75
TIP41C 50
TIP42C 50
TIP112H (T0167V) 75
TIPL791A 1.95
2SC3156 ....4.50
2SD1398 ....2.50
2SD1453 ....2.95
2SD1497 ....3.95
2SD1497/02 ....5.95
7805 50
7812 50
TRANSISTOR EQUIVALENT BOOKS
TVT A-Z & 2N-2SD 26.50

AKAI VIDEO SPARES
VS1/5
BELT KIT 1.95
PINCH ROLLER 3.95
REEL IDLER UNIT 6.95
TAKE UP CLUTCH 8.95
TENSION BAND 2.95
VIDEO HEAD VS1/5 ....17.95
VIDEO HEAD VS4 ....34.50

ALBA VIDEO SPARES
VCR4000
BELT KIT 1.95
CAPACITOR BACK-UP 1.85
PINCH ROLLER 3.95
REEL IDLER 3.95
REEL PULLEY 1.95
REPAIR KIT 11.50
TENSION BAND 2.50
VIDEO HEAD 16.95
VCR5000
BELT KIT 1.95
PINCH ROLLER 3.95
REEL IDLER 3.95
REEL PULLEY 1.95
TENSION BAND 2.50
VIDEO HEAD 16.95
VCR6000
BELT KIT 1.95
CLUTCH ASSEMBLY 4.50
PINCH ROLLER 3.95
REEL IDLER 4.50
REPAIR KIT 12.95
TENSION BAND 2.50
VIDEO HEAD 17.95

AMSTRAD VIDEO SPARES
VCR4500
BELT KIT 1.95
GEAR ASSEMBLY 9.95
MODIFICATION KIT 6.50
PINCH ROLLER 3.50
VIDEO HEAD 14.95
VCR4600BELT KIT 1.95
GEAR ASSEMBLY 9.95
MODIFICATION KIT 6.50
PINCH ROLLER 3.50
VIDEO HEAD 14.50
VCR7000
BELT KIT 1.95
LAMP 95
PINCH ROLLER 3.95
REEL IDLER 3.95
REEL MOTOR 14.95
VIDEO HEAD 15.25
VCR6000
BELT KIT 1.95
PINCH ROLLER 3.95
VIDEO HEAD 17.95

FERGUSON VIDEO SPARES
3V29/30
BELT KIT 1.95
CAPSTAN MOTOR 32.50
CASSETTE LAMP 70
LOADING BELTS (5) 1.95
PINCH ROLLER 3.95
REPAIR KIT 12.95
REEL IDLER 2.95
TAKE UP CLUTCH 2.95
TAKE UP IDLER 1.95
VIDEO HEAD 8.75
3V35/39
BELT KIT 1.95
CAPSTAN MOTOR 21.50
CASSETTE HOUSING 25.95
LOADING BELTS (5) 1.95
MAINS TRANSFORMER 23.95
PINCH ROLLER 3.95
REEL IDLER 2.95
REPAIR KIT 12.95
TAKE UP IDLER 1.95
TAKE UP CLUTCH 2.95
VIDEO HEAD 8.75
3V44/45
BELT KIT 1.50
CASSETTE HOUSING 25.95
PINCH ROLLER 3.95
REMOTE CONTROL 15.95
REPAIR KIT 14.95
VIDEO HEAD 19.50
3V65/FV11
BELT KIT 1.75
CAPSTAN MOTOR 27.50
CASSETTE HOUSING 29.95
PINCH ROLLER 3.95
REEL IDLER 2.75
REPAIR KIT 11.95
VIDEO HEAD 17.95

FISHER VIDEO SPARES
FVH5000
BELT KIT 2.20
REEL IDLER 5.50
PINCH ROLLER 3.50
TENSION BAND 2.60
VIDEO HEAD 24.50
FVH615/720
BELT KIT 1.95
CLUTCH ASSEMBLY 5.95
PINCH ROLLER 4.50
REEL IDLER 5.95
VIDEO HEAD 15.95
FVH905/910
BELT KIT 1.95
CLUTCH ASSEMBLY 19.95
REEL IDLER 5.95
VIDEO HEAD FVH905 ....15.95

HITACHI VIDEO SPARES
VT8000/8700E
BELT KIT 1.95
CAPSTAN MOTOR 38.50
FF/REW IDLER 2.95
FF/REW PULLEY 95
PINCH ROLLER 3.95
PLAY IDLER 3.95
REEL TABLE 3.95
TENSION BAND 2.95
VIDEO HEAD 15.70
VT9300/9700E
BELT KIT 1.95
CAPSTAN MOTOR 31.95
FF/REW IDLER 2.75
FF/REW PULLEY 95
PINCH ROLLER 3.95
PLAY IDLER 3.95
REMOTE CONTROL 16.95
TENSION BAND 2.95
VIDEO HEAD 15.70
VT11/33E
AUDIO HEAD VT11E 25.50
AUDIO HEAD VT33E 14.95
BELT KIT 1.95
CAPSTAN MOTOR VT11E 23.95
CAPSTAN MOTOR VT33E 23.95
CASSETTE HOUSING 16.50
CLUTCH ASSEMBLY 7.95
FF/REW IDLER Genuine 2.50
PINCH ROLLER 3.95
REPAIR KIT 15.95
RF CONVERTOR VT11E 29.95
TENSION BAND 2.95
VIDEO HEAD 15.70
VT63/64E
BELT KIT 1.95
CAPSTAN MOTOR 27.50
CASSETTE HOUSING 14.70
CLUTCH ASSEMBLY 7.95
FF/REW IDLER 2.50
PINCH ROLLER 3.95
REMOTE CONTROL 13.25
SERVICE MANUAL 10.95
TENSION BAND 2.50
VIDEO HEAD VT63/64E 20.30
VIDEO HEAD VT65 ....28.50
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PINCH ROLLER 3.95
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REPAIR KIT
15.95TENSION BAND 2.95
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VIDEO HEAD VT130E 24.95

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NV230/430
REPAIR KIT GENUINE 11.50
BELT KIT 1.95
MODE SWITCH 3.95
PINCH ROLLER 3.95
REEL IDLER GENUINE 2.95
VIDEO HEAD NV230 ....17.50
NV333/366
REPAIR KIT GENUINE 11.50
BELT KIT 1.95
PINCH ROLLER 3.95
PLAY IDLER GENUINE 4.95
REEL IDLER GENUINE 1.25
VIDEO HEAD NV333 ....8.95
VIDEO HEAD NV366 ....19.95
NV370
REPAIR KIT GENUINE 11.75
BELT KIT 1.95
MODE SWITCH 3.95
PINCH ROLLER 3.95
REEL IDLER GENUINE 2.95
VIDEO HEAD 9.95
NV730
REPAIR KIT GENUINE 10.95
BELT KIT 1.95
MODE SWITCH 3.95
PINCH ROLLER 3.95
REEL IDLER GENUINE 3.95
TENSION BAND 2.45
VIDEO HEAD 18.95
NV777
REPAIR KIT GENUINE 11.95
BELT KIT 1.95
PINCH ROLLER 3.95
REEL IDLER GENUINE 3.95
VIDEO HEAD 18.95
NV2000/2010
REPAIR KIT GENUINE 18.95
BELT KIT 1.95
PINCH ROLLER 3.95
PLAY IDLER GENUINE 1.25
REEL IDLER GENUINE 1.25
VIDEO HEAD 8.95
NV7000/7200
REPAIR KIT GENUINE 14.95
BELT KIT 1.95
PINCH ROLLER 3.95
PLAY CLUTCH GENUINE 4.95
REEL IDLER GENUINE 1.25
VIDEO HEAD 8.95
NVG7/10/12
REPAIR KIT GENUINE 9.95
BELT KIT 1.95
MODE SWITCH 3.95
PINCH ROLLER 3.95
REEL IDLER GENUINE 2.95
VIDEO HEAD NVG7/9 ....17.30

PHILIPS VIDEO SPARES
VR6185/6291
BELT KIT 2.95
CASSETTE HOUSING 16.95
PINCH ROLLER ASSY 7.50
REPAIR KIT 21.50
REMOTE CONTROL 29.50
VIDEO HEAD 42.50
VR6367
BELT KIT 2.95
CASSETTE HOUSING 16.95
PINCH ROLLER ASSY 7.50
REMOTE CONTROL 13.25
REPAIR KIT 21.50
VIDEO HEAD 40.70
VR6460/6520
BELT KIT 1.95
PINCH ROLLER 3.95
REEL IDLER 2.95
REPAIR KIT 12.50
VIDEO HEAD 9.95
VR6462/6560
REPAIR KIT 12.95
CASSETTE HOUSING 16.95
PINCH ROLLER 3.95
REEL IDLER GENUINE 4.95
VIDEO HEAD GENUINE 44.95
VR6467
REPAIR KIT GENUINE 21.50
BELT KIT 2.95
CASSETTE HOUSING 17.95
PINCH ROLLER ARM ASSY 7.50
VIDEO HEAD GENUINE 40.70
VR6760
REPAIR KIT GENUINE 21.50
BELT KIT 2.95
CASSETTE HOUSING 17.95
PINCH ROLLER ASSY 7.50
VIDEO HEAD GENUINE 41.70

SANYO VIDEO SPARES
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BELT KIT 1.00
REEL MOTOR GENUINE 7.95
REEL PULLEY GENUINE 5.95
VIDEO HEAD 22.50
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BELT KIT 2.25
PINCH ROLLER 3.50
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REEL MOTOR 14.95
TENSION BAND 2.60
VIDEO HEAD 21.70
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BELT KIT 1.95
PINCH ROLLER 3.50
REEL DRIVE ROLLER 5.95
TENSION BAND 2.60
VIDEO HEAD 20.50

SHARP VIDEO SPARES
VC9300/381
BELT KIT 2.50
PINCH ROLLER 3.95
REEL IDLER GENUINE 3.95
REEL MOTOR GENUINE 16.25
TENSION BAND 2.95
VIDEO HEAD 14.75
VC481/482
BELT KIT ....
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REEL IDLER GENUINE 3.95
REEL MOTOR GENUINE 19.95
TENSION BAND 2.95
VIDEO HEAD 14.75
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BELT KIT 2.50
REEL IDLER GENUINE 3.95
PINCH ROLLER 3.95
VIDEO HEAD 14.75
VC681
BELT KIT 2.50
PINCH ROLLER 3.95
REEL PULLEY GENUINE 7.95
VIDEO HEAD 14.75
VCA140/VCT72
BELT KIT 2.95
PINCH ROLLER 3.95
REEL PULLEY GENUINE 7.95
TENSION BAND 3.50
VIDEO HEAD 14.75

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BELT KIT C6 ....1.95
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REWIND KIT C5/7 ....4.95
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VIDEO HEAD 14.95

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MITSUBISHI HS302 ....1.95
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NEC 9053 ....2.95
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FERGUSON 3V00/22 50
FERGUSON 3V29 80
FERGUSON 3V35 LED 1.95
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PANASONIC NV2000 95
SHARP 8300 95
SHARP 9300 ....1.50
UNIVERSAL 50

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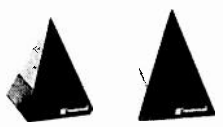
WORKS MOST PHILIPS SETS
BASIC FUNCTIONS
ENGINEERS MUST



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NO WIRES, JUST PLUG IN AND
TRANSMIT BY YOUR REMOTE
CONTROL TO ANY ROOM IN
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FERGUSON T732......................
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GOLDSTAR 105-523C 24.95
GOLDSTAR GHV 1221 ....21.95
GOODMANS TX1100/1200....18.95
GRANADA UNIVERSAL 12.95
GRUNDIG TP400 TEXT.........12.90
GRUNDIG TP650 TEXT.........14.25
GRUNDIG TP660...................21.95
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HITACHI VT120E 13.95
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ITT TX3126............................20.95
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TATUNG RC60.......................14.95
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TOSHIBA CT9128..................17.95
TOSHIBA V55 ....11.95
TOSHIBA T534A/B 15.95

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AKAI VS4...............................34.50
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ALBA 6000X..........................17.95
AMSTRAD 4500/9000 ....14.95
AMSTRAD 4600/4700 ....14.50
AMSTRAD 6000 ....17.95
AMSTRAD 7000....................15.25
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FERGUSON FV12..................34.50
FERGUSON FV13..................41.50
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FERGUSON FV31..................26.50
FERGUSON FV32..................27.95
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HITACHI VT65.......................28.50
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JVC HRD755.........................34.50
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MITSUBISHI HS318 ....24.50
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ORION VH3...........................19.95
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PANASONIC NV333 ....8.95
PANASONIC NV366 ....19.95
PANASONIC NV370 ....9.95
PANASONIC NV430 ....14.25
PANASONIC NV688 ....27.70
PANASONIC NV730 ....18.95
PANASONIC NV777 ....18.95
PANASONIC NV788 ....25.95
PANASONIC NV870 ....37.30
PANASONIC NV2000/7000 .....8.95
PANASONIC NVG7/9.............17.30
PANASONIC NVG10/12.........17.30
PANASONIC NVG18.............28.70
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PANASONIC NVG45.............34.50
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PHILIPS 6467 GENUINE 40.70
PHILIPS 6760 GENUINE 41.70
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PYE DV468 ....40.70
REDIFFUSION 620 ....14.75
SAISHO VR705/805 ....15.25
SAISHO VR3200...................17.50
SAISHO VR3500...................17.50
SAISHO VR3600...................19.50
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SCHNEIDER SVC246............21.95
SENTRA 8000................... ....16.95
SENTRA 8400.......................16.95
SENTRA 8600.......................17.95
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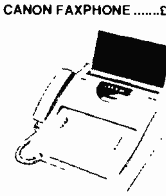

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2SC-1924	51.53
2SC 1929	1.10
2SC 1938	0.86
2SC-1940	0.38
2SC 1941	0.30
2SC 1942	2.10
2SC 1944	2.58
2SC 1945	3.53
2SC-1946A	11.48
2SC-1947	3.68
2SC 1955	7.76
2SC-1957	0.50
2SC-1959	0.08
2SC 1962	1.50
2SC 1966	9.77
2SC 1967	12.78
2SC 1969	1.64
2SC 1970	1.17
2SC 1971	2.63
2SC-1972	7.88
2SC-1973	0.60
2SC 1975	0.98
2SC-1983	0.90
2SC 1984	0.78
2SC 1985	0.67
2SC 1986	0.90
2SC 2001	0.12
2SC 2002	0.18
2SC 2003	0.23
2SC-2004	0.18
2SC-2009	0.30
2SC 2021	0.11
2SC-2022	1.10
2SC 2023	2.00
2SC 2026	0.38
2SC-2027	2.25
2SC-2028	0.99
2SC 2053	0.45
2SC 2055	0.72
2SC 2056	3.84
2SC 2058	0.12
2SC 2060	0.21
2SC 2068	0.45
2SC 2071	0.72
2SC 2073	0.45
2SC-2075	1.13
2SC 2078	0.52
2SC 2081	10.10
2SC-2085	0.57
2SC 2086	0.45
2SC 2094	11.60
2SC 2097	20.25
2SC 2098	5.54
2SC 2099	20.91
2SC-2102	16.79
2SC 2118	9.42
2SC 2120	0.12
2SC 2124	0.15
2SC 2131	3.70
2SC 2139	2.47
2SC 2141	0.67
2SC 2149	4.27
2SC 2150	2.97
2SC-2153	0.41
2SC 2165	1.88
2SC 2166	0.84
2SC 2168	1.01
2SC 2181	18.84
2SC-2188	0.35
2SC 2199	3.77
2SC 2200	2.25
2SC 2209	0.45
2SC 2210	0.36
2SC 2221	3.68
2SC 2222	10.92
2SC-2228	0.30
2SC-2228A	0.20
2SC 2229	0.20
2SC 2230	0.23
2SC 2233	0.67
2SC 2235	0.23
2SC 2236	0.23
2SC 2237	4.27
2SC 2238	0.57
2SC 2238A	0.65
2SC-2240	0.15
2SC 2245	8.87
2SC 2258	0.38
2SC-2260	4.50
2SC 2270	0.50
2SC 2271	0.20
2SC 2274	0.20
2SC 2275	0.50
2SC 2283	8.33
2SC 2285	
2SC 2285A	25.50
2SC 2289	8.81
2SC-2290	20.07
2SC 2291	0.38
2SC 2298	0.48
2SC 2307	3.23
2SC 2308	0.11
2SC 2309	0.12
2SC 2310	0.15
2SC 2312	2.32
2SC 2314	0.25
2SC 2316	1.49
2SC 2320	0.08
2SC 2324	0.35
2SC 2329	3.60
2SC 2331	0.75
2SC 2333	1.08
2SC 2334	1.02
2SC-2335	0.98
2SC 2336	0.60
2SC 2344	0.58

2SC-2347	0.18
2SC 2360	0.35
2SC 2361	0.60
2SC 2362	0.23
2SC 2366	51.42
2SC 2371	0.25
2SC 2373	1.01
2SC 2383	0.23
2SC 2389	0.18
2SC 2395	15.98
2SC-2396	0.20
2SC 2407	0.52
2SC 2408	0.56
2SC 2412K	0.18
2SC 2413	0.20
2SC 2429	6.49
2SC 2431	7.74
2SC 2433	12.57
2SC 2437	14.75
2SC-2440	2.03
2SC 2441	0.52
2SC 2458	0.08
2SC 2459	0.11
2SC 2461	2.60
2SC 2471	0.18
2SC 2481	0.48
2SC 2482	0.23
2SC 2483	0.50
2SC 2491	1.28
2SC 2495	17.15
2SC 2497	0.75
2SC 2498	0.12
2SC-2500	0.25
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2SC 2516	0.84
2SC 2519	0.12
2SC-2523	4.93
2SC 2526	6.52
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2SC 2530	1.32
2SC 2534	1.02
2SC 2535	1.62
2SC 2538	0.72
2SC-2539	9.52
2SC-2540	16.82
2SC 2542	1.88
2SC-2545	0.23
2SC 2546	0.33
2SC 2547D	0.20
2SC 2547E	0.21
2SC 2549	0.38
2SC-2550	0.52
2SC 2551	0.27
2SC 2552	0.67
2SC-2553	1.08
2SC 2555	1.43
2SC 2562	0.67
2SC-2563	1.20
2SC 2564	2.28
2SC 2568	0.48
2SC 2570	0.25
2SC-2571	2.10
2SC 2585	4.93
2SC 2588	3.75
2SC 2590	0.41
2SC 2591	0.56
2SC 2594	0.60
2SC 2603	0.15
2SC 2610	0.25
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2SC 2626	4.44
2SC 2628	11.82
2SC-2629	16.05
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2SC 2631	0.21
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2SC 2634	0.12
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2SC 2636	0.21
2SC 2637	0.63
2SC 2640	19.13
2SC-2653	0.52
2SC 2654	0.78
2SC 2655	0.23
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2SC 2665	1.35
2SC 2668	0.14
2SC-2671	0.45
2SC 2681	1.88
2SC 2682	0.35
2SC-2688	0.32
2SC 2690	0.52
2SC 2694	28.50
2SC 2695	21.30
2SC 2705	0.20
2SC 2710	0.15
2SC 2712	0.08
2SC 2716	0.15
2SC 2719	0.35
2SC 2721	0.51
2SC 2724	0.11
2SC 2738	1.23
2SC 2740	3.18
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2SC 2750	1.80
2SC 2751	2.76
2SC-2753	0.47
2SC 2767	1.56
2SC 2769	2.84
2SC 2782	27.75
2SC 2785	0.08
2SC 2786	0.15
2SC 2787	0.15
2SC 2791	5.52
2SC 2792	3.53
2SC-2793	4.97
2SC 2808	0.15

2SC 2810	1.94
2SC 2816	1.86
2SC 2818	8.73
2SC 2820	10.61
2SC 2824	0.35
2SC 2827	1.32
2SC 2832	2.09
2SC 2832A	2.21
2SC 2834	4.13
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2SC 2837	2.78
2SC 2839	0.11
2SC 2840	0.08
2SC 2851	1.20
2SC-2853	0.18
2SC 2857	
2SC-2876	0.42
2SC-2877	0.52
2SC 2878	0.12
2SC 2898	2.69
2SC 2899	0.66
2SC 2901	0.30
2SC 2908	1.10
2SC 2909	0.25
2SC 2910	0.17
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2SC-2921	4.43
2SC-2922	4.38
2SC-2923	0.67
2SC 2925	0.38
2SC 2926	0.23
2SC 2929	1.44
2SC 2934	0.45
2SC 2937	1.41
2SC 2938	2.39
2SC 2944	4.44
2SC 2952	0.90
2SC 2954	0.90
2SC 2958	0.27
2SC 2960	0.11
2SC 2962	5.54
2SC 2979	2.10
2SC 2983	0.65
2SC-2987	2.03
2SC-2987A	2.06
2SC 2988	1.46
2SC 2995	0.15
2SC-2999	0.12
2SC-3001	11.25
2SC 3011	0.67
2SC 3012	1.88
2SC 3019	2.13
2SC-3021	10.58
2SC-3030	5.54
2SC 3032	2.40
2SC 3036	0.60
2SC 3038	0.67
2SC 3039	0.67
2SC 3040	1.43
2SC 3042	1.80
2SC 3057	0.65
2SC 3058	8.48
2SC 3059	7.70
2SC 3060	8.61
2SC 3066	0.23
2SC-3068	0.21
2SC 3070	0.38
2SC 3074	0.98
2SC 3075	0.75
2SC 3077	0.41
2SC 3086	0.83
2SC 3087	0.93
2SC 3089	1.34
2SC 3101	5.16
2SC 3104	14.88
2SC 3112	0.09
2SC 3113	0.23
2SC 3114T	0.12
2SC 3116	0.38
2SC 3117	0.39
2SC 3130	0.23
2SC-3133	3.38
2SC 3148	2.40
2SC 3149	1.05
2SC 3150	0.96
2SC 3151	1.26
2SC 3152	1.58
2SC 3153	2.01
2SC 3157	1.20
2SC 3158	1.31
2SC 3159	1.88
2SC 3162	4.59
2SC 3163	5.90
2SC 3164	5.10
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2SC 3170	1.58
2SC 3173	0.86
2SC 3175	1.13
2SC 3178	2.36
2SC 3179	0.72
2SC 3180	1.35
2SC 3181	2.25
2SC 3182	1.58
2SC 3183	0.54
2SC 3209	0.35
2SC-321	0.45
2SC 3210	3.48
2SC 3211	1.88
2SC-3212	3.96
2SC-3212A	4.29
2SC 3220	8.73
2SC 3224	0.30
2SC-3225	0.33
2SC 3242	0.17
2SC 3243	0.18
2SC 3244	0.23
2SC 3246	0.20
2SC 3249	0.20
2SC 3257	1.59
2SC 3258	0.90
2SC 3259	3.00

2SC 3263	3.24
2SC-3264	4.37
2SC 3269	0.18
2SC 3270	0.20
2SC 3277	1.65
2SC 3279	0.23
2SC 3280	2.63
2SC-3281	2.03
2SC 3284	3.75
2SC 3293	0.45
2SC 3296	0.67
2SC 3298	0.67
2SC 3298A	0.90
2SC 3299	0.67
2SC 3303	1.01
2SC-3306	1.68
2SC 3307	6.00
2SC 3309	0.87
2SC 3310	1.13
2SC 3311	0.08
2SC 3312	0.15
2SC 3315	0.20
2SC 3316	1.90
2SC 3317	2.18
2SC 3318	2.32
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2SC 3327	0.18
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2SC 3345	1.04
2SC 3346	1.13
2SC 3352	1.31
2SC-3353	2.47
2SC-3355	0.41
2SC 3356	0.48
2SC 3357	0.36
2SC 3359	0.30
2SC 3376	1.76
2SC 3377	0.15
2SC 3378	0.33
2SC 3381	1.50
2SC 3383	0.30
2SC 3387	3.30
2SC 3393	0.20
2SC 3395	0.08
2SC 3396	0.15
2SC 3399	0.15
2SC 3400	0.11
2SC 3401	0.12
2SC 3402	0.11
2SC 3405	1.13
2SC-3409	2.25
2SC-3416	0.38
2SC 3417	0.33
2SC 3419	0.36
2SC 3420	0.35
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2SC 3422	0.45
2SC 3423	0.41
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2SC 3435	3.90
2SC 3446	0.93
2SC 3447	1.13
2SC 3448	1.13
2SC 3450	2.06
2SC 3451	2.13
2SC 3456	1.17
2SC 3457	1.13
2SC 3458	1.88
2SC 3459	2.09
2SC 3460	2.16
2SC 3461	2.90
2SC 3467	0.23
2SC 3468	0.38
2SC 3502	0.39
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2SC 3505	3.77
2SC 3506	3.43
2SC-3507	4.13
2SC 3509	4.53
2SC 3518	0.52
2SC-3519	3.43
2SC 3526	0.52
2SC 3531	1.17
2SC 3545	0.30
2SC 3549	1.17
2SC 3551	4.57
2SC-3552	4.86
2SC 3553	1.20
2SC 3558	0.69
2SC-3559	1.95
2SC 3567	0.86
2SC 3568	1.16
2SC-358	0.24
2SC 3581	0.30
2SC-3595	1.17
2SC 3596	1.88
2SC-3597	0.75
2SC 3598	2.21
2SC 3599	2.15
2SC 3600	2.25
2SC 3604	4.93
2SC-3605	0.62
2SC 3607	0.67
2SC 3608	0.56
2SC 3609	0.67
2SC 3612	3.53
2SC 3616	0.45
2SC 3619	0.38
2SC 3620	0.45
2SC 3623	0.15
2SC 3631	0.52
2SC-3636	2.25
2SC 3642	2.85
2SC 3644	4.50
2SC 3651	4.57
2SC 3652	1.05

2SC 3656	0.09
2SC 3657	3.38
2SC-3659	4.61
2SC 3668	0.38
2SC 3675	0.75
2SC 3676	1.02
2SC 3678	2.43
2SC 3679	2.24
2SC 3680	2.85
2SC 3685	3.36
2SC 3686	3.68
2SC 3687	4.93
2SC 3688	5.99
2SC 3688 SGSSGS	4.98
2SC 369	0.23
2SC 3691	0.74
2SC 3692	1.13
2SC 3694	1.28
2SC 3705	0.30
2SC 3707	0.60
2SC-371	0.12
2SC 3715	3.45
2SC 3716	2.63
2SC 3717	0.30
2SC 3719	0.72
2SC 372	0.25
2SC 373	0.11
2SC 3738	5.69
2SC 3740	0.23
2SC-3743	2.10
2SC 3746	0.69
2SC 3747	-
2SC 3748	0.98
2SC 3752	1.34
2SC 3753	1.50
2SC 3770	0.15
2SC 3778	0.23
2SC 3779	0.20
2SC 3781	1.13
2SC 3783	4.13
2SC 3785	0.33
2SC 3786	0.36
2SC 3787	0.44
2SC-3788	0.60
2SC-3789	0.38
2SC 3790	0.33
2SC 3793	1.70
2SC-3795	1.16
2SC-3798	1.49
2SC 380	0.11
2SC 3807	0.52
2SC 3811	0.23
2SC-382	0.48
2SC-3831	2.25
2SC 3832	2.09
2SC 3833	2.03
2SC-3834	2.25
2SC 3847	7.44
2SC 3851	0.98
2SC 3851A	1.14
2SC 3852	0.90
2SC 3852A	-
2SC 3853	2.09
2SC 3854	2.21
2SC 3856	2.63
2SC 3857	4.02
2SC 3858	4.88
2SC 3866	2.90
2SC 3868	1.17
2SC 3870	1.41
2SC 3884	3.23
2SC 3885A	4.68
2SC 3886A	6.65
2SC 388A	0.52
2SC 3890	0.78
2SC 3892A	3.75
2SC 3893A	4.17
2SC 3894	2.64
2SC 3895	2.93
2SC 3896	5.49
2SC 3897	5.25
2SC 3907	3.15
2SC 3909	3.38
2SC 3916	0.30
2SC 392	0.66
2SC 394	0.15
2SC 3940	0.24
2SC 3943	0.78
2SC 3944	0.60
2SC 3946	0.60
2SC 3948	4.47
2SC 3949	9.86
2SC 3950	0.67
2SC 3951	0.60
2SC 3952	0.69
2SC 3953	0.52
2SC 3954	0.90
2SC 3955	0.60
2SC 3973	1.88
2SC 3975	1.88
2SC 3979	1.37
2SC 3987	2.25
2SC 3993	8.70
2SC 3996	10.58
2SC 3997	16.50
2SC 4006	0.38
2SC 4020	2.25
2SC 4023	2.47
2SC 403	0.25
2SC 4046	0.52
2SC 4051	2.18
2SC 4052	2.18
2SC 4053	2.84
2SC 4054	2.84
2SC 4055	2.70
2SC 4056	2.40
2SC 4057	3.95
2SC-4058	4.59
2SC-4059	6.12
2SC 4060	7.20
2SC-4064	1.49
2SC 4075	1.35
2SC 4096	2.78
2SC 4106	1.50
2SC 4107	2.63
2SC 4108	2.25
2SC 4109	2.21
2SC 4119	12.00
2SC 4122	3.75

2SC 4123	3.24
2SC 4124	3.30
2SC 4125	6.39
2SC 4133	0.60
2SC-4137	0.36
2SC 4138	2.18
2SC 4148	1.85
2SC-4149	2.06
2SC 4150	2.25
2SC 4151	2.63
2SC 4169	0.23
2SC-4207	0.15
2SC 4230	3.29
2SC 4231	3.48
2SC 4232	4.14
2SC 4233	3.75
2SC-4234	4.05
2SC 4235	4.82
2SC-4236	6.00
2SC 4237	6.38
2SC 4242	1.76
2SC 4262	0.18
2SC 4273	1.44
2SC 4288	10.77
2SC 4289A	11.51
2SC-4290	12.67
2SC 4291	2.25
2SC-4293	4.88
2SC 4295	0.18
2SC 4301	4.13
2SC 4304	1.89
2SC-4305	0.52
2SC 4310	5.90
2SC 4311	6.12
2SC-4312	6.78
2SC-4313	8.52
2SC 4314	11.25
2SC-4327	2.55
2SC 4351	0.93
2SC 4367	0.38
2SC 4382	3.00
2SC 4383	2.70
2SC-4386	2.63
2SC-4388	4.50
2SC-4408	0.30
2SC-4439	1.88
2SC 4466	3.75
2SC-4490	0.38
2SC-454	0.11
2SC-4547	2.10
2SC 458	0.08
2SC-460	0.11
2SC-460C	0.08
2SC-461	0.11
2SC-4743	3.38
2SC 4769	2.63
2SC 4802	4.64
2SC-491	1.13
2SC-496	0.27
2SC 497	0.90
2SC 515A	0.80
2SC 535	0.15
2SC-536	0.08
2SC 546A	0.50
2SC-558	1.90
2SC-563	0.63
2SC-593	0.35
2SC-603	0.05
2SC-605	0.38
2SC 619	0.30
2SC 634	0.38
2SC 641	0.27
2SC 642A	2.25
2SC 644	0.08
2SC 647	2.09
2SC 665	1.66
2SC 680A	1.31
2SC-683	0.35
2SC 708	0.52
2SC 710	0.11
2SC 711	0.11
2SC 730	3.15
2SC 732	0.08
2SC-733	0.08
2SC 735	0.12
2SC 738	0.12
2SC-739	0.71
2SC 756	2.25
2SC 761	0.65
2SC 762	0.67
2SC 763	0.23
2SC 783	1.23
2SC-790	0.52
2SC 792	3.00
2SC 805	1.37
2SC-805A	1.58
2SC 818	1.66
2SC 828	0.11
2SC-829	0.08
2SC-829B	0.08
2SC 867A	5.02
2SC 869	0.52
2SC-870	0.25
2SC 900B	2.06
2SC-9014	0.08
2SC 930	0.11
2SC-940	2.43
2SC-941	0.12
2SC 943	0.80
2SC 944	0.52
2SC-945	0.08
2SC 945P	0.06
2SC 950	0.11
2SC 959	1.61
2SC 97A	3.78
2SC-980	0.57
2SC-982	0.20
2SC 983	0.39
2SC 998	4.68
2SD	
2SD-1012	0.18
2SD 1020	0.15
2SD-1021	0.35
2SD-1022	3.00
2SD 1023	3.06
2SD 1024	0.90
2SD 1025	3.63
2SD 1026	5.90
2SD-1027	7.35
2SD 1030	0.25

2SD 1033	0.52
2SD 1037	7.38
2SD 1046	1.05
2SD 1047	1.64
2SD-1051	0.42
2SD-1060	0.57
2SD-1061	0.54
2SD-1062	0.78
2SD-1063	1.47
2SD-1064	1.31
2SD 1069	1.05
2SD 1071	2.70
2SD 1073	2.25
2SD 1088	1.49
2SD 111	4.37
2SD 1111	0.23
2SD-1113	1.76
2SD 1127K	2.21
2SD 1128	0.90
2SD-1133	0.80
2SD 1134	0.83
2SD-1135	0.78
2SD-1136	0.74
2SD-1138	0.65
2SD-1140	0.33
2SD-1142	2.78
7SD-1145	0.18
7SD 1148	1.43
7SD-1153	0.27
7SD 1159	0.48
7SD 1160	0.72
7SD 1163	0.98
7SD-1163A	1.02
7SD 1164K	0.67
7SD 1164Z	0.67
7SD 1168	3.11
7SD 1169	0.83
7SD-1175	3.45
7SD 1186	3.07
7SD-1187	1.95
7SD 1189	0.35
7SD-1190	0.57
2SD 1191	0.93
2SD 1192	0.65
2SD 1195	0.45
2SD 1196	0.63
2SD 1197	1.28
2SD 1206	0.45
2SD-1207	0.20
2SD-1208	3.90
2SD 121	6.60
2SD-1210	1.80
2SD 1211	0.35
2SD 1212	1.02
2SD 1213	1.88
2SD 1218	0.47
2SD 1220	0.33
2SD 1223	0.45
2SD-1225	0.33
2SD-1226	0.15
2SD 1227	0.30
2SD 1229	1.43
2SD-1235	0.72
2SD 1237	0.72
2SD-1244	0.27
2SD 1246	0.20
2SD 1247	0.30
2SD-1248	1.08
2SD-1251	0.63
2SD 1260	0.62
2SD 1263	0.63
2SD-1263A	0.90
2SD-1264	0.87
2SD-1264A	0.87
2SD-1265	0.67
2SD 1266P	0.60
2SD 1266Q	0.60
2SD 1266R	0.60
2SD 1267	0.57
2SD-1267A	0.72
2SD-1271	1.28
2SD-1271A	1.28
2SD 1272	1.02
2SD-1273	0.72
2SD-1274	1.20
2SD-1275	0.60
2SD-1276	0.78
2SD-1277	0.98
2SD 1277A	0.98
2SD-1279	4.30
2SD 128	0.35
2SD 1286	0.75
2SD-1288	1.28
2SD 1289	1.61
2SD 1291	2.46
2SD 1292	0.30
2SD-1294	2.24
2SD 1297	2.91
2SD 130	0.90
2SD-1302	0.21
2SD 1308	0.63
2SD 1309	0.71
2SD 1310	0.50
2SD-1311	0.54
2SD 1313	9.47
2SD-1316	0.63
2SD 1317	0.18
2SD 1323	0.24
2SD-1326	0.78
2SD-1327	0.93
2SD-1330	0.21
2SD-1345	0.54
2SD 1347	0.25
2SD 1348	0.33
2SD-1350	0.56
2SD-1365	1.35
2SD-1367	0.27
2SD 1376	0.41
2SD-1379	0.27
2SD 1380	0.33
2SD-1383	0.35
2SD 1384	0.36
2SD 1389	1.34
2SD-1390	2.10
2SD 1391	3.11
2SD 1392	0.67
2SD-1394	0.75
2SD-1395	0.60
2SD 1396	1.31
2SD-1397	1.41
2SD-1398	1.49
2SD 1399	2.15
2SD 1400	1.72
2SD 1402	1.83
2SD 1403	2.07
2SD 1404	0.67
2SD-1405	0.66
2SD 1406	0.45
2SD 1407	0.86
2SD-1408	0.67
2SD 1409	1.35
2SD-1412	1.14
2SD-1413	1.13
2SD 1414	6.18
2SD 1415	1.08
2SD 1417	0.67
2SD 1425	3.06
2SD 1426	2.10
2SD 1427	2.55
2SD 1428	2.93
2SD 1429	3.38
2SD 1430	2.63
2SD 1431	2.76

2SD 1432	4.30
2SD 1433	5.36
2SD-1438	0.72
2SD 1439	1.98
2SD-1442	1.13
2SD-1445	1.40
2SD-1448	0.60
2SD 1450	0.23
2SD 1451	2.07
2SD-1452	2.25
2SD 1453	1.35
2SD 1453 03	1.35
2SD 1453-07	2.25
2SD-1455	2.78
2SD-1457	1.34
2SD-1459	0.41
2SD 1468	0.12
2SD-1479	1.32
2SD-1480	1.02
2SD 1485	1.88
2SD 1487	2.03
2SD-1490	0.38
2SD 1491	0.51
2SD-1494	2.32
2SD-1496	2.99
2SD-1497 02	7.13
2SD 1497-06	7.13
2SD-1504	0.17
2SD 1505	0.38
2SD-1507	0.38
2SD-1508	0.52
2SD 1509	0.72
2SD 1510	0.20
2SD 1519	1.72
2SD 1521	0.45
2SD 1525	8.25
2SD-1526	0.44
2SD-1527	1.29
2SD 1541	3.00
2SD 1544	3.63
2SD 1546	5.77
2SD 1554	2.25
2SD-1555	2.18
2SD 1556	6.12
2SD 1559	3.24
2SD-1564	0.63
2SD 1565	0.75
2SD-1571	1.49
2SD-1572	0.71
2SD 1575	1.70
2SD 1576	2.99
2SD 1577	2.96
2SD 1579	0.41
2SD 1589	0.83
2SD-1590	0.71
2SD-1591	1.71
2SD-1593	0.80
2SD-1595	0.72
2SD 1601	0.90
2SD 1604	0.86
2SD 1608	1.02
2SD-1609	0.38
2SD 1610	0.41
2SD 1629	0.60
2SD 1630	2.46
2SD 1632	3.41
2SD-1633	0.83
2SD-1637	0.38
2SD 1640	0.30
2SD-1645	0.45
2SD-1647	0.39
2SD-1849	1.59
2SD-1650	2.03
2SD-1651	1.64
2SD-1656	2.25
2SD-1658	0.65
2SD 1661	0.30
2SD-1663	2.93
2SD-1664	0.17
2SD-1666	0.51
2SD 1667	0.48
2SD-1668	0.50
2SD-1669	0.72
2SD 1677	1.88
2SD 1680	2.43
2SD 1682	0.52
2SD 1683	0.38
2SD 1692	0.90
2SD 1707	2.63
2SD 1710	1.74
2SD-1718	2.47
2SD 1718A	2.47
2SD 1723	0.60
2SD 1725	0.52
2SD-1729	2.70
2SD-1730	1.13
2SD 1732	1.26
2SD 1739	3.03
2SD 1740	0.87
2SD 1748	0.63
2SD 1759	0.57
2SD-1760	0.45
2SD 1761	0.52
2SD-1762	0.38
2SD-1765	0.83
2SD 1769	1.13
2SD-1773	1.17
2SD 1783	0.33
2SD-1785	1.35
2SD 1788	1.76
2SD 1789	1.88
2SD 1790	1.95
2SD 1791	2.18
2SD-1792	2.32
2SD 1793	3.75
2SD-1794	3.90
2SD 1795	8.73
2SD 1796	1.88
2SD 1804	0.75
2SD-1815	0.44
2SD-1825	0.48
2SD-1832	0.75
2SD-1843	0.67
2SD 1845	1.43
2SD-1846	2.63
2SD 1847	2.78
2SD 1849	3.59
2SD 1850	3.30
2SD-1856	0.36
2SD 1858	0.17
2SD 1877	1.72
2SD 1878	2.25
2SD 1879	2.25

2SD-1880	3.24
2SD-1881	3.32
2SD-1883	1.50
2SD-1884	1.80
2SD-1886	3.45
2SD 1887	3.47
2SD-1896	2.24
2SD-1910	2.18
2SD 1911	2.85
2SD 1913	0.45
2SD-1929	0.45
2SD 1933	1.35
2SD-1939	0.48
2SD-1941	4.14
2SD-1944	0.38
2SD 1953	0.15
2SD-1959	2.03
2SD-1961	0.21
2SD 1978	0.30
2SD-198	1.68
2SD-1984	0.65
2SD-199	2.34
2SD 1991	0.15
2SD-200	1.90
2SD-201	1.79
2SD 2012	0.42
2SD-2015	1.41
2SD-2018	0.75
2SD-2019	0.75
2SD-2027	0.60
2SD-2046	0.38
2SD-2125	4.13
2SD-2151	1.88
2SD-235	1.01
2SD-235Y	0.90
2SD-24YD	0.57
2SD-257	2.51
2SD 289	0.52
2SD 291	1.17
2SD-313	0.38
2SD 314	0.41
2SD 315	0.90
2SD-325	0.38
2SD-330	0.41
2SD-348	3.18
2SD-350	3.30
2SD-350A	3.38
2SD-357	0.48
2SD 358	0.60
2SD 359	0.44
2SD 360	0.45
2SD-362	0.90
2SD-371	2.32
2SD 380	4.49
2SD 381	0.56
2SD-386	0.60
2SD-388	1.94
2SD 389	0.78
2SD-400	0.23
2SD-401A	0.48
2SD-402	0.63
2SD-414	0.39
2SD-414A	0.45
2SD-415	0.41
2SD-424	3.75
2SD-426	2.25
2SD 427	2.78
2SD-438	0.23
2SD-439	0.38
2SD-460	0.54
2SD-467	0.18
2SD-467A	0.18
2SD-468	0.18
2SD-469	2.73
2SD-471	0.23
2SD-471A	0.12
2SD-476	0.86
2SD-476A	0.96
2SD-525	0.67
2SD-526	0.60
2SD-535	4.95
2SD 545	0.20
2SD-553	0.95
2SD 555	4.50
2SD-556	1.90
2SD-558	0.99
2SD-560	0.60
2SD 568	1.23
2SD-571	0.25
2SD 575	3.78
2SD-592	0.14
2SD-592R	0.27
2SD-600	0.41
2SD-601	0.11
2SD 602	0.23
2SD-612	0.27
2SD 613	0.56
2SD-627	2.63
2SD 629	1.76
2SD-633	0.65
2SD-634	0.87
2SD-635	0.90
2SD-636	0.12
2SD-637	0.11
2SD 638	0.18
2SD 639	0.23
2SD 639R	0.20
2SD-640	2.25
2SD 641	5.77
2SD 655	0.18
2SD 657	3.26
2SD 661	0.23
2SD 666A	0.25
2SD-666AC	0.25
2SD-667	0.23
2SD-667A	0.23
2SD 668	0.35
2SD 668A	0.33
2SD-669	0.38
2SD-669A	0.48
2SD-669AB	0.48
2SD 669AC	0.48
2SD 673	2.31
2SD-683	5.42
2SD 685	4.50
2SD 686	0.50
2SD 687	0.72
2SD-688	2.00
2SD 689	0.80
2SD-699A	0.42
2SD-712	0.67
2SD-716	0.98
2SD-717	1.34

2SD-718	1.04
2SD-722	1.26
2SD-725	3.75
2SD-727	1.43
2SD-731	2.10
2SD-733	2.58
2SD-734	0.18
2SD-741	0.52
2SD-743	0.67
2SD-743A	0.75
2SD-748A	2.40
2SD-756	0.27
2SD-756A	0.36
2SD-757	0.41
2SD 758	0.56
2SD 760	0.75
2SD 761	0.67
2SD 762	1.13
2SD-763	0.52
2SD-768	0.86
2SD 772	1.01
2SD 773	0.23
2SD-774	0.32
2SD 777	2.84
2SD-784	3.00
2SD 786P	0.23
2SD-786Q	0.23
2SD 786S	0.23
2SD-787	0.23
2SD 788	0.27
2SD-789C	0.21
2SD-789E	0.21
2SD-792	4.25
2SD-793	0.38
2SD-794	0.35
2SD-795	0.48
2SD 795A	0.56
2SD 797	4.50
2SD 804	0.75
2SD-807	3.36
2SD-809	0.38
2SD-811	2.58
2SD-818	3.10
2SD-819	2.81
2SD-820	3.21
2SD-821	3.38
2SD-822	4.14
2SD-823	0.67
2SD-826	0.35
2SD-833	0.57
2SD-835	0.63
2SD-836	0.78
2SD 836A	0.78
2SD 837	0.67
2SD-837B	0.83
2SD 841	1.13
2SD-843	1.65
2SD-844	1.23
2SD-845	2.03
2SD-849R	2.31
2SD-850	4.88
2SD-856	0.58
2SD-857	0.67
2SD-858	1.43
2SD-863	0.23
2SD-866	1.13
2SD-866A	1.23
2SD 868	2.76
2SD-869	2.25
2SD-870	2.24
2SD-871	4.50
2SD-873	1.98
2SD-874A	0.27
2SD-876	1.02
2SD 878	2.03
2SD 879	0.18
2SD-880	0.30
2SD 882	0.27
2SD-884	1.50
2SD-892	0.27
2SD-892A	0.27
2SD-894	0.35
2SD-895	1.20
2SD 896	1.20
2SD-898B	2.18
2SD-900	2.55
2SD-904	5.25
2SD-904K	6.00
2SD-905	4.01
2SD-907	2.43
2SD 916	0.57
2SD-917	2.03
2SD-921	2.25
2SD 923	2.28
2SD 946	0.52
2SD 946B	0.50
2SD 947	0.27
2SD-950	3.75
2SD-951	3.38
2SD 952	2.36
2SD-953	3.74
2SD 958	0.20
2SD 965	0.45
2SD-970	1.28
2SD-972	0.39
2SD-973	0.33
2SD-973A	0.20
2SD-974	0.63
2SD-975	0.67
2SD-985	0.41
2SD-986	0.41
2SD-993	2.43
2SJ	
2SJ-102	3.48
2SJ-103	0.58
2SJ-104	1.13
2SJ 106	0.27
2SJ-107	0.98
2SJ-108	0.42
2SJ-113	8.69
2SJ-114	9.00
2SJ-115	4.40
2SJ 116	10.05
2SJ-117	4.74
2SJ-118	5.27
2SJ-119	5.97
2SJ-120L	1.20
2SJ-120S	1.31
2SJ-122	4.35
2SJ-160	4.88
2SJ 161	5.90
2SJ 162	6.75
2SJ-174	2.37

2SJ-175	1.56
2SJ-176	1.98
2SJ-18	3.54
2SJ-182L	0.98
2SJ-218	5.51
2SJ-48	4.82
2SJ-49	4.67
2SJ-50	4.13
2SJ 55	9.75
2SJ-56	6.15
2SJ-72B	1.44
2SJ-74	0.48
2SJ-74GR	0.48
2SJ 75	2.32
2SJ 76	1.72
2SJ 77	2.46
2SJ 78	1.70
2SJ 79	1.97
2SK	
2SK-104	0.25
2SK 1045	3.75
2SK-105	0.23
2SK-1056	4.77
2SK 1057	5.24
2SK-1058	5.99
2SK-106	0.20
2SK 107	0.23
2SK-109	0.83
2SK-1095	3.00
2SK-1117	2.25
2SK 1118	2.25
2SK-1124	4.71
2SK 117BL	0.23
2SK-118	0.25
2SK-121	0.45
2SK-1245	3.29
2SK 1246	3.72
2SK-125	0.80
2SK 1254L	1.20
2SK-1254S	1.31
2SK-133	5.01
2SK-1335	1.28
2SK-1336	0.45
2SK 134	4.67
2SK 135	4.13
2SK 146V	1.70
2SK-147	0.93
2SK-147BL	1.02
2SK-147GR	0.83
2SK-147V	0.89
2SK-15-0	3.00
2SK 150	1.13
2SK-161	0.24
2SK-162	0.87
2SK-1626	1.56
2SK-163	0.20
2SK-168	0.21
2SK-170GR	0.30
2SK-175	7.24
2SK-176	6.15
2SK-184	0.21
2SK 192A	0.23
2SK 193	0.38
2SK 195	0.48
2SK 197	0.38
2SK-212	0.23
2SK-213	1.32
2SK-214	1.43
2SK-215	3.38
2SK-216	1.61
2SK-217	0.27
2SK-218	3.43
2SK-219	1.17
2SK-240	1.08
2SK-241	0.23
2SK-246	0.23
2SK-270	0.42
2SK-294	2.76
2SK-301	0.18
2SK 30A	0.30
2SK 30AGR	0.25
2SK 310	1.79
2SK-312	7.86
2SK-313	8.02
2SK 315	0.57
2SK 319	2.93
2SK-320	3.06
2SK 322	1.17
2SK-323	0.30
2SK-33	0.20
2SK-346	1.88
2SK-358	2.32
2SK-365	0.41
2SK 369	0.23
2SK 370	0.27
2SK-371	0.27
2SK-381	0.12
2SK-385	5.25
2SK 386	4.91
2SK-388	6.77
2SK-389	0.96
2SK-399	4.61
2SK-40	0.41
2SK-400	5.55
2SK 405	3.70
2SK 408	7.50
2SK 41	0.25
2SK-413	4.98
2SK-414	4.32
2SK 415	4.14
2SK-416	1.35
2SK 416L	1.31
2SK 416S	1.37
2SK-422	0.60
2SK 423	0.60
2SK-429	1.38
2SK-429S	1.76
2SK 430L	1.31
2SK-430S	1.38
2SK-44	0.23
2SK-442	3.17
2SK-49	0.25
2SK-511	3.53
2SK-513	2.67
2SK-517	1.53
2SK-525	3.18
2SK-530	2.03
2SK-531	2.91
2SK 532	1.88
2SK-537	2.12
2SK 538	4.73
2SK-539	9.75
2SK 544	0.24

2SK-55	0.30
2SK-553	1.88
2SK-555	3.53
2SK-556	3.93
2SK-557	3.45
2SK-55D	0.30
2SK-560	4.77
2SK-565	3.98
2SK 566	6.75
2SK-58	0.75
2SK-591	3.17
2SK-606	0.30
2SK-612	0.67
2SK-68	0.27
2SK-681	0.52
2SK 684	8.25
2SK-693	7.95
2SK 695	4.80
2SK-699	0.75
2SK 701	1.13
2SK-703	0.99
2SK-724	5.63
2SK-725	4.80
2SK-727	5.25
2SK-73	0.58
2SK-735	4.82
2SK-738	0.67
2SK-758	2.25
2SK 769L	10.50
2SK-787	8.69
2SK-790	5.52
2SK 791	1.88
2SK-792	2.25
2SK 793	4.43
2SK-794	4.13
2SK-817	2.70
2SK-854	1.88
2SK-872	7.58
2SK-903	6.00
2SK-945	1.05
2SK-951	6.00
2SK-954	4.50
2SK-955	5.63
2SK-960	6.00
2SK-974J	1.20
2SK-974L	0.69
3SK	
3SK-101	0.38
3SK-102GR	0.56
3SK-107	0.67
3SK-121	1.20
3SK-129	1.49
3SK-134	0.57
3SK-136	0.35
3SK 165	1.83
3SK-166	2.28
3SK-40	0.48
3SK 45	0.80
3SK 51	0.80
3SK-59	0.83
3SK-73	0.50
3SK-74	0.41
3SK-77	0.38
3SK-81	0.41
3SK-85	0.60
3SK-87	0.35
3SK-88	0.42
62525	0.45
9012	0.08
9014	0.08
AA 100	9.00
AA-100	9.00
AC	
AC-127	0.30
AC-128	0.30
AC-142	0.23
AC-186	0.30
AC-187	0.30
AC-187K	0.60
AC-188	0.25
AC-188K	0.54
AC08FSM	1.50
AC10FSM	1.38
AD	
AD-149	1.10
AD-161	0.90
AD-162	0.84
AD-262	0.60
AF	
AF-121	0.52
AF 124	0.67
AF-127	0.52
AF-178	0.38
AF-179	0.38
AF-180	0.38
AF 181	0.30
AF-239	0.38
BC	
BC-107	0.12
BC 107B	0.11
BC 108	0.13
BC 108A	0.11
BC 108B	0.14
BC 108C	0.14
BC 109	0.11
BC-109A	0.11
BC-109B	0.12
BC 109C	0.14
BC-113	0.18
BC-114	0.09
BC-115	0.17
BC-116	0.17
BC 118	0.17
BC 120	0.08
BC-125	0.09
BC 126	0.11
BC 136	0.09
BC-137	0.18
BC-138	0.30
BC 141	0.23
BC 142	0.20
BC 143	0.32
BC-147	0.23
BC-147B	0.05
BC 148	0.17
BC 148A	0.23
BC 148B	0.20
BC-149	0.08
BC 149B	0.08

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TELEVISION

Channels Galore

One increasingly wonders why so much political effort was put into keeping alive the MAC approach to the development of TV transmission when the digital approach was advancing at such a rate. Philips and Thomson, who have a great deal of influence with the European Commission, had of course invested heavily in MAC – and saw it as a way of halting the advance of Far Eastern consumer electronics manufacturers in the European market. But they've not been idle with respect to digital TV, which has everything going for it – including the prospect of an internationally accepted standard.

The aspect of digital TV that has been much in the news of late is the prospect of vastly increasing the number of channels in the bandwidth available through the use of signal compression. BBC and BT engineers demonstrated at the recent ISO/MPEG (the Moving Pictures Expert Group of the International Standards Organisation) meeting in London a video coding system that compresses a standard-definition TV signal to a data rate of 6Mbits/sec rather than 216Mbits/sec. Of particular interest technically is the fact that this system has a 'two-layer' capability, providing standard or HDTV pictures in either of two modes, simulcast or compatible. In the former the SDTV and HDTV images are coded independently while in the latter the SDTV signal is used as one prediction option for the HDTV encoder. Digital compression systems reduce the demand on spectrum space by selecting for transmission only the differences between successive fields rather than sending complete fields. The receiver's decoder uses a field store to hold the field, the incoming data being used to update it.

Thus digital signal processing enables us to cram more channels into a given bandwidth and/or provide higher-definition pictures. At the recent *Financial Times* Cable and Satellite conference Celso Azevedo, technical director of Societe Europeenne des Satellites (SES) which runs the Astra system, announced that by building digital capability into its new satellites the Astra system would be able to provide 180 channels in two years' time. This could be doubled to 360 channels by launching a further satellite. The digital compression system to be used squeezes ten standard channels into the space now occupied by one.

From the broadcasting viewpoint the economics are interesting. A single-channel transponder at present costs £4m a year to lease. If it carries ten digitally compressed channels the rent per channel could fall proportionally, introducing all sorts of possibilities. It seems however that the main use envisaged – who could provide 180 channels of separate programming? – is as a means of making feature films available to the viewer at a reasonable cost. Six channels could, it was suggested, be devoted to one film, with staggered start times so that the wait for the start of a particular film would not be more than about twenty minutes.

Digital compression enables the data rate for digital TV signals to be reduced by a factor of about fifty without any noticeable impairment of picture quality. It can be used for satellite, terrestrial or cable TV channels – and other services of course. Added complexity is required in the receiver, but with modern chip technology this shouldn't translate into any dramatic price increase. If we accept SCS's forecasting, and it has proved to be reliable in the past, this massive increase in the number of channels could be available within two-three years.

It is particularly gratifying that the UK continues to play a major role in the development of digital TV. The original impetus for its development came from the need for standards conversion. By early 1973 a field-rate standards converter developed by the IBA was in regular use. DICE (digital intercontinental conversion equipment) as it was known was an outstanding engineering achievement, the fastest computer in the world at the time. By the early Eighties compression techniques that enabled the bandwidth required to be halved had been developed. Along the way came teletext, Nicam and other developments. The UK has all along been in the forefront in digital signal processing.

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COVER PHOTO

This month's cover photograph shows the Ferguson IKC2 chassis – see article on pages 416-9

REED BUSINESS PUBLISHING

Importance of Dish Size with Astra Reception

Ian Martin

Some time back in these pages I wrote about the installation of my own Amstrad SRX200 Astra system and, subsequently, my Philips STU902 BSB system. Like many in the industry, I have since then bolted a lot of satellite dishes to a lot of walls and found several factors that commonly affect system performance.

Sparklies

The most common complaint with existing installations is of sparklies. This is usually because the signal's carrier-to-noise (C/N) ratio is too low. In most cases the cure is to realign the dish carefully, using a signal-strength meter, and perhaps add a little mechanical skew to the LNB with the voltage-switched type. Sometimes you find that the gain of an LNB or a receiver is lower on one or more channels than the others. In such cases changing a head-end component or using an LNB with a lower noise figure can give improved results. Whilst changing any head-end component, check for ingress of moisture or spiders. Where the cause of the problem is a mismatch in the cable, shortening or even lengthening it can just occasionally help. Unfortunately it's not easy to check on such deficiencies, let alone remedy them, in the limited time available when attending a simple Astra installation – and the problem always becomes worse as time passes or as soon as the installer goes away!

Even when all the above points have been checked and corrected it's still possible to have signal problems on a few channels.

This is especially so when a 60cm dish is used in a "fringe" area such as Wales, the South West or anywhere north of the M62. The problem is usually experienced first with some of the vertically polarised German mode 2 channels via Astra 1A – their signal strength becomes weaker as one travels westwards and northwards. It's accentuated when the receiver has a poor threshold and the LNB has a not-so-low noise figure. Wet weather worsens the situation by attenuating the signal from – and sometimes to – the satellite.

Dish Size

One solution, local planning regulations permitting, could be to use a larger dish. Originally SES, which owns Astra, specified the use of a 60cm dish and an LNB with a noise figure of 1·5dB in the central European area where the signal strength (e.i.r.p.) is 52dBW. Use of a 75cm dish was recommended in the "fringe" areas mentioned above, where the signal strength is 50dBW. Given these conditions it was predicted that CCIR grade 4 (or better) quality reception would be achieved with a clear sky, while acceptable performance would be obtained under 99·9 per cent of weather conditions. This however was a "link-budget" calculation: practical experience has taught us about the effects of bad weather and poor installation.

I decided to carry out some checks on dish performance by using various sizes with a standard set-up. All other things being equal, an improvement in delivered signal strength should be obtained as dish diameter is increased. The tests were carried out using an Amstrad SRD400 receiver and three dishes provided by Lenson Heath, each of which was fitted with the same Nothern Telecom LNB/polariser unit. Comparisons were made between 60cm mesh and 80cm solid dishes, some additional measurements being made using Lenson's new 98cm solid dish. Before any practical measurements were carried out, the relative gain of each dish was calculated from its signal-gathering area. This was then compared with the manufacturer's data. Table 1 lists the results of this exercise.

Performance Tests

Measurements were carried out on each of Astra 1A and 1B's channels, using the 60 and 80cm dishes, to establish the effect on the C/N level of using a larger dish. The results are listed in Table 2. The location was in South Wales and the measurements were made under clear sky conditions. Equipment conditions were as follows: LNB noise figure 1·3dB (quoted), meter receiver threshold 8dB (quoted).

Each Astra satellite has four transponder groups. Two use vertical and two horizontal polarisation. The four groups are "aimed" at different points in Continental Europe, i.e. they have different footprints/service areas. SES distinguishes the groups by referring to them as mode 1 horizontal, mode 1 vertical, mode 2 horizontal and mode 2 horizontal. Except for the Movie Channel, the Sky services allocated to the UK use mode 1 with vertical polarisation. Mode 1 is aimed to the west to give a footprint centred on Northern France/SE England. Hence the mode 1 signals should be the strongest ones.

Table 2 shows that the Sky channels 4, 8, 12 and 16 produce the highest C/N levels while the German channels 2, 6, 10 and 14 produce the lowest levels. This is largely because of the different group footprints. The D2-MAC channels 3, 7 and 11 have slightly better C/N ratios than expected, due to the MAC system's resilience to noise degradation. The Astra 1B satellite's transponder groups are not so clearly distinguishable in terms of measured C/N ratios, though again the vertical mode 1 signals are the strongest, particularly Documania via transponder 32. The choice of transponder 23 for UK Gold seems strange, as it produces one of the lowest C/N ratios. Overall these measurements seem typical of systems in this part of the world.

In considering the C/N ratio figures given in Table 2 we

Table 1: Dish size and relative gain.

Dish diameter (cm)	63*	80	98
Relative gain	1	1·61	2·42
Maker's quoted gain (dB)	36	38·5	41

*Lenson Heath's 60cm nominal diameter dish has an actual mean diameter of 63cm.

Table 2: C/N level measurements.

Channel/ group	Programme	C/N level (dB) 60cm dish	80cm dish
Astra 1A			
1 1H	Screensport	13·6	15·8
2 2V	RTL	13	14·8
3 2H	TV3	14·5	16·2
4 1V	Eurosport	15·1	16·9
5 1H	Lifestyle/JSTV	14	15·8
6 2V	SAT 1	12·5	14·4
7 2H	TV1000	14·5	15·9
8 1V	Sky One	14·9	16
9 1H	Teleclub	13·7	15·3
10 2V	3 Sat	12	14·2
11 2H	Filmnet	13·3	15·1
12 1V	Sky News	14·3	15·9
13 1H	RTL V	13·7	15·5
14 2V	Pro 7	13	14·6
15 2H	MTV	13·6	15·9
16 1V	Sky Movies Plus	14·7	16·4
Astra 1B			
17 1H	Premier	13·7	15·4
18 2V	Movie Channel	14·6	16
19 2H	ZDF	14·6	15·9
20 1V	Sky Sport	13·5	15·1
21 1H	DSF	14·1	15·7
22 2V	MTV	14·4	16
23 2H	UK Gold	12·6	13·9
24 1V	TCC/JSTV	14·1	15·9
25 1H	N3	14·2	15·3
26 2V	Sky Gold/TV Asia	13·6	15·4
27 2H	TV3	15·1	16·7
28 1V	CNN International	14·3	15·6
29 1H	NTV	13·8	15·4
30 2V	Cinemania	14·8	16·6
31 2H	TV3	12·3	14·9
32 1V	Documania	15	16·7

For measurement conditions see main text.

should perhaps mention that for good quality reception a C/N ratio of about 13dB is desirable. Less than 13dB usually means degraded performance in terms of a worse S/N ratio and sparklies. With the equipment used it was not possible to measure accurately below 11dB.

Similar results were obtained when the Amstrad receiver was used with an older "blue cap" LNB (noise figure 1·8dB) except that on all channels the measured C/N levels were approximately 1dB lower. Received picture quality was acceptable, though it was sometimes impossible to eliminate sparklies completely with the UK Gold and German channels when using a 60cm dish. Again this is typical of installations in this area.

Better results were obtained when the 98cm dish was tested, an improvement of 3dB in the C/N ratio being recorded in comparison with the 60cm dish. This would provide a good increase in the performance margin under adverse weather conditions. Unfortunately this size of dish is not specified for Astra reception, though it could form the basis of a motorised system. This takes us into the realms of planning permission of course.

As a separate test, mostly to satisfy my own curiosity, the same checks were made using an older 60cm solid aluminium dish. No measurable performance differences were noted in comparison with the results obtained using the 60cm mesh-type dish. Lenson Heath points out that the gain of a mesh dish should be similar to that of a solid one provided the holes are not too large. Of greater importance apparently is the shape of the holes: poorly designed perforations can trap water and snow, attenuating the signal when the weather turns bad. The choice of a solid or mesh dish is largely a cosmetic one.

Conclusions

What conclusions can we draw from these tests? It seems that SES's original calculations for the expected signal strength and dish and receiver characteristics were correct. When one gets close to the boundary of the 52dBW footprint however signal degradation increases. Although this boundary defines the area in which the use of a 60cm dish is recommended, better results are obtained using an 80cm dish. This is definitely the case where the customer wishes to receive German programmes without interference. More important perhaps is the improved margin against interference under bad weather conditions provided by a larger dish.

Another advantage of a larger dish is its reduced beamwidth, which means that it will be less likely to pick up interference from satellites adjacent to the one with which it is aligned. I have already come across a 60cm Astra system that, because of slightly incorrect azimuth alignment, was receiving signals from the Eutelsat craft at 16° as well. This problem can only worsen with time, as more satellites are placed in orbit and dish alignments move.

Acknowledgement

My thanks to Lenson Heath for the loan of dishes and the provision of technical data. In a later article I'll describe the installation of a polar mount designed for use with their 80 and 98cm dishes.

Letters

CHEAP WASHERS

During the course of my daily round I've noticed an increasing number of self-installed aerial brackets. Although they are fitted well enough the screw holes are too big for most woodscrews and leave little enough landing for Rawlbolts unless a washer is used. The thing that drew my attention was the number of cases where a two-pence piece with a hole drilled through the centre was being used in place of a washer. This intrigued me so much that I asked the price of a two-pence sized washer at my local hardware shop. The answer? Ten pence each!

Now don't get me wrong. I don't think that anyone can expect to buy anything for less than ten pence today, and if you think about it most of our use of the odd penny is because VAT brings the price to £XX·99 or something similar. But isn't it a sign of the ravages of inflation when five coins of the realm can be used as washers for the price of one of the real thing! I should perhaps add that I think it's against the law to deface British currency. Punishment is probably death by hanging or the rack. I believe it's quite an old law.

John Hopkins, The TV Workshop,
Felixstowe, Suffolk.

BRASS DRIVE BUSH

My thanks to W. Wilcock (February) and S.J. Caine (March) for their comments about the Sharp brass drive bush. If only to ensure that I haven't mislead anyone on the subject of the method of fitting I must comment further. In my original note (December 1992) I said that the brass item should be fitted using a hot soldering iron. Clearly this would be no good with the Sharp part. The one to which I was referring has a tapered fit however and is made to be heated for fitting to the shaft. I hope I didn't give the impression that I was actually soldering the thing on. The taper-fit bush is available from VAS Electronics, Gleneagles Avenue, Leicester (0533 664 850).

Chris Watton,
Boston, Lincs.

NICADS AND CAMCORNERS

I read John Kendall's letter (March) with some sympathy. The problem with the palmcorder is that the layman thinks, when it shuts down, that the 6V battery has been properly discharged. It hasn't. The memory effect will then affect the charge-discharge cycle and in no time at all the battery has become useless for its purpose. It can recover from this effect, with careful treatment, but the layman will have gone off to buy another battery – at some cost!

A nicad battery delivers only 1·2V per cell. Thus a battery of five is needed for 6V. Ideally they should be discharged until each cell reaches 0·9V, the end-of-charge voltage for a 6V unit being 4·5V. This is far below the point at which the camcorder shuts down. Possibly cost and size are the reasons for using a 6V battery, but if the end result is such an unsatisfactory charge life surely, as Mr. Kendall suggests, a 7·2V unit with some regulation in the machine would be a better option?

Discharging the battery until it is flat is not a good idea. Some cells may reach 0V before others. These will then begin to charge in the reverse direction, which makes life even more difficult. I've made a discharger for my 12V nicads. It senses when the terminal voltage has fallen to 9V then shuts off. By doing it this way I've managed to keep in service for over six years the batteries I use. Varta produced a very good guide for nicad users at one time: it might be worth trying to obtain one.

Many people comment about the short life of nicads used in radio receivers and personal stereo equipment. These items were designed to be used with zinc-carbon or alkaline batteries whose cell voltage is 1·5V. When a nicad battery with only 1·2V per cell is used the end-point voltage for the load is reached that much sooner!

Graeme M. Young,
Nottingham.

NICAM ON A SHOESTRING

I read with interest Keith Wevill's article in the February issue, having myself built a near identical system about ten months ago using components obtained from the same sources. I bypassed the TDA8421 tone control chip with some regret as it has such obvious potential, but I'd no way of obtaining data on the device or the I2C bus system. My solution was simply to take the audio signals from CS56/7 to 10kΩ log. potentiometers and, after removing diodes DS81/2, take the sliders of the potentiometers to RW37/CW28 and RW34/CW25 via 22μF capacitors.

The video signal required was obtained from the excellent signals panel used in the Philips G11 chassis. Since this requires some 40V to tune across the bands it fitted well with the 36V the Nicam panel needs. A further advantage of this signals panel is that it has a stand-alone audio demodulator and output section that also operates at 36V. This can be used for initial tuning, or as a separate mono output.

I wired up the G11 unit first to ensure that it operated satisfactorily, then carried out modifications to the Nicam panel as described by K. Wevill. The Nicam signal was taken from the video detector to the Nicam panel. In my case a d.c. bias was already present at the panel's video input so no problems were expected and none were found. Since I didn't intend to use the video signal for viewing I deliberately tweaked the vision i.f. to enhance the Nicam signal level.

The sound quality is excellent without any additional tone control and fully justifies reports on the system.

I.C. Rohsler,
Harborne, Birmingham.

COWBOYS SHOOT BACK

I read with particular interest Ed Rowland's article (February) on cowboys since by his definition I would be one of them though I've had twenty five years experience of repairing TVs and VCRs as well as the design and manufacture of various electronic products. But I'm not a member of any guild. I've moved away from full-time repair work now but do undertake the odd job in any spare time I am lucky enough to have.

While the cases mentioned by Ed Rowland are horrific, I can quote quite a number of instances of gross over charging and what amounts almost to fraud by 'respectable' dealers. An acquaintance of mine recently took a six-year old Hitachi VCR to one firm and was told that the trouble was caused by defective heads, which cost £97 plus fitting, and that the machine was therefore a write off. When my acquaintance asked for it back he was told rather aggressively that there was no point and that it would be disposed of for him. He rather stupidly agreed to this.

Now you and I know that a set of replacement heads for such a machine can be obtained for between £10 and £20. I wouldn't mind betting that the dealer concerned whacked in such a set and either put the machine out on rental or sold it off. Such cases are not rare in this part of the world. I recently fitted a motor supplied by the customer to a record deck. Total time taken was less than five minutes. The quote from another firm was £45 plus VAT.

I'm sure that most dealers are from time to time guilty of making up losses incurred in sorting out the real pig that we've all had occasionally. My point is that there seems to be an increasing trend for certain dealers to do this all the time. The same trend can be observed with other retail businesses. My wife recently took a ring to a well-known firm of High Street jewellers for a small replacement opal to be fitted. The manager quoted £150 – we had the job done for £8 by another more honest but much smaller jeweller.

Maybe if the repair business cleaned up its act and charged an honest rate for each job, based on the amount of time spent doing it, instead of working out the cost on the "how much can I get from this client" basis, the cowboys would be out of business because the public would learn to trust local dealers. I've just had a set in from someone who lives forty miles away: he simply doesn't like being ripped off the minute he walks through the door of a 'respectable' dealer.

L.J. Pitts, B.Sc.(Hons.), FIAP, LRSC,
South Brent, Devon.

I feel that I must take issue over Ed Rowland's Cowboys article (February). It seems to suggest that anyone who offers a repair service without certain paperwork or qualifications is a crook. A comparatively few bad experiences are cited, leaving the reader to infer that this is the inevitable penalty for not paying the full price asked by those who have the paperwork. Qualified people are not immune from dishonest practices however.

Be honest about the fact that many cowboys, almost certainly a majority, are capable of doing just as good a job as those with qualifications. Many of them will honourably admit defeat if they cannot cope.

It's natural for those who have undergone formal training to feel hard done by when they find that others can do a lot of their work as a result of informal learning and self-taught skills. One shouldn't deny the right to those members of the public who want, or can only afford, to take a cheaper and often worthwhile risk in getting their servicing done. I know that there are safety issues here, but Ed Rowland didn't specifically mention these. Clearly any servicing involves risks. Electronic work is not alone in this respect, and there will always be a minority of bad cowboys. But this is what free competition and choice is all about.

And for heaven's sake don't encourage the Eurocrats to get their ham-fisted fingers on any more of our activities. This would only make life more difficult for us all, including those who feel that they are fully qualified.

What's needed is a way of punishing those who behave badly rather than more restrictive practices.

Martin J. Loach,
Abingdon, Oxon.

I'd like to point out that not all cowboys are the small fry, as suggested in Ed Rowland's article (February). About two years ago I was working at a training establishment in Liverpool. Trainees from our and other departments were allowed to bring in TV sets, VCRs etc. to be repaired where possible. The majority of sets were old ones (Philips G8s etc.), many intended for use with little Johnny's computer games.

One morning however a three year old set made by a large European manufacturer was brought in. Its owner told us that the local approved dealer, who advertised and sold just this one brand and had sold him the set, had said that the tube was duff. A replacement, with fitting etc., would cost around £150, with a small discount for cash. He could have the latest all singing and dancing model however for a good discount with trade in. There was an argument and the disgruntled set owner withdrew. We were his second opinion.

The type of tube involved is renowned for premature failure. Its display was sad to say the least – very dark and muddy. The red appeared to be missing, but on closer observation seemed to be fading in and out cyclically. A check showed that the tube base voltages were all more or less correct. By now most of you will have guessed that the tube was o.k. Disconnecting the degaussing plug and carrying out a manual degauss restored a perfect picture. The degaussing thermistor was the offending item of course and was replaced. The old one sounded like Mick Jagger's maracas, and showed perfectly for our students what the inside of a cooked thermistor capsule looks like. From set switch on to repair completion took about an hour, including discussion of the fault with the trainees initiating the sequence of steps in the fault-finding process. The happy owner bought everyone a pint.

His annoyance with the dealer was understandable. Further questioning brought out the information that during his visit to the dealer the set was at no time out of his sight (he was actually taken into the workshop) and that the set was never opened, diagnosis being based on off-air signal reception. How many other basic rules were ignored?

How many other people are taken in by these methods? Joe Public expects an accredited dealer to be a little more honest than the Snoddies of this world, but there are nevertheless such obvious rackets.

About a week later the set's owner came back to see us. He'd returned to the shop and confronted the engineer, who had a 'manager' badge on his coat. Once again he was offered a discount to buy a new set. He left after telling the 'manager' that he would never shop there again.

P. Perkins,
Wirral, Merseyside.

FIXING GRUNDIGS

Excellent technical advice on Grundig products can now be obtained from a very helpful gentleman, Allan Dyson of Tameside Technical Services. He's an ex-Grundig TLO whose advice is available to the trade at a very reasonable charge.

Our own problem started when a service manual for the VS520 VCR couldn't be obtained from Willow Vale, who told us that they had been trying to obtain it from Grundig for months. I had paid my membership to TTS: my phone call to Allan Dyson resulted in a tuner/i.f. fault being traced to component level – with a complimentary service manual being thrown in!

With Grundig phone lines that are permanently busy, or "we don't give technical advice to non-approved service departments", I can certainly recommend Allan Dyson's service. He can be reached on 061 367 9400. This is what technical advice should be like.

Brian Davidson, Davidson Bros.,
Greenock, Renfrewshire.

Modern TV Receiver Techniques

Part 4

Eugene Trundle

There was a time when TV receiver audio circuits could be dealt with in a few paragraphs. While this is still true with simple, basic TV sets, there have been tremendous changes in audio systems at both ends of the broadcasting chain over the last few years. We'll start with the simplest arrangement and work up from there.

Mono FM System

The monaural sound signal is transmitted on its own frequency-modulated r.f. carrier, with ±50kHz maximum deviation, at a level 10dB below that of the vision carrier. With system I the sound carrier frequency is spaced 6MHz above the vision carrier: with the European systems B/G the spacing is 5·5MHz above the vision carrier. As before, we'll stick to system I for our examples.

The sound carrier beats with the local oscillator in the tuner to produce an i.f. output at 33·5MHz. There are two alternative ways in which this signal can be processed. It can either be filtered out then amplified and demodulated, or passed via the vision i.f. amplifier to the vision demodulator where it will beat with the vision carrier to produce a 6MHz difference signal, with the f.m. intact, which can then be selected, amplified and demodulated. The latter system, called the intercarrier system, has been in use for many years. It has several advantages: tuning errors and drift have no effect on the carrier frequency, which is governed solely by the very accurately maintained vision-sound spacing at the transmitter; the sound carrier benefits from the gain provided by the vision i.f. amplifier; and the sound circuit is simple.

Typical Circuit

Fig. 1 shows a typical simple TV sound system of this type. The input from the vision demodulator is first passed through a ceramic filter which is resonant at 6MHz, its bandwidth being about 200kHz. This is wide enough to embrace the ±50kHz f.m. sound deviation while rejecting the luminance and chroma signals. In some receivers two ceramic filters are used, connected in series. The sound carrier enters the chip at pin 1, after which it's passed through several stages of amplification with limiting – the limiting clips off any amplitude modulation caused by the vision signal, the a.m. rejection with normal input levels being about 55dB.

The clipping action produces a squarewave output. As this contains many harmonics of the baseband frequency the signal is next passed through a low-pass filter. This restores the carrier waveshape to something like a sinewave for application to the f.m. demodulator, which is of the quadrature synchronous type. Again, as described last month, the action is based on the sample-and-hold principle. The sampling gate is opened for an instant during each carrier cycle. An unmodulated carrier will be passing through zero when the gate is opened, so there will be no output. As the phase/timing of the signal advances and retreats, the sampling action generates an output that's proportional to the frequency deviation.

A reference carrier is required to produce the gating action. This is generated by the high-Q tuned circuit L1/C5 whose flywheel effect averages the carrier frequency, thus providing a constant-phase reference feed for the demodulator. In current practice a ceramic filter is used for this purpose instead of a discrete LC circuit.

Next comes a voltage-controlled amplifier (VCA) whose gain depends on the resistance between pin 6 of the i.c. and chassis. An alternative way of arranging for this volume control action is to apply a variable d.c. control voltage to pin 6, the volume level then being proportional to the applied voltage. Where control is done by sending serial data along a bus line the chip must incorporate a circuit to decode the data and set the gain of an amplifier stage. Back to the simple circuit shown in Fig. 1 however.

The Audio Amplifier

The demodulated audio signal has to be de-emphasised. An RC network performs this operation, the capacitor being connected to pin 12 of the chip while the 10kΩ resistor is within the chip. The signal is now ready for application to the driver and output stages which in a simple system are generally, as shown here, within the same chip. The output stage usually consists of a push-pull pair of transistors operated under class B conditions, the d.c. mid-point voltage being isolated from the loudspeaker by coupling capacitor C10.

The value of the resistors connected to pin 7 of the chip determine, as part of a negative feedback loop, the a.c. gain of the output stage, the capacitors connected to pin 8 setting the amplifier's upper frequency limit. R5 and C12 form a Boucherot cell which suppresses any tendency for h.f. oscil-

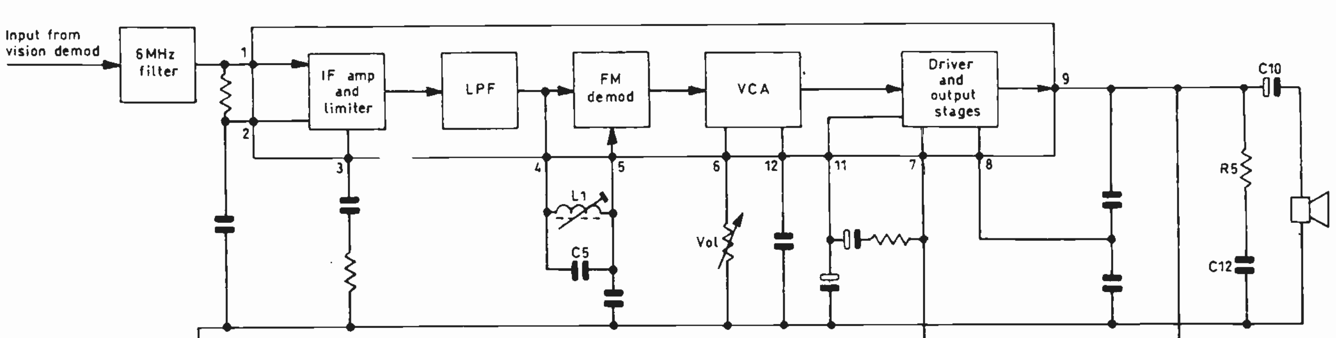


Fig. 1: Typical intercarrier sound/audio amplifier chip arrangement.

lation, due to the inductive load (the loudspeaker and its wiring), to occur in the output stage – similar arrangements are used in field output stages.

A small chip of the type taken as an example here will provide an audio output power of about 3W average, depending on the supply voltage and the heatsink arrangement used. This type of i.c., or a small power amplifier chip fed from a separate intercarrier sound amplifier/demodulator i.c., easily caters for the needs of a portable set or an economy large-screen receiver using a single loudspeaker.

Although for purposes of illustration we've shown a dedicated sound channel chip, in modern sets the intercarrier sound and audio preamplifier stages are likely to be incorporated in a more complex chip that performs many other functions.

Stereo Sound

There are several possible sources of stereo sound in a TV receiver: a built-in Nicam decoder; external sound-with-picture sources such as a satellite TV receiver, a hi-fi VCR or a Laserdisc player; and, in some countries, a built-in analogue stereo sound decoder. Incorporating a stereo sound system calls for difficult choices by the setmaker in terms of loudspeaker arrangements and operating power. The power drain introduced by a reasonably high-energy stereo audio system may be at least equal to that of the line output stage. With a class B output stage it fluctuates in sympathy with the sound: if a constant-current system is chosen there's little problem with regulation but a lot of heat has to be dissipated. For outputs up to about 5 + 5W a single dual-channel power output chip is generally used; for higher powers there is usually a separate audio output chip in each channel.

Since low-frequency sounds are not very directional some sets have a single, centrally-mounted woofer that's fed with the L and R signals and a pair of side-mounted boxes that take L and R feeds respectively and produce just the medium- and high-frequency sounds. Fig. 2 shows such an arrangement, devised by Sony. The centrally-mounted 13cm woofer has separate 7Ω coils for the L and R audio signals, which are fed to them via low-pass LC filters. The side-boxes each contain a 7·5 x 13cm mid-range unit, a 5cm dome tweeter and a first-order crossover network. In conventional stereo TV sets much ingenuity is used by manufacturers to overcome the acoustic problems associated with small loudspeakers in plastic cabinets. Bang and Olufsen, always aware of sound quality, have in some models used a pair of rear speaker-loading horns inside the TV set's cabinet, sticking up on each side of the c.r.t.

No matter how well a TV set's sound system is designed, there's no doubt that taking separate audio feeds from the set – or VCR – to a hi-fi system with widely-spaced loudspeaker enclosures is better for stereo.

Spacial Effects

Because a stereo receiver has two sound channels with closely-mounted speakers and may well work with a monaural signal for much of the time, several 'ambience' techniques have been devised to enhance the sound. They are also sometimes used in audio equipment.

The first of these is the 'stereo-wide' system, which gives the subjective effect of increased L and R sound separation. It's done electrically, by emphasising the difference between the L and R audio signals. The simplest and most common way of doing this is to inject into each audio channel an anti-phase (polarity-reversed) signal from the

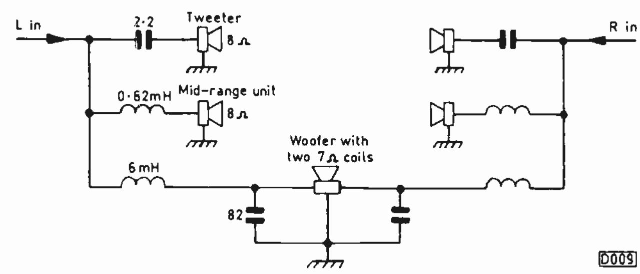


Fig. 2: 3-D loudspeaker system with a common base unit.

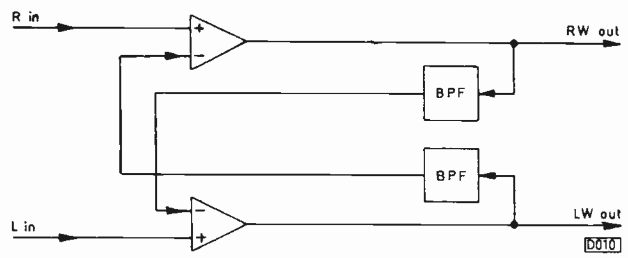
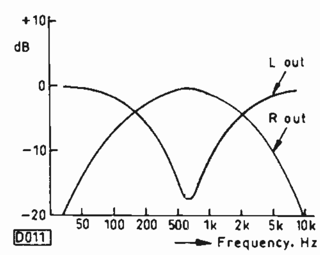


Fig. 3: A stereo-wide arrangement.



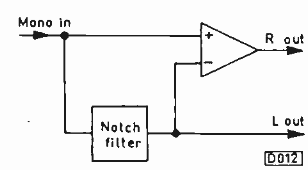


Fig. 4: Response curves for one form of pseudo-stereo system.

Fig. 5: Way of obtaining the response curves shown in Fig. 4.

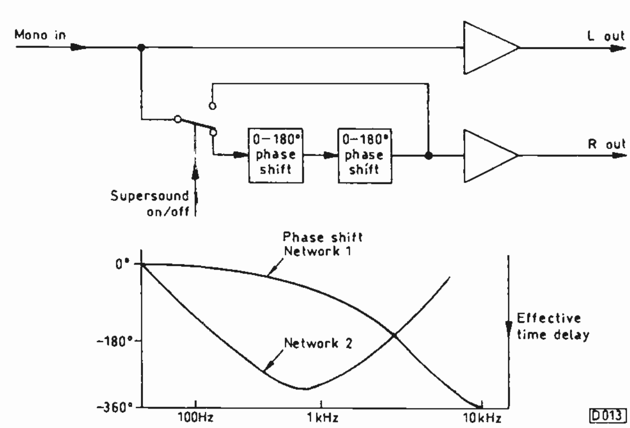


Fig. 6: Ferguson's Supersound system, in which the signals in the R channel are subjected to a frequency-dependent time delay.

other channel, generally via filters that pass only the mid- and high-frequency components of the audio signals. Fig. 3 shows the arrangement. Thus the greater the difference between the L and R sounds, the greater the differential emphasis. This arrangement is sometimes called spatial sound – the terms are often used indiscriminately.

With a monaural sound source and a pair of correctly-phased speakers at each side of the set the sound appears to come from a point between them – the picture tube screen. It's possible to process the monaural signal electrically to produce a pseudo- or artificial-stereo effect. While hardly natural, a subjectively pleasing 'projection into space' effect is obtained. One way of achieving this effect is to feed different frequency bands to the two speakers – see Fig. 4. Here a notch filter is used to reduce the mid-range frequencies in the feed to one speaker (left) while the other speaker (right) is fed with the original monaural signal minus the signal fed to the left speaker. Fig. 5 shows how this is done.

An alternative way of achieving this sort of effect is shown in Fig. 6. The signal in the left channel is left alone while the signal in the right channel is passed through two frequency-dependent delay networks. Their combined effect is to introduce a 180° phase shift at around 1kHz, increasing to a phase shift of 360° as the frequency rises. This time delay, proportional to frequency, in one channel gives a subjectively 'live' quality to the sound.

Before we leave the sound processing section, a word on the bass, treble and balance controls with which most stereo TV sets are fitted. Tone control is carried out by operational amplifiers with frequency-selective RC networks in their feedback paths. The amplifier's gain is set by a d.c. level at at an i.c. pin or a control data decoder within the chip. Typical control curves are shown in Fig. 7. Balance is set by differentially adjusting the gain of two VCAs, one in each channel.

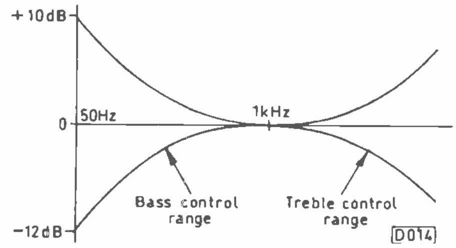


Fig. 7: Typical tone control response curves.

Satellite TV Sound

MAC TV transmissions use the Nicam/packet sound system we'll examine next month. With most conventional satellite TV transmissions that use f.m. vision modulation, for example the majority of the Astra channels, there are f.m. carriers for the sound, very similar to those used for terrestrial monaural TV sound. The main difference is that there are more of them! Fig. 8 shows a typical satellite TV channel spectrum, with five sound carriers sitting at 6·5, 7·02, 7·2, 7·38 and 7·56MHz on the h.f. side of the baseband video signal. The main carrier, at +6·5MHz, is used for the monaural sound signal, with a bandwidth of 20Hz-15kHz. Carrier deviation is ±85kHz and the pre-emphasis time-constant 50μsec.

Thus the f.m. signal processing system is exactly the same as that used for terrestrial TV transmissions, already described, save for the operating frequency – in the example just quoted the filter and demodulator are tuned to 6·5MHz. The simplest satellite TV receivers demodulate only the main sound carrier, providing a single audio output at a level of about 0dB (0·775V r.m.s.) for feeding to a TV receiver or VCR.

Auxiliary Carriers

Rather less deviation (±50kHz) is used with the auxiliary sound carriers, though the audio bandwidth is the same: thus the modulation index is rather lower. As this would result in

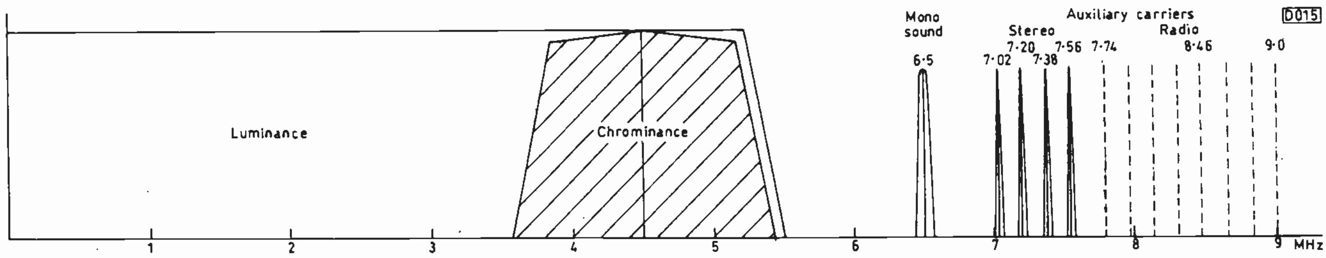


Fig. 8: Baseband Astra channel spectrum. In addition to the primary and four stereo carriers there may be up to eight further carriers, typically used for radio programmes. The spacing of the four stereo carriers is 180kHz.

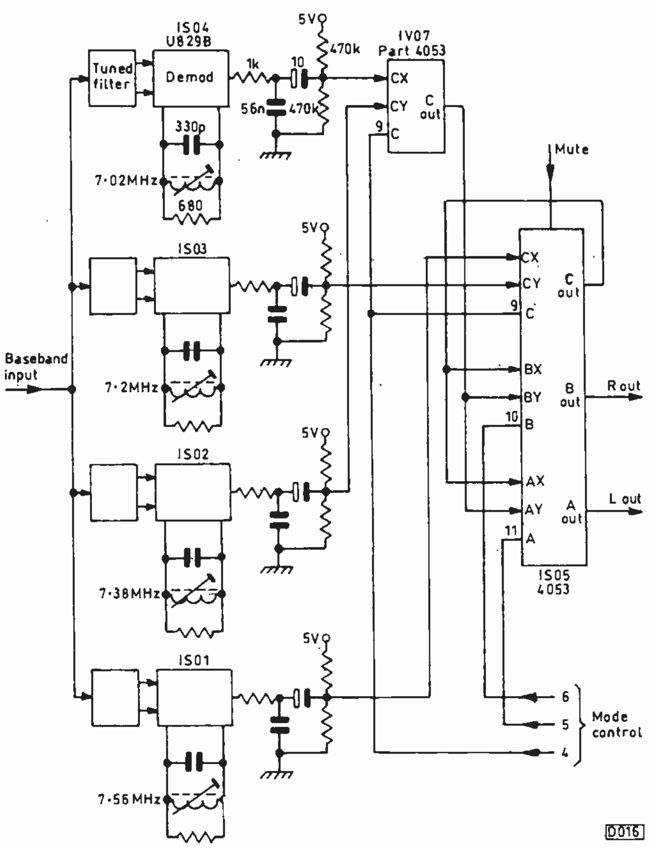


Fig. 9: Audio demodulator arrangement used in the Ferguson SRA4 satellite TV receiver. The four channels are identical.

a poorer signal-to-noise ratio a noise-reduction system is used – with Astra transmissions the Wegener Panda 1 type is employed. The term Panda is derived from 'processed narrow-deviation audio'. It's a form of adaptive pre-emphasis. The dynamic range of the audio signal is compressed before transmission so that, in relative terms, high-level signals are attenuated and low-level ones are boosted, the amount of compression also being frequency-dependent. The opposite has to be done to the baseband audio signal in the receiver so that its dynamic range is restored. In the process the noise component is suppressed.

The system has much in common with the companding principle used in hi-fi VCRs and with Dolby noise-reduction techniques. It's implemented by i.c. VCAs whose control voltages are derived from the signal itself via filters. Without noise reduction the signal-to-noise ratio of a narrow-band satellite TV sound channel is about 50dB: the Wegener Panda 1 system provides an improvement of about 18dB, increasing the subjective signal-to-noise ratio towards 70dB, which is very good for an analogue transmission.

Table 1 shows the uses to which the auxiliary sound carriers are put, for stereo and multi-lingual sound, with Astra transmissions. Fig. 9 shows the simple multi-channel sound selection system used in one satellite TV receiver, in which each carrier is selected by an LC tuned circuit and fed to its own f.m. demodulator. The four demodulators work all the time, the switching chips IV07 and IS05 selecting the ones required in accordance with the control signals applied to pins 9, 10 and 11.

Sound Carrier Conversion

An alternative to using four parallel sets of filters and demodulators is to employ a superhet system to convert the wanted carriers to fixed frequencies that can be handled by a pair of fixed-tuned filters and demodulators. This technique has the advantage of being versatile: it will work with any pair of carrier frequencies, including the piggy-back radio stations (see Fig. 8) that many transponders carry on carrier frequencies between 7·74 and 9MHz, while in sophisticated systems the required channel can be user-programmed per transponder and stored in memory.

There are several variations on the sound-superhet technique. A common one is shown in block diagram form in Fig. 10. Two fixed-frequency oscillators run at 17·72 and 18·08MHz. The output from one or the other is selected and fed to one of the gates of a dual-gate f.e.t. mixer, where it beats with the incoming signal to produce i.f.s at 10·52MHz (R channel) and 10·7MHz (L channel). With the output from the 17·72MHz oscillator in use the R sound comes from the 7·2MHz carrier (17·72 – 7·2 = 10·52MHz) while the L sound comes from the 7·02MHz carrier (17·72 – 7·02 = 10·7MHz). When the system control switches over to select the output from the 18·08MHz oscillator the R and L sound signals come from the 7·56MHz and 7·38MHz carriers respectively.

Table 1: Astra sound carrier arrangements.

Mode	7·02MHz	7·2MHz	7·38MHz	7·56MHz
1	Language 1 L	Language 1 R	Language 2 L	Language 2 R
2	Language 1 L	Language 1 R	Lang. 2 mono	Lang. 3 mono
3	Lang. 1 mono	Lang. 2 mono	Lang. 3 mono	Lang. 4 mono

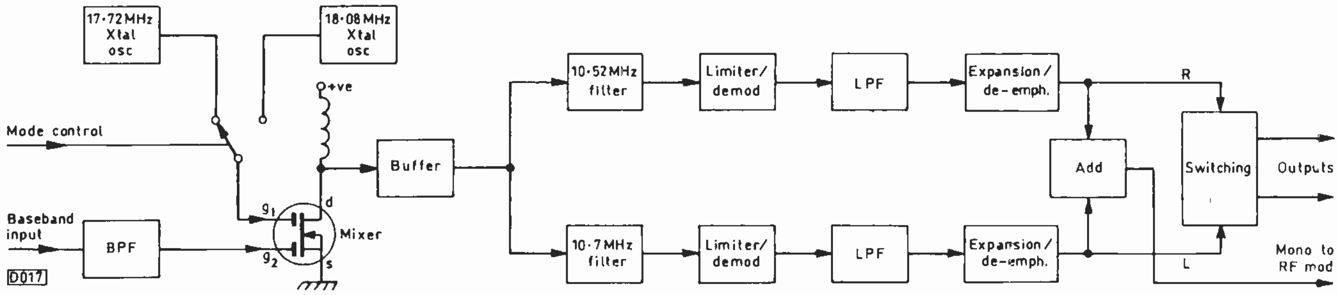


Fig 10: Superhet sound carrier selection system. The wanted carriers are shifted to 10·52 and 10·7MHz. Not all receivers have true Wegener Panda 1 expanders: the system is a licensed one and alternatives, which are known as soundalikes, may be used.

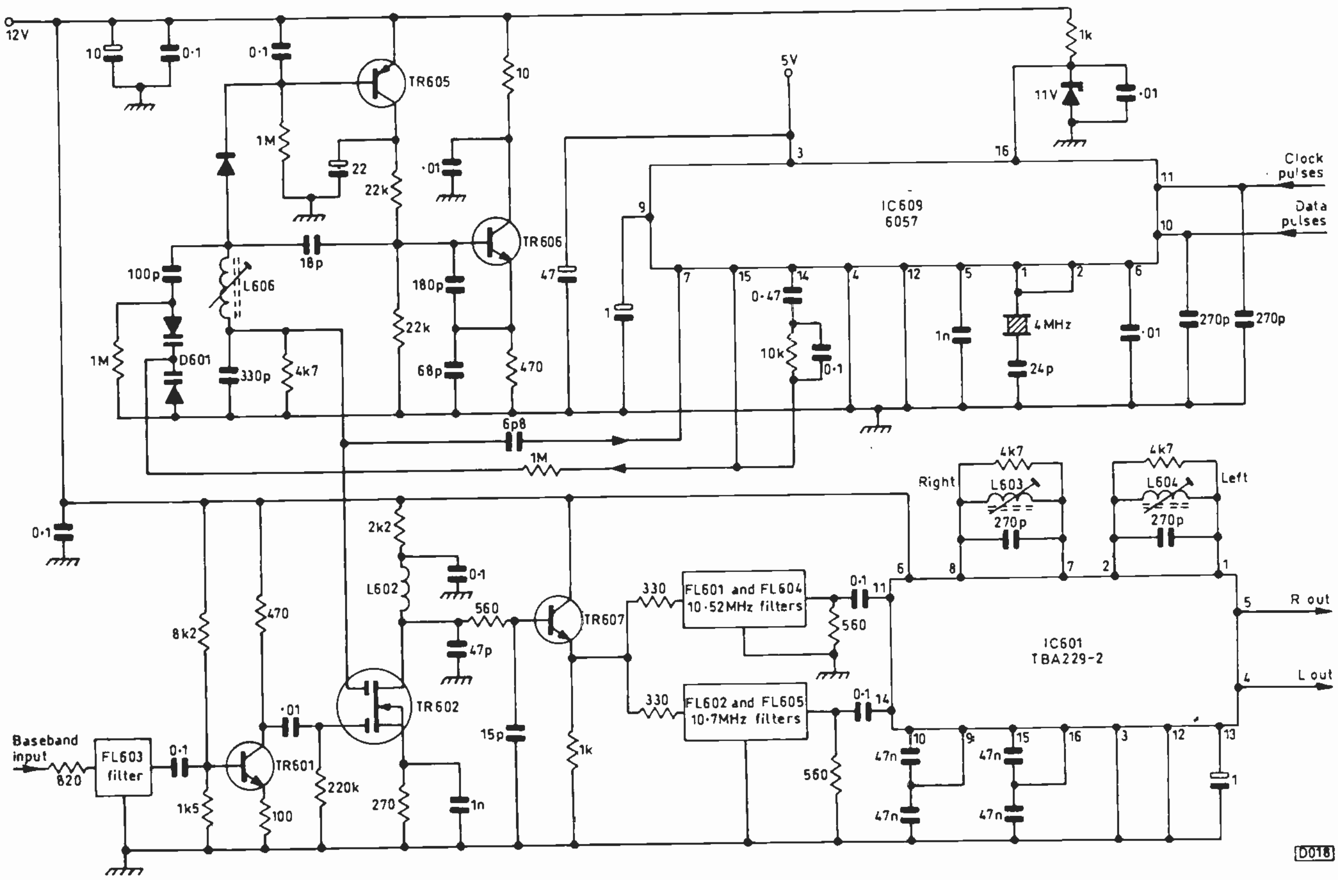


Fig. 11: Frequency-synthesis satellite sound tuning system, with effectively continuous coverage over 5-9MHz. The R and L outputs from IC601 in this Tatung design go to a dual Wegener Panda expander chip.

Instead of having fixed oscillators it's possible to use a variable or programmable oscillator: adjusting its frequency will tune, rather like a radio receiver, through the band of sound carriers associated with each satellite broadcasting channel. Fig. 11 shows one possible circuit. Tr606 is the local oscillator whose frequency is controlled by IC609 which contains a programmable divider and a 4MHz reference oscillator. These form a frequency-synthesis tuning system which is controlled by the receiver's microcomputer system control chip. The oscillator's output is fed to gate two of mixer transistor Tr602, whose other gate receives the whole spectrum of sound carriers from bandpass filter FL603 – this has a bandwidth of 5-9MHz.

The mixer's output contains all the sound carriers, converted to difference frequencies in the range 8-13MHz. Those centred on 10·52 and 10·7MHz are selected by ceramic filters FL601/4 and FL602/5 respectively and applied to pins 11 and 14 of the dual f.m. demodulator chip IC601. By programming IC601 any pair of sound carriers 180kHz apart (as in Table 1) can be brought into line with the filters and demodulators. In this particular design the sound is tunable in 10kHz steps from 5MHz to 9MHz, and any required point can be stored in memory. These tuning/control systems will be described in detail later in this series.

The L and R outputs from pins 4 and 5 of IC601 are passed to de-emphasis circuits that can be switched between simple linear (50μsec) or Wegener-expander operation.

Earlier in this series we looked at the principle of the double-superhet. In the type of satellite receiver we've just considered the sound carriers undergo four frequency changes: in the LNB, at the indoor tuner, at the vision demodulator and at the sound carrier frequency changer.

Next Month

Having covered analogue TV sound systems, in the next instalment we'll examine digital TV sound broadcasting – the Nicam and MAC/packet systems now used with many terrestrial and satellite TV transmissions.

VCR Clinic

Reports from Eugene Trundle, Nick Beer, Chris Avis, Graham Richards, Brian Storm, Alfred Damp. Chris Watton, Ed Rowland, J.R. Cutts, Michael Dranfield and John Edwards

GoldStar GHV1240I

This machine produced an unstable E-E picture, with poor sync, white crushing and bright psychedelic colours. The cause, as is usually the case, was the 1μF a.g.c. reservoir/decoupling capacitor, in this case C715. It was open-circuit. **E.T.**

Akai VS23

This machine has a rather complex power supply, with a mains transformer, chopper circuits and voltage doublers. One of the more obscure faults that arises in this area is partial failure of C6 (220μF, 10V). The symptoms are wavy horizontal bars (like r.f. interference) across the picture and on-screen captions and intermittent colour in the E-E and playback modes.

It's worth noting that if the audio/preamplifier PCB behind the drum isn't earthed the syscon shuts the deck down within a few seconds in all modes. Beware of this! **E.T.**

Tatung TVR6111

We do a lot of Tatung servicing and have on several occasions come across the following fault: the reel drive intermittently fails to engage when fast forward or rewind is selected. If you get this symptom, check that lever trigger 260 is free to slide along brake plate 261. If it's stiff, the metal stop for the brake plate (formed from the deck plate) needs to be bent very slightly to the right as you view the underside of the deck from the front. The numbers quoted above are taken from the exploded deck diagram in the service manual. This machine also appears under the Amstrad banner. **E.T.**

JVC HRD150/Ferguson 3V45

The play symbol, a dotted triangle, was lit up the whole time the machine was switched on, whether or not the play mode was engaged. It was caused by leakage between pins 4 and 5 of the fluorescent display PCB. Someone must have managed to spill liquid through the cassette loading slot! Thorough scrubbing with surgical spirit removed the conductive deposit in this very high-impedance circuit. **E.T.**

Sharp VC381

Misalignment is becoming a common problem with older VCRs. Realignment usually provides a lasting cure, making repairs justifiable. This particular example suffered from intermittent playback chroma. When the colour was present there was patterning on it. The cure was to reset the carrier peak adjustment slightly. In the record mode there was no picture because the dark clip was misadjusted. **N.B.**

Granada VHSHX3/Hitachi VT8700

This old timer had been bought for £50 at a sale. There are still plenty of them about! The customer said that it wouldn't play. On test there was no vision in the E-E mode – that's right, there were dry-joints in the i.f. can. It was the first time in years I've had that one. Next the supply guide post was missing, then the loading belt and the spool tyres were duff. After sorting that lot out and setting the machine up I found that it worked very well. An interesting point was that it had a large safety test label on the side from the previous day – presumably all electrical items in the sale had been tested. **N.B.**

Mitsubishi HS330

The complaint with this machine was that the sound would vibrate when the machine had warmed up. Having tested the machine for ages and heard no "vibration" I questioned the customer to find out whether she meant wow and flutter, which is not uncommon with this model. Not so. It seemed to be a buzz. So I had a poke around and had success – a buzz appeared on the playback sound. Its cause was traced to a dirty connection between the copper-coloured spring metal that earths the top of the cassette housing and the regulator heatsink. A clean and retension cured the problem. **N.B.**

Ferguson 3V54/55/57

Here's a trap for the unwary, like me. The VCR owner's house mains supply earth leakage trip had operated for some reason. When it was reset, the VCR was stuck in the aux mode. Embarrassment prevents a description of our efforts to restore sanity to the confused microcontroller chip and ourselves until a wiser colleague advised us to press the recessed "ch set" button. **C.A.**

Hinari VXL5

Two non-working, ex-rental machines we'd purchased had the same fault – when play was selected the tape laced, the drum ran very fast then the tape unlaced. The cause of the trouble was that the 6V supply to the drum feedback amplifier IC104 was very low as C145 (100uF, 10V) was short-circuit. We used a replacement rated at 16V. **C.A.**

Ferguson 3V54/55

We purchased a quantity of 3V54 non-remote control machines for reconditioning as the preferred 3V55 remote control version wasn't available at the time. It surprised us to find that infra-red receivers were fitted, though the machines would respond only to manual operation. When we traced the signal path from the IR receiver's output we came to a link, which had been cut, next to connector CN402 on the small eject-tracking PCB PC1614/1626. When the broken link is replaced the 3V54 becomes a fully remote-controlled 3V55! **C.A.**

Hitachi VT64

Playback was all right but when record was selected the drum and capstan failed to rotate though the record indicator lit and the tape laced up briefly before unlacing again. We found that the record/play switching voltage double-diode block D626 was open-circuit on the record side. By coincidence we found a similar faulty device recently in the sound section of an older Hitachi machine. In both cases a couple of good old 1N4148 diodes wired in back-to-back proved to be a suitable replacement. **C.A.**

Sentra VX8100HQ/Samsung VI710

For no erase replace transistor Q0501. It's a 2SD261 and no other transistor will work in this position! The cause of its failure is the erase head going open-circuit intermittently because of the plug/socket arrangement. Remove this and solder the lead on directly. How many more types of VCR will need this modification? **G.R.**

Hinari VXL8

The problem, because of mains-borne transients, was no E-E operation, no channel changing, cannot program etc. with just the letter E in the display. Unsolder the back-up capacitor for thirty seconds then reconnect it. Switch on and the microcontroller chip should recover from its crash. We've had this more than once and the routine has worked each time! **G.R.**

GoldStar GHV1248I

The E-E pictures were pulling, with ragged edges, more so on some channels than others. Attenuating the input signal (via the aerial lead) established that it was an i.f./a.g.c. type fault – in fact the symptoms were identical to those you get with some CUC series Grundig TV sets. Replacing C715 (1μF, 63V) put matters right. We assume that it provides a.g.c. smoothing but as we don't have the manual we can't be sure. **G.R.**

Alba VCR6000X/Sentra VX8400

As mentioned by Nick Beer in the January Clinic these machines very often suffer from tuning drift. Decoupling capacitors C133/4/5 for the VT line are prone to being leaky. In addition hardwiring the VT line to cure leakage will indeed provide a cure. But the reason for this tuning drift isn't leakage between the print tracks: it's caused by leakage on the component legs themselves! – around C134. The problem is caused by the quantity of glue that's put around the components in this area of the PCB during manufacture (top upper left-hand side with the board hinged up). I suspect that this glue absorbs moisture and then slowly becomes conductive. Thus rather than hardwiring it's easier and quicker to remove this glue and replace C134 (0·1μF). The μ574 33V regulator on this board can also be the reason for tuning drift. **G.R.**

Panasonic NVJ42

Although this machine would accept a cassette it was difficult to get the cassette back and the mechanism spooled backwards and forwards a great deal, rarely performing any function correctly. Checks soon showed that the solenoid which engages the mechanism was operating erratically. Instead of a satisfyingly solid clunk when the operation buttons were pressed only an anaemic click was heard. The solenoid drive system has two parts, a kick and a hold circuit. D603 in the kick section was open-circuit, a replacement restoring normal operation. **B.S.**

Panasonic NVF55

I seem to get more than my fair share of search-tuning faults. This machine would search but wouldn't lock on to stations. Checks on the sync low, a.f.c. defeat and a.f.c. feeds showed that there was nothing amiss to and from the demodulator pack, so out came this plug-in pack, revealing a surface-mounted diode (D6701, type MA151WK) with one end missing. A replacement cured the problem. **B.S.**

Ferguson FV31R

This machine had a nasty habit of breaking its back-tension arm as the deck mechanics mistimed themselves, no matter how carefully the instructions in the manual were followed. We noticed that when the machine set off in play the drum motor didn't rotate. This turned out to be a vital clue. The drum stood still because the 5V supply to pin 2 of chip IM02 was missing. From a look at the circuit diagram this appears to be totally unrelated. The PCB layout holds the clue: the link that supplies 5V to IM02 also supplies the pull-up resistor RT67 in the mode-sensing circuit, the cause of the trouble being a dry-joint on this link. With the dry-joint resoldered and the deck mechanics realigned yet again everything worked correctly. All that was left to do was to fit a new back-tension arm. **A.D.**

Ferguson 3V44/JVC HRD140

The drum and the capstan were both running slowly. A check on the servo reference signal, using a frequency counter, showed that it was running at only 2·5MHz. The cure was to replace the 4·433MHz crystal in the chroma circuit. **A.D.**

Matsui VX3000

The complaint was of loss of tuning overnight. On the bench however no channels could be tuned in. R6045 (33kΩ) was open-circuit. **A.D.**

Akai VS22

The problem with this machine was a bad hum bar on the E-E pictures. We found that C4 (47μF, 25V) on the power supply PCB was leaky. **A.D.**

Hitachi VTM722

The E-E audio was low and distorted while playback of a prerecorded tape produced only a cyclic chirping sound. We found that the always 9V supply to IC401 was low at only 4·9V because zener diode ZD854 on the power board was short-circuit. **A.D.**

Toshiba V83

The capstan motor was clearly running too fast. A check on the drive voltage showed that it was high at about 10-11V instead of 6·7V. Checks around the servo chip IC501 showed that although the voltage at pin 14 (capstan a.p.c.) was correct at 3·3V the voltage at pin 15 was only 0·9V instead of 3·3V. Scope checks at pins 19 and 20 (CTL in and out) showed that the control pulses were of correct amplitude though the frequency was of course high because of the excessive tape speed. The tracking input at pin 28 varied the length of the waveform, so all seemed to be correct here.

The next check was on the FG pulses at TP518. The waveform here had gaps in it and varied a little in amplitude. Unfortunately I ignored this, putting the irregularity down to the motor's increased and wowing speed. Wrong decision! So after replacing IC501 and finding that the fault remained as before I had a closer look at the FG pulses. When I dismantled the capstan assembly I found that the coil which forms the stator of the pulse generator was dry-jointed at the point where the enamelled copper wire is connected to the terminal. **C.W.**

Amstrad VCR4600

This machine was dead with the 2A fuse F603 open-circuit. I checked the rectifiers in the main power supply and as they all read o.k. a new fuse was fitted. It blew only a few seconds after switching the machine on again. The cause of the fault turned out to be C836 (3·3µF, 35V) which is in one of the voltage regulator circuits on the main servo/system control panel. **C.W.**

Logik VR950/Samsung VI611

This machine came to us with the infra-red sensor broken and the loading arms flopping about all over the place. The owner said that she'd tried to remove a jammed cassette and had damaged it in the process. What in fact appeared to have happened was that the nylon gear sector – it's the fan-shaped bit on the loading mechanism – had split where the steel pin is located, allowing the pin to slip out. Hence the looseness of the loading arms. A spot of Superglue was all that was required to repair the infra-red assembly. A new gear sector and pin – they are separate items – had to be ordered from Mastercare.

Imagine out surprise when, a few days later, the postman delivered two packages from Mastercare, one a box containing the gear sector, the other a jiffy bag containing the pin! Anyway fitting the parts and removing a thick ring of oxide from the capstan restored normal operation. **E.R.**

Saisho VR1200HQ/Matsui VX820/Hinari VXL35

Failure of Q02, type 2SD1207, is common with these machines. We find that a TIP41C with a heatsink is a reliable replacement. **J.R.C.**

Hitachi VT150

This machine is almost the same as the VT130 but has long play. The problem was a tape stuck inside, no functions and no eject. Whilst checking around we found that the M54649L loading motor and cassette lift motor control chip IC902 was very hot. As both motors ran when powered from a separate d.c. supply we replaced IC902. Unfortunately this made no difference. Voltage checks then showed that the 12V supply at pin 9 was very low at 0·5V. It's worth noting that this chip has two 12V supplies, one at pin 7 for the internal logic and one at pin 9 for the high-current motor drive.

Tracing back from pin 9 brought us to the power supply where IC851 had 18V at its input but no 12V output. Although the power supply panel looks the same as that in the VT130 the regulator chip is different – type STK5476. This is a 12-pin device with only pins 1-10 used. We didn't have one in stock though we did have the STK5471 as used in the VT130. When we removed the STK5476 we found that the heatsink was drilled with two sets of holes. The smaller 10-pin STK5471 was quickly fitted to the heatsink, restoring full operation. Could the STK5476 have been fitted because of a shortage of the other type of regulator? **M.Dr.**

Hitachi VT7000

This two-part tuner-timer/VCR came in with the symptoms of a dirty head. Cleaning this appeared to cure the fault but when a recording was made and played back nothing but snow and sound had been recorded. After borrowing a service manual we found that the record 9V supply at pin 8 of the TA4190 chip IC205 was very low at only 1V in the record mode. The source of this supply was traced to a small relay, RL402, on the bottom PCB. There was 9V at the input to this relay but no output. As we couldn't find a relay with the same pin connections amongst our scrap panels we decided to try cleaning the contacts of the old one. We used an Electrolube contact cleaning strip that's specially made for this type of job. It provided a complete cure and after a long soak test the machine was pronounced fit again. **M.Dr.**

Toshiba V71

As a new reel motor failed to restore reel operation we started to make checks in the drive circuit. The conditions at the fast forward and rewind selection pins of the TA7267P motor drive chip IC603 were correct but there was no motor supply at pin 3. Replacing this i.c. cured the problem.

For reference purposes note that in the rewind mode pin 7 is at 12V, pin 6 drops from 12V to 5V then returns to 12V, pin 5 changes from zero to 0·7V, pin 4 is the chassis pin, pin 3 changes from zero to to 5V for a couple of seconds then rises to 10V, pin 2 changes from 5V to zero and pin 1 stays at 5V. In the fast forward mode the voltages are the same except that pin 2 remains at 5V and pin 1 changes from 5V to zero. It's not uncommon for the reel motor or IC603 to fail, so the above readings may be of help in deciding which item to blame if you don't have the manual. **J.E.**

Akai VS105

Everything worked correctly except eject, the problem here being that the cassette came out flush with the front panel and couldn't be gripped. All the mechanical functions are set in motion by a motor which drives the main rotary cam beneath the deck via a plastic toothed belt and worm pulley. The carriage up/down lever is driven by a groove in the rotary cam. It was not travelling far enough to push the carriage all the way up, i.e. to eject. When the metal plate that covers the rotary cam was removed we saw that there was a split across half the width of the cam. Replacing the cam and retiming the mechanism cured the problem. Only the eject mode was affected because the other modes used the good portion of the cam. **J.E.**

Ferguson 3V44/JVC HRD140

This machine wouldn't accept a cassette. As the power supply circuit protectors were intact we turned our attention to the carriage assembly. The cassette could be loaded manually, after which all functions such as fast forward, rewind and play worked normally and the cassette was ejected correctly. We found that the cause of the problem was the leaf switch at the right-hand side of the carriage assembly. All was well after fitting a replacement. **J.E.**

CD Player Casebook

Reports from Nick Beer, Mike Leach and Savio Da Costa

Toshiba SL55

In the February casebook I mentioned an SM55 that refused to play some discs because the lens was dirty. It seems to be a problem with these machines – I've had others since. Despite the large metal cover over the mechanism the lens gets badly affected by dirt. **N.B.**

JVC XLE300

With consumer electronic equipment becoming ever more complex we all too often overlook the obvious. This was just such a case, and I could have kicked myself for not realising sooner what was happening. The complaint was that the player sometimes wouldn't read a disc, though when it did the results were o.k. On test in the workshop it wouldn't read any discs at all. So we assumed that the laser assembly was faulty and fitted a replacement. As this seemed to cure the problem we set up the machine and left it on a test run. Just for good measure we tried a long-play disc as well. This too was o.k.

When the next disc was tried however the machine took an extremely long time to read the TOC – in fact it made several attempts before it played the disc. After taking out the new laser assembly and again checking the mechanics I eventually realised what was going on. When a disc that lasted say an hour or more had been played the laser unit returned only very slowly to the beginning to read the next disc, which rotated very slowly. This in fact was the key to the problem. Fitting a new sled motor provided a complete cure. **M.L.**

Akai ACM370L

With most discs that were tried in it this midi system wouldn't play the first one or two tracks. The outer tracks played all right. As the machine always read the TOC we decided that the laser unit was o.k. After some soul-searching we resolved the problem: the PLL coil was marginally out of adjustment and wouldn't lock up at the beginning of the disc. Slight adjustment of the coil was all that was necessary. **M.L.**

Sharp DX650

This American (110V) machine came on when a new mains transformer from RS Components had been fitted to adjust for the different mains supply voltage. But when a disc was inserted CD showed in the display. The sled motor had seized – a drop of oil on the bearings freed it. After that the machine worked well. **S.DaC.**

HELP WANTED

Wanted: An e.h.t. transformer for the Tektronix type 545B scope, part no. 120-0308-00. Also an August 1986 copy of *Television*. W. Larman, Derimar, Horton Road, Stanwell Moor, Middx TW19 6BD.

Can anyone supply the correct circuit for the light gun that's used with the Binatone 01/4907 video game? Roger Burchett, 12 Ormonde Road, Hythe, Kent CT21 6DN. 0303 267 969.

Wanted: Circuit diagram or service manual for the LCM Electronics Ltd. telephone answering machine type P148F. F.C. Hughesdon, 19 Lower Road, Higher Denham, Uxbridge, Middx UB9 5EA. 0895 833 774.

Can anyone supply an AUX-box for the Luxor Model 6615 TV receiver, also a service manual? R. Burgess, 82 Bressey Grove, London E18 2HX. 081 989 6830.

Can anyone supply details of the modification to convert a Philips BSB receiver, Model STU902, for PAL reception? Peter Clarke, 28 Wentworth Gate, Linton Park, Wetherby, W. Yorks LS22 4XD. 0937 582 828.

Can anyone supply a battery or batteries for the Sony Model SLF1UB portable VCR – they are 12V types? R. Buckley, 25 Clarence Place, Morice Town, Plymouth PL2 1SF. 0752 560 660.

Wanted: Manuals for the following equipment – Sony VO1810 U-Matic VTR; Teac reel-to-reel X1000M; Sharp VC9300H VCR; Sony AV3420CE portable reel-to-reel VTR. Terry Martini, 6 Levant House, Mile End Road, London E1 4RB. 071 790 6807.

Wanted: Any Philips LaserVision discs (CLV or CAV) or any CD-Video (single or extended play) discs. B. Willis, 50 Sarum Crescent, Wokingham, Berks RG11 1XF. 0734 784 002.

Does anyone have a collection of *Television* from the first issue (April 1950) to 1977? Would be going to a very good home! Also maybe *Practical Wireless* from the first issue to 1970. Michael Dranfield, Dranfield and Harrop Colour TV-Video, 62 Fairfield Road, Buxton, Derbyshire SK17 7DW. 0298 71689 day, 0298 26094 home.

Wanted: Service information for the Lloyds LVC3000 VCR, made by NEC. S. Burns, 1 Harewood Drive, Ilford, Essex IG5 0PJ. 081 550 8222.

Wanted: LOPT for the Waltham Model 1401. Also a TDA1104, TDA1106 or MB1106 i.c. B. Battams, 23 Dudley Drive, South Ruislip, Middx HA4 6QN. 081 845 5123.

Wanted: Mains transformer for the JVC Model 7170GB and a LOPT for the Panasonic TC381GR. I.E. Finch, 6 Avon Court, Avondale Road, Luton LU1 1DT. 0582 487 533.

Wanted: Circuit diagram for the Bush Arena Model BC6130A (Rank Z718G chassis). Photocopy would do. D. Maciver, 46 Newhaven Main Street, Newhaven, Edinburgh EH6 4TD. 031 551 1616.

Can anyone supply service and operating manuals for the Houston Instruments EDMP-56E plotter? Stephen Shaw, PO Box 1404, Randfontein 1760 S. Africa.

Inside the Ferguson IKC2 Chassis

J. LeJeune

It's some four years now since Ferguson started to use Thomson-designed TV chassis. We are becoming familiar with a certain family likeness between them, as was the case with the 'old' Ferguson-designed chassis. The IKC2 is obviously a descendant of the ICC5 with which it bears many similarities, including the infamous though quite reliable thyristor field output stage. So what's new?

For one thing there's a totally different discrete-component chopper power supply. This is partly due to the use of a different colour decoder chip, type TA8659CN, which also incorporates the sync circuitry and the field and line timebase generators – you will recall that in the ICC5 a TEA2029C chip produced the line, field and chopper drive waveforms. Other features of the TA8659CN include automatic switching between PAL/SECAM/NTSC operation and a sharpness control circuit. The chassis is used in models with 41 and 51cm tubes. Unfortunately the audio section is nothing to rave over and has given rise to some customer complaints – in early versions of Model 41P3 the audio is definitely odd!

This article explains the new features incorporated in the IKC2 chassis, notably the power supply, and aims to help with fault finding, covering some common failures and how to deal with complaints about audio performance.

The Power Supply

Fig. 1 shows the power supply circuit used in the IKC2 chassis. It's a conventional chopper arrangement, but has three modes of operation – start-up, standby and full power. The chopper transformer LP36 provides mains isolation, and feedback from the secondary to the primary side of the circuit is also transformer-coupled (LP42), just as in the ICC5.

At switch-on the power supply operates in its start-up mode. Transistors TP09 and TP12 form a relaxation oscillator that produces a sawtooth waveform at a frequency of approximately 15kHz. The ramp is generated by CP09 which charges via RP09 and RP03. DP13 clamps the waveform to chassis potential. It's then fed to the base of amplifier transistor TP13. To get the oscillator running, a start-up voltage is provided by half-wave rectification from the mains supply – one side of the bridge rectifier provides the rectification, the feed being via RP36. RP06 provides a feed for the amplifier and driver stages.

Once the chopper circuit gets going and the secondary supply voltages are established the start-up oscillator is disabled by the crowbar circuit consisting of TP02/3 and the associated components. It senses the rise in the voltage produced by the rectifier circuit DP30/CP30. When the voltage at the junction of potential divider RP02/7 is sufficient to turn on DP20, the crowbar transistors TP02/3 latch on, removing the supply to the start-up oscillator.

TP02 and TP03 are also used in the standby mode, when they operate in a slightly different manner. Because the line output stage is inoperative in this mode, the drain on the power supply is very light. As there are no line pulses to drive the regulation system, the power supply runs in a kind of self-oscillating condition. What happens is that the start-up oscillator delivers 'bursts' of 15kHz drive. When the voltage developed across CP30 rises sufficiently, TP02/3 shut down the oscillator. The whole power supply then stops and the voltage across CP30 falls. Thus the oscillator can run again. This 'squegging' action provides a rudimentary level of regulation on the primary side of the chopper transformer, maintaining the voltage levels sufficiently for the standby condition.

To switch the set to full power operation a remote control command produces a low output at pin 20 of the microcomputer control chip IR01 (see Fig. 2). TR16 and TR17 then switch on, raising the PO (Power On) line to 15V. This brings the TA8659CN chip IV01 into operation and the line drive appears. The control action is at pin 40 of IV01 – it rises to 9V in the on condition. The line output stage now starts to work and pulses from pin 9 of the output transformer are integrated to produce a sawtooth waveform at the base of transistor TP54, which drives TP13 via TP69 and LP42. TP13 receives negative-going pulses that cut it off.

Now for the regulating action in the chopper circuit. Transistor TP53 acts as a comparator. Its emitter is held at a constant 5·6V by the action of zener diode DP55 and diode DP54 – the combination of a zener diode and a silicon diode provides the correct temperature coefficient. TP53's base senses the h.t. voltage via the potential divider RP51/PP52/RP52, PP52 being used to set the h.t. voltage. Thus the voltage at the collector of TP53 and the emitter of TP54 varies as the h.t. voltage varies. This sets the point during the sawtooth waveform at the base of TP54 at which this transistor switches on. TP54 is in fact acting as a pulse-width modulator. Note that the h.t. is set at different levels for different tubes. In Model 41P3 the h.t. should be 107V; in Model A51F it should be 111V with an Hitachi tube and 113V with a Philips/Videocolour tube.

As TP54's on time varies, so the conduction period of the chopper transistor TP29 alters to stabilise the output voltages. The base of transistor TP13 is forward biased via RP13. Negative-going, width-modulated pulses are fed to its base via DP17 and DP16 to switch it off. When TP13 is on, TP16 is off and TP17 is on – these are the chopper driver transistors. When TP13 is switched off TP16 conducts and TP17 switches off. Current via CP24 then drives the chopper transistor TP29 into conduction. The voltage across CP24 is limited to 2·1V by the combined junction voltages of the three diodes DP24/26/27. When TP13 switches on again TP17 conducts, discharging CP24 and cutting off TP29.

The longer TP29's period of conduction, the greater the amount of energy stored in the core of the chopper transformer and the higher the voltages developed by the rectifier diodes when TP29 switches off to release this energy.

TP18 and TP19 form an excess-current trip. Excess current is sensed across resistors RP32 and RP34 which are in series with the chopper transistor. When TP18/19 latch on, the drive to TP16/17 is removed. The supply to the start-up oscillator is also removed because DP08/9 conduct. There is auto-reset at a rate determined by the time-constant of CP18 and RP26.

The Line Timebase

Apart from the fact that, as in the ICC5 chassis, the output transformer has a load winding for the field output

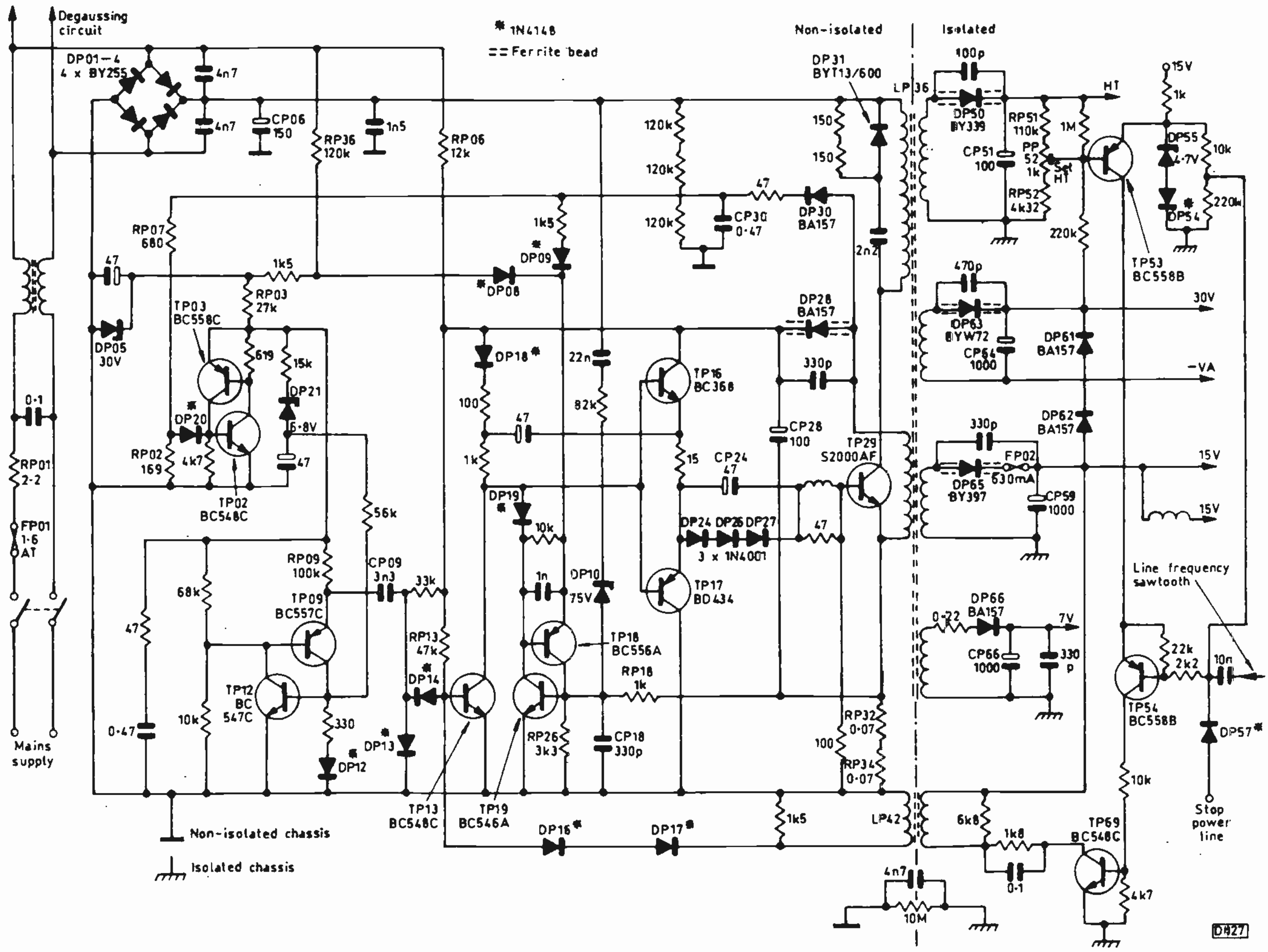


Fig. 1: The chopper power supply circuit used in the IKC2 chassis.

stage the line timebase is conventional. The line drive waveform is produced by the TA8659CN chip IV01. It emerges at pin 39 and is applied to the base of the S2055AF line output transistor TL19 via a straightforward driver stage whose main components are TL17 (BSR50) and transformer LL19. There's no active raster-correction circuitry and no width control. Coil LL26 provides linearity adjustment.

Safety Circuit

An unusual feature of the timebase section of the chassis is the safety circuit, see Fig. 3, which monitors the field output stage current, the beam-current limiter voltage and the line output stage derived 13V supply. RF24 (see Fig. 4) monitors the current flowing in the field scan coils. An excess will switch on transistor TV12, putting 13V on the SP (Stop Power) line. Diode DL16 switches on while DL17 is biased off, removing the line drive. Beam current is sensed via zener diode DV02 and the 13V supply via zener diode DV08. Excessive beam current (a negative-going voltage at the anode of DV02) switches TV01 on. Excessive voltage on the 13V line switches TV02 on, in turn switching on TV01. In either event the PO line, at some 15V, is linked to the SP line which, in addition to forward biasing DL16, acts on the regulator in the chopper circuit via DP57 (see

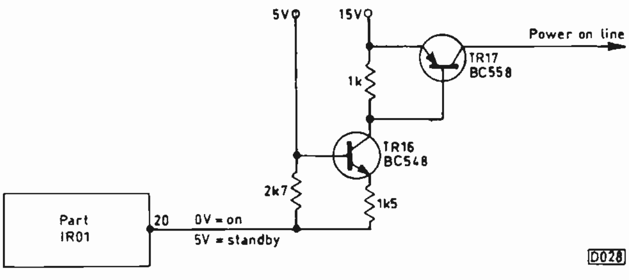


Fig. 2: The switch-on control circuit.

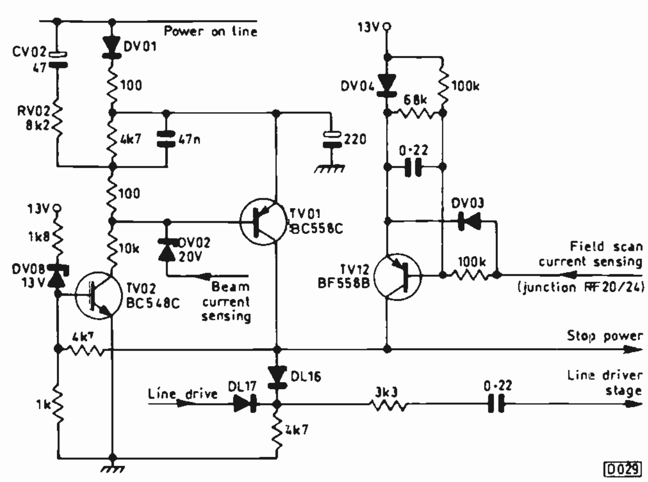


Fig. 3: The safety circuit. Some sets use a simplified arrangement with just two transistors: TV01 is then used for field overload protection and the beam current limiting is omitted (all sets have conventional beam current limiting via the contrast control circuit).

Fig. 1). This removes the line drive to TP54 with the result that the power supply operates in the standby mode. Note that TV02 (type BC548C) is incorrectly shown as a pnp device in the circuit diagrams in the service manuals.

The Field Timebase

The field timebase has unusual features throughout. Fig. 4 shows the circuit. Although the TA8659CN chip IV01 produces a field drive waveform at pin 31 this is used for sync purposes only. The field sawtooth waveform is generated across CF06, which is linked to the 180V line via the two 1·5MΩ resistors RF01/02. The ramp is negative-going however, CF06 being linearly discharged during the forward scan period via the pnp transistor TF08 which is driven at its base by the feedback capacitor CF02. IV01's field drive output is fed to the base of transistor TF25 which produces negative-going pulses at its collector to synchronise TF08. The negative-going field ramp is fed to the non-inverting input (pin 3) of operational amplifier IF01a. This is half of a TL082 dual junction f.e.t. operational-amplifier chip. The height control PF11 is part of the negative feedback network connected to IF01a's inverting input (pin 2).

The second operational amplifier IF01b is used as a pulse-width modulator. IF01a produces a negative-going output ramp at pin 1. This is applied to the non-inverting input of IF01b (pin 5). IF01b's inverting input (pin 6) is fed with a line-frequency sawtooth waveform (produced from integrated line flyback pulses). Pin 7 (output) of IF01b goes high whenever the voltage at pin 6 exceeds that at pin 5. The result at pin 7 is a series of line-frequency pulses whose width increases as the field ramp progresses – this is illustrated in Fig. 5. During teletext operation an additional 25Hz signal is applied to pin 6. This destroys the interlacing to remove vertical jitter.

The width-modulated line-frequency pulses are applied to the gate of the field output thyristor TF16 to switch it on. The field scan coils are connected in series with RF24/20/23, the winding between pins 5 and 6 of the line output transformer, and TF16/DF16 between the 13V supply and chassis. During the field flyback the thyristor is not triggered and DF16 rectifies the line-frequency pulses picked up by the winding on the transformer, charging CF25 to about 80V. This produces a voltage difference of about 65V across the scan coils, sufficient to produce a rapid flyback. When the thyristor is triggered on at the start of the field scan the pulse is of short duration. TF16 switches off when the next line pulse is produced by the transformer. Thus TF16 is on for only a brief period. It's switched on progressively earlier during each line, remaining on for a longer time. As a result the voltage across CF25 is reduced linearly to approximately 3V at the end of the field scan. This integrating action produces a linear field scan current.

Signal Processing

Colour decoding, sync processing and generation of timebase drive waveforms are carried out by the TA8659CN chip IV01, a Toshiba device with 64 pins. Though designed for multi-standard operation, UK sets are sold as PAL-I only models. Thus many of the pins are not used, being left open-circuit or returned to chassis via resistors. It has two crystal oscillators, one working at 4·43MHz for the colour decoding and the other at 503kHz (approximately 32 times line frequency) in the line sync phase-locked loop. Direct rather than count-down sync is used for the field drive in order to cater for non-standard signals.

The RGB output stages, of the class AB type, are on the c.r.t. base panel which has red and green gain and cut-off controls for grey-scale setting.

Tuner/IF Section

The tuner and the i.f. circuitry are contained within a screened compartment, their separate modules being soldered into the main PCB. The tuner is a Thomson MTP-I-2011, which has a dual-gate MOSFET r.f. amplifier stage with reverse bias a.g.c. It incorporates the PLL tuning control system. An LA7550 chip (IS10) amplifies and demodulates the sound and vision signals. It incorporates a d.c. volume control system. I.F. bandpass filtering is provided by a single-ended input SAWF.

Audio Output

A TDA2030A chip provides the audio output. It's operated with 30V and –30V supplies. The circuitry is simple and easily understood, but the peculiar audio quality provided by some Model 41P3 receivers requires a bit of explanation. Early production sets have a 24Ω speaker at the side of the cabinet. There's space for a similar unit at the opposite side, and one of the same type can be installed, wired in parallel with the existing speaker. An immediate improvement in sound quality will be noted. The sound is louder of course. Any worries about the TDA2030A overheating because of the doubled load current appear to be unfounded. Louder sound can also be obtained by reducing the value of RA07 in the feedback circuit from 5·6kΩ to 3·9kΩ, as in Model A51F. This increases the power available to around 5W.

The plastic moulded cabinets tend to rattle at high volume. Ferguson has available a small kit of damping pads to stop this – it's quite effective. Model A51F is the main suffered from this malady.

The Microcomputer Control Chip

Control of the receiver's functions is the responsibility of the TMP47C634N FERG 01 microcomputer chip IR01. These include on-screen displays, keyboard scanning and front panel display matrixing, the analogue controls and power on-off. Most of the operations are straightforward but the power control port, pin 20, is a useful one to know. Fig. 2 showed the circuitry and we've already seen that pin 20 goes low for power on, switching TR16 and TR17 on – TR16 is another transistor that's shown as a pnp instead of an npn device in the official circuit diagrams. There's a short delay in the application of drive to the line timebase as CV02 in the safety circuit (Fig. 3) has to charge. This prevents any wildly incorrect-frequency drive being applied to the line output stage, with the possibility of damage.

Teletext and Externals

Models 41P3 and A51F are fitted with a scart interface and Fastext PCB. Demodulated video output signals are available at pin 19 of the scart socket while pin 20 accepts an analogue video input. In Model A51F front-panel Cinch connectors are paralleled with the scart socket. RGB input signals can be fed to the scart socket, after which they pass to a CD4066B switching chip that sends either external or teletext RGB signals to the display circuits. The two-chip Fastext decoder is controlled by IR01 via an I2C bus.

The scart/text modules vary between the 41P3 and the A51F, but only in minor details. Both have an on-board 5V regulator whose input is obtained from the chopper's 7V

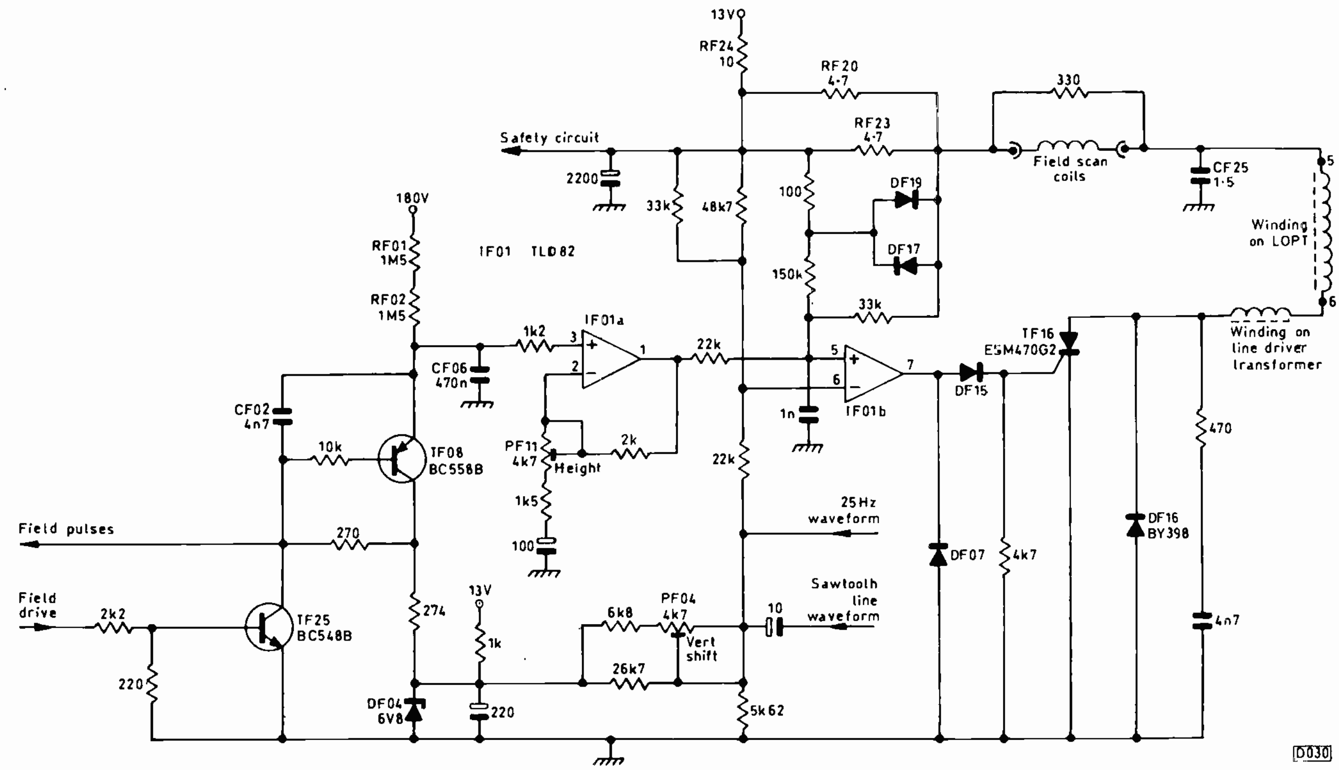


Fig. 4: The field timebase circuit.

output but requires, in addition, the presence of the line output stage derived 13V supply (V5) to enable it. A switch-on delay is included in the regulator circuit to prevent operation during the power-up sequence.

The scart interface handles composite PAL input and output signals, stereo audio input and output signals (there's only a mono output stage however) and RGB inputs. Pin 8 is for AV switching and pin 16 for RGB switching.

Servicing

While the chassis has a good reliability record the fact that it's tightly packed with components can cause difficulty when fault tracing and repairs have to be carried out. The copper side of the PCB is marked with the positions of the major components. This helps with location, but the circuit diagram is confusing in that lines which join don't always have a dot while use in a few places of the Continental habit of lumping wires into a 'loom' has infiltrated into publications that were once famed for their clarity and well thought-out design. Because of its low fault rate the chassis is not a familiar one to most engineers. This has made it, rather unfairly, unpopular.

Since many faults can cause the power supply to shut down it's possible to test the latter on its own in the standby

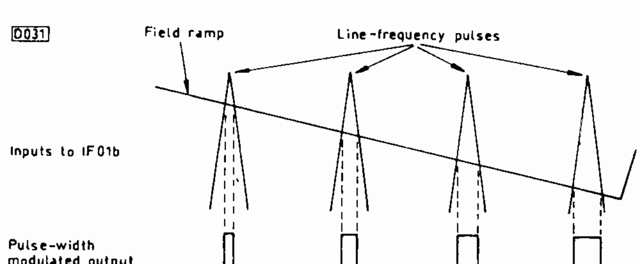


Fig. 5: Operation of the pulse-width modulator (IF01b).

mode. Running it at full power is not possible because this requires line pulses to drive the regulation system. To test the power supply on its own in the standby mode, disconnect pin 20 of IR01. Note that in the standby mode the voltage outputs obtained from the power supply will be approximately 25 per cent low and not in their correct ratios.

Faults in the IKC2 chassis are generally confined to the line output stage and the power supply, as you'd expect. A common complaint with early production sets was of tripping off at high beam currents. This was remedied by a string of modifications. Whilst these cure the trouble they are not easy to implement in the ordinary dealer's service workshop. For the brave however here are the details:

Change TL19's heatsink to a new type, part no. 50855846. Connect an 8·2Ω, 10% 10W resistor and a 2,700pF, 20% 100V capacitor in parallel and mount them on the new heatsink using the clip assembly that comes with it. These components replace jumper wire J138 in the h.t. feed to the line output transformer, so remove the link and connect the RC combination in its place via flying leads. Change RP18 to 1kΩ, 5%; C54 to 220nF, 63V; RP55 to 220kΩ, 5% 0·16W; and RP26 to 3·3kΩ, 5% 0·25W. Add a 22kΩ, 5% 0·25W resistor (RP50) between the base and emitter of TP54. If tripping still occurs, the value of RP26 may be further reduced as follows: to 1·8kΩ with 14in. sets, 1·5kΩ with 15-17in. sets or 1·2kΩ with 20in. sets.

DP28 going short-circuit will prevent the power supply working because the chopper driver stage has no supply – a clue is that RP06 will be quite hot. The 180V rectifier DL11 going short-circuit and its associated resistor RL11 open-circuit will affect the pulse feed from the line output transformer to the power supply with the result that the set trips.

Finally, take care when desoldering components in this chassis: good-quality desoldering wick should be used.

A Day at the Thick End

Chris Watton

It was a cold, rainy dismal Monday morning. As I entered the shop at around 9·20 a.m. to start the week with the usual zest and vigour I saw a strange figure, an unshaven man with unruly hair, dirty shoes and a solemn look. It was fearsome at this time of the morning, but as the haze of cigarette smoke cleared and the view through my bloodshot eyes came into focus I realised that some oaf had left a mirror facing the shop door when we closed on Saturday.

Turmoil

The day was uneventful until 9·35. Then all hell broke loose and the phone, which I'm sure is connected to the shop's door bell since one doesn't go without the other, didn't stop until lunchtime. We're the only TV shop in a village about ten miles from the nearest town and I'm sure all our customers think that if it's got a plug, a length of wire or some batteries we must be able to repair it or, worse, tell them how to use it. The recent bout of electric fence generators proves the point. Must be the time for the sheep to eat all the bits that we don't when the cabbage harvest is over.

Every Monday starts the same way for us. First we sort out the jobs we forgot to do on Saturday, then we start on the repairs where loan sets have been put out.

Some Easy Ones

The first of these was simple, a 22in. manual control Philips K30 that was tripping. It still tripped after the tripler had been unhooked. Oh no, please don't be difficult this early in the morning. After a quick check on the line output transistor I started to smile again – it read about 2kΩ between its emitter and collector. A new BU208 and a quick look for reasons why the old one should have failed soon revealed some dry-joints in this area, one on the flyback tuning capacitor. I'm sure that this was the cause of the transistor failure. Anyway the set was now working and displaying a good picture. So we put it on the soak test rack and lifted the next one on to the bench.

This was a Samsung CI1541ZG with a line across the screen. The field output stage in this chassis receives its supply from the line output stage. But not on this occasion as the 1·5Ω safety feed resistor R412 had failed. Replacement cured the fault and the set was left to run for the rest of the day to prove that no other fault had caused R412's death.

The Leslie Speaker System

After the first cup of tea and with two easy jobs under my belt I was ready for anything. I let myself in for a real treat, a Leslie speaker system. Now for those of you who haven't had the pleasure of acquaintance with this magnificent job here is what it is. An immense cabinet made from one-inch thick veneered plywood, measuring some 4ft 6in. by 3ft by 2ft and weighing about as much as a Philips G6 (remember those?), houses a 15in. woofer, two mid-range speakers and a tweeter, not forgetting the US-made solid-state amplifier in the bottom. There are also two motors that drive a rotating baffle for the woofer, and a pair of horns into which the tweeter is directed. In principle these rotating devices make the sound come and go. Questionable I think, but the owner assures me that this is what makes an organ sound like an organ. The problem was that the mains fuse kept blowing. Its cause was in the power supply where four huge diodes form a bridge rectifier for the amplifier. Two of them were short-circuit.

A Satellite TV Job

Now for a very important job. The boss had been complaining about the spotty picture his satellite TV system produced. My recent visit proved that the dish alignment was o.k., so the LNB was condemned. Right again. Four jobs in a row. This can't last! The new LNB was fitted in record time and a check on all channels produced perfect results. Incidentally although the satellite TV system is an Amstrad SRX200 the LNB I fitted was a new type called Continental. It's a smaller unit and has screws rather than rivets to hold it together. The F connection is at the bottom instead of the face side. It produced much better quality than the standard unit, with much less background noise – and is about ten quid cheaper.

A Tripping Sony TV

The last job before lunch was an 18in. Sony set that tripped. I don't know much about these sets but some basic fault-finding procedures soon put me on the right road. As with all sets that are tripping we first have to find out whether the fault is in the power supply or elsewhere. The way I do this with most sets is to identify the output from the power supply to the line output stage, disconnect this and use a 60W bulb to replace the load. If the tripping stops, the h.t. voltage can be checked. If this is correct the cause of the fault is likely to be somewhere in the line output stage.

Back to the Sony set. I followed my own advice and the tripping stopped. As the h.t. was about right at 118V I assumed that the power supply was o.k. So I removed the bulb and for some reason the idea that there must be a short-circuit in the line output stage was in my head. After much checking of diodes and capacitors it occurred to me that the line output stage was perhaps open-circuit rather than short-circuit. To test this theory I again disconnected the power supply and ran it with a lamp as the load. It worked. Then I disconnected the lamp and the power supply started to trip. I reconnected the power supply and put my lamp on the case connection of the line output device, a gate-controlled switch (GCS). The power supply now worked. This seemed to make fault finding much easier. I came to the conclusion that there was no line drive. As the bench was a bit piled up and the scope wasn't to hand I had another brainwave. If I put the meter on to its frequency counter range and checked for line drive I should get a reading of around 15kHz. So I checked at the gate of the GCS and found that there was a 15kHz signal here. It was time to check the GCS, which was open-circuit. Well, all this had led me somewhat astray but maybe next time I'll remember that the power supply won't run with an open-circuit load. And once again praise to the man who invented light bulbs.

After Lunch

Back from a healthy lunch – two cream buns, a bag of chips and a tin of pop followed by a very dry cigar – I now felt awful. But the first job that faced me was a set with which I'm more familiar than the one that preceded the refuelling session. It was a Finlux 9510 that was dead. My attention was drawn to the blackened d.c. fuse, so I checked the chopper transistor which was short-circuit. Experience has shown that when this device has failed the 270kΩ resistor Ru17 will be open-circuit. Replacing these two items brought the set back to life but there was no sync. Transistor Tb1 on the video output panel is the video inverter for the sync feed. It was open-circuit. Incidentally if you've not come across these sets before don't try to open the tuning flap – there isn't one. Many of these sets are marked around the on/off switch where people have tried to open the trim to adjust the set. It's all done via the remote control unit.

Things were really going well. I always start to worry when it's like this, knowing that some pitfall awaits. Would it be the Toshiba 140R4B that was next in line? It ran all right for long enough to make a cuppa and talk to colleagues about the state of the world. We soon put all the major unrest and catastrophes to rights. Then the Toshiba began to burp, producing a display that looked like a wineglass. Time for the pitfall I bet. When I removed the back the set ran for half a minute, burped a bit then ran again. Strange, I thought. Maybe a power supply fault of some sort. Time for some tapping on the panel. This made the funny noise come and go. There was a dry-joint on the line output transformer. This just shows that when you think it's going to be difficult it's easy, but when you think it's easy stop thinking.

VCRs

With about two hours to go to tea time I really had to set about some of the VCRs that were piling up. I mused over the job cards and picked an old favourite, an Hitachi VT11E. The job card said "won't rewind, chews tapes and stops whilst playing". Great! I popped in a dummy cassette and set it going. Sure enough the reel torque was poor, and the loading belts squealed as the arms reached the end of their travel. So I removed the case and opened the bottom panel, then connected the machine to a monitor and checked the recording and playback to make sure that the heads were o.k. They were, so the strip-down started.

I do this in two halves with these machines, as with most others. First the top: the head drum discharge brush, the pinch roller, the back-tension band, the reel idler and both reel discs, not forgetting where the height shims and washers etc. come from. I also remove the capstan oil seal at this time. With all these bits laid out, cleaning can commence. The reel shafts and the slant poles, tape guides and lower cylinder are all cleaned with alcohol. The reel discs are cleaned with methylated spirit, both inside the spindle holes and on the drive surfaces.

Part two is to tip the machine upside down then remove the capstan securing plate (two screws), take off the belts then remove the capstan – that's why I took off the oil seal before. Almost certainly the capstan shaft will be all brown and sticky. Finally the clutch/drive unit is removed (again two screws). Now there are bits everywhere.

My next step is to clean out the capstan bushes. Two pipe cleaners twisted together fit nicely. Soak them in meths and pull them through a few times. This removes all sorts of muck. When the bushes are clean I insert a cotton bud, with only one end on it, from the tape side of the deck which is now nearest the bench. Push it in just far enough so that it won't fall out then run some oil into the bushes from the open end (God this is confusing!). It will have time to work its way into the bushes while other work is being carried out. I feel that it's essential to service the capstan shaft in this way as I'm sure that heavy running greatly contributes to capstan motor failure. At about £45 trade these items should be looked after. I also put a drop of oil on the bearing at the other end of the capstan motor itself, using a thin blade to get it under the drive pulley. Make sure that any surplus is removed before reassembly. At this point the drive pulley must be cleaned. The old belt gunge that sticks like glue can be taken off using an ink rubber or a fibre pencil.

Finally the clutch unit can be completely stripped, taking care to note the positions of all the securing split washers and which way round the various wheels should be. Clean all the surfaces with meths – not the felt in the clutch of course – then very lightly oil the three spindles. When the clutch unit is reassembled with a replacement belt it should run like new. The grooves in the drive end of the clutch can be cleaned easily when out of the unit, but don't be tempted to roughen the surface in an effort to improve the traction to the idler – it won't work. A toothbrush and meths or a fibre pencil are excellent for this purpose.

Reassembly should be easy – remember to wipe away any oil that may get on to the belts or reel drive components. Remove the cotton bud from the capstan bearing and start to put it all back together. First the clutch, then the capstan which is now very shiny, watching out for the drop of oil that will come from the bushes when the capstan is pushed home. Then fit the two new belts and the capstan securing plate. The last part to sort out here is the loading motor drive belts. One screw and take off one belt. Unplug the connector and the motor is out. Check whether the bearing of the intermediate drive pulley is dry, also the motor bearing – lubrication may be needed. Replace both belts, then refit the motor and connector. All is now finished at this end and the unit can now be turned the right way up.

Put the reel discs back on, with a tiny spot of oil on the spindles. Fit a new belt between the take-up disc and the dummy counter pulley. Replace the back-tension band and fit a new pinch roller. Clean the static discharge brush and refit it. Lastly, wipe the capstan shaft and replace the oil seal. With no more bits left on the bench and all the moving parts and the tape guides, heads and lower cylinder gleaming like new pins it's time to try the machine. The result? Perfection, as always. Well sometimes.

Final Chores

So much for all the good times I've had today. Now to start ringing customers with estimates and ordering spares. Colleagues have put job cards into my tray, requesting spares and asking me to ring Mr. and Mrs. So-and-so to tell them that their TV set is really too old to mend. As you know, not all of them take this too well. Some think that you're a robber while others think that a relative has just passed away. But on with the chores that only the dog's body gets left with.

Well, the customers have all been contacted, now for some fun. The recently purchased viewdata terminal awaits. Part numbers found, autodial on and away we go. Why does my terminal always say "?" – because the last time I used COPS I didn't press Q to leave the system, that's why. Sorry Willow Vale. Other orders are faxed. Now we eagerly await the parts...

Long-distance Television

Roger Bunney

January was one of the quietest months ever for DX-TV reception. At the present stage of the solar cycle F2 layer propagation is virtually non-existent. What little SpE reception was noted is recorded below. Very early in January and again early in February there was an improvement in tropospheric conditions, with associated high pressure and fog. Even meteor scatter propagation has been very poor. So to the brief SpE log:

5/1/93	DR (Denmark) ch. E2; +PTT (Switzerland) E2.
8/1/93	NRK (Norway) E3; TVE (Spain) E2.
16/1/93	SVT (Sweden) E2, 3; CIS (Russia) R1; TVE E3.
17/1/93	TVE E2, 3.
23/1/93	DR E3; NRK E2.
24/1/93	TVE E2.
30/1/93	+PTT E2; TVE E2.
31/1/93	TVE E2.

Iain Menzies (Aberdeen) reports two auroral events, a small one on the 5th and a more sustained evening one on the 25th. My thanks to Iain, Simon Hamer (Powys), David Oliver (Birmingham), David Glenday (Arbroath), Tim Anderson (St Leonards), Roger Fussell (Torpoint) and Peter Schubert (Rainham) for sending in reception reports.

50MHz Experiment

An interesting experiment in the 50MHz band is being carried out by two Californian amateurs. In the early hours of February 6-7th the moon was centred between Western Europe and the US West Coast, presenting an ideally placed reflector for aerials at the two locations. Signals were transmitted for two hours each day, on even minutes, the aim being to reflect signals from the States to Europe via the moon. Amateur station W6JKV fed 1·5kW to a 16 x 6 element aerial stack (20·5dBd gain) at 50·03MHz. Station K6QXY fed similar power to a 4 x 11 element aerial (18·5dBd gain) at 50·007MHz. With the aerials aimed at the horizon an additional 3-6dB of ground gain was obtained. I hope to be able to report on the results in due course.

News Items

UK: Following the failure of the country-wide Channel 5 franchise allocation the ITC is considering a more localised system based on larger towns and cities. A consultative paper will be published in the summer. ITV network programming could be distributed in digital form from 1994 onwards, with NTL operating the service.

In its January 1993 bulletin the UK Six Metre Group summarises the current situation with 50MHz amateur operators throughout Europe. With the possible exception of Portugal (no information available) there are now operators in all European countries. Output powers range from 3W up to 500W (Denmark): restrictions vary from country to country depending on other Band I services, in particular TV transmitters.

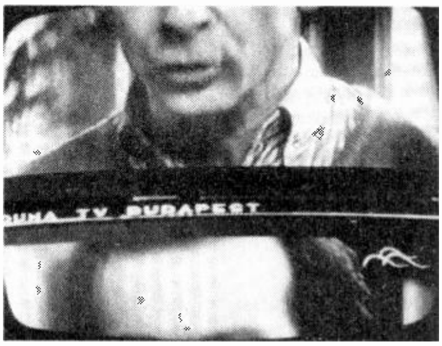
CIS: The Lithuanian OK1 relay over the LTV2 network has ended – a full-time LTV2 service is planned. It seems that the Swedish Kinnevik broadcaster (TV2/TV1000) may use the LTV2 system for a commercial service. A new OK1 transmitter is in operation at Kaliningrad, on ch. R4 with 5kW.

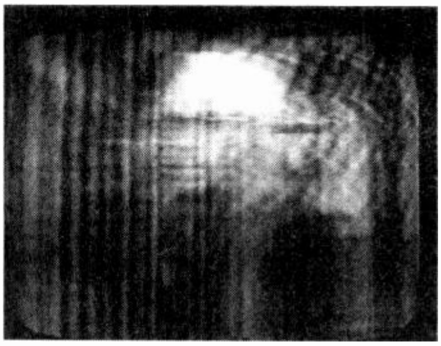
Belgium: Canal Plus is now being transmitted from Leglise on chs. E11 and E63. It's a 24-hour service.

Finland: The MTV service has now moved to the third network and hopes to achieve country-wide coverage within months. An interesting English-language f.m./TV/satellite bulletin called *FM-TV Busybody*, aimed at DXers throughout Europe, is being published by FMBB, Box 7, SF-05901, Hyvinkaa, Finland, from whom sample copies can be obtained. The 1993 subscription rate, for nine issues, is 110 FIM.

Turkey: Up to ten commercial TV stations are now transmitting, either on test or with programmes. The latest programme provider is Flash TV.

Greece: The authorities are about to award commercial broadcasting licences. There have been almost ninety applicants, some of which are already transmitting! Hellas 62, Sky TV, Channel Seven X, Kanali 29, Nea Teleorasis,





Left: A convenient station identification, the Duna TV field blanking pulse insert, received via Eutelsat II F3 at 16°E. Centre: SpE reception of RTT (Tunisia) ch. E4 at St. Leonards, East Sussex by Tim Anderson. Right: Multipath ch. E2 reception of a Koran reading from IRIB (Iran) in early 1992 by Ryn Muntjewerff in The Netherlands – classic F2 reception.

Antenna TV and Mega Channel are all in operation and hope for national network status. State broadcaster ERT is maintaining its three services.

India: The Metro Channel has been given permission to operate, initially in the four main population areas (Madras, Delhi, Bombay and Calcutta).

Satellite TV

Good news for sat-zappers: the EBU programme exchange network has moved from the vintage Eutelsat I F5 at 21·5°E to the modern Eutelsat II F4 at 7°E, with four transponders in use daily at much higher powers than previously. You will notice that the pictures, because of the use of sound-in-syncs, are unsteady. One method of picture stabilisation is to strip off the incoming sync pulses and insert locally-generated ones phased with the picture to obtain correct lock. At present sync inserter units do not appear to be available commercially, though PDS offered a video sync processor that did just this in the early days of satellite TV. If anyone has one of the latter units lying about unused, please let me know! Eutelsat I F2 at 3°E was fired up in late January with an uplink from an Austrian station: signals were seen for three days then ceased.

The EBU's French-based (Lyon) Euronews service started on January 1st, providing up to twenty hours of news material daily with sound subcarriers for various languages. Check at 11·575GHz (vertical) from Eutelsat II F1 (13°E). An Italian news service called Elefante TV is due to start at any time.

Staring this spring Marco Polo 2, now at 0·8°W and renamed Thor after being sold to Norwegian Telecom, will start carrying CNNI and Filmnet programming. Children's and sports channels will be added later in the year. Both CNNI and Filmnet will us Eurocrypt S, CNNI with D-MAC and Filmnet with D2-MAC. Keep a lookout at 11·785, 11·861, 11·938 and 12·015GHz.

Screensport has now been combined with Eurosport and may adopt scrambling. A French-language version, TV Sport, is to be transmitted via the Telecom 2 satellite. Red Hot Dutch, the scrambled hard porn channel that's been in the news recently, may adopt an addressable rotating line encryption standard instead of the present inverted video plus 100kHz sinewave. A further two German-based hard porn channels are promised by early summer. A UK version of the American Nickelodeon children's channel is due to be started by BSkyB this autumn via Astra 1C.

A new identification to watch out for is VTM – Vlaamse Televisie Maatschappij NV. This is a Belgian satellite news gathering operator that uses analogue or digitally compressed video plus voice, data or fax transmissions.

Hispasat, the Iberian satellite at 30 or 31°W (depending on which publication you read), is now in operation with various encrypted services at high levels plus the German Tele 5 channel dubbed into Spanish.

Glum faces in Australia over the loss of the Optus B2 satellite due to a launch malfunction. A replacement won't be ready until mid-1994. Optus B1 is now carrying some of the services previously carried by the elderly Aussat A2 satellite, with Aussat A3 taking over the others. The Thaicom 1 satellite, due for launch in November, will go into orbit at 101°E, carrying twelve C band transponders. It will provide a rival service to Star TV via AsiaSat 1. The Hindi-language ZEE TV service via AsiaSat 1 intends to start 24-hour operation by mid-summer and hopes to be able to use AsiaSat's northern beam to give coverage over the whole of Asia and the Middle East.

BBC World Service TV is now being transmitted terrestrially by the South African M Net service, which uses scrambling. Apparently it's possible to view BBC WSTV for free by subtle manipulation of the M Net decoder – one newspaper published details of the knob programming required.

According to Pat Hawker, writing in the February issue of *Radio Communication*, LNBs have been producing interference in the h.f. bands. The source of the interference was tracked down by an amateur using an OptoElectronics 2300 spectrum analyser. It seems that the problem is being caused by high-level operation of the local oscillator in many Ku band LNBs, which are not covered by EMC guidelines. It's possible that interference of this type could occur in Band I.

Market Place

The third edition of *European Scrambling Systems – Circuits, Tactics and Techniques* by John McCormac has just been published. Also known as the "black book", it's a goldmine of information on the principles and practice of encryption, including how the various systems were defeated and how you can do this yourself! There are full details of each encryption standard, including Videocrypt. As the book is aimed at European readers in general Filmnet, RTL-4, Canal Plus-RA1 and so on are all covered in detail. I found the "dirty tricks" section particularly interesting. A concluding section mentions that the Eurocrypt smart card "is based on the Bull CP8 masked programmed

ECONOMIC DEVICES 32 TEMPLE STREET, WOLVERHAMPTON, WV2 4AN

15/80H	3.83	2SC1573Q	0.26	2SD716	1.11	BC148	0.12	BD232	0.28	BFR90A	0.61	CD4069	0.17	M5231L	0.55	SN29764AN	1.47	TA7233P	1.77	TDA1518Q	3.32	TIC106M	0.60
15/85R	3.84	2SC1675	0.09	2SD718	1.45	BC148A	0.06	BD234	0.25	BFR91	0.43	CD4070	0.14	M53216P	1.48	SN7474N	0.38	TA7240AP	0.08	TDA1670A	2.81	TIC45	0.59
17052	3.20	2SC1685	0.14	2SD734	0.24	BC148B	0.04	BD237	0.30	BFR96	0.53	CNX62A	0.88	M54532	1.28	SN76013ND	7.99	TA7240P	2.21	TDA1701	4.86	TIL100	0.52
17053	2.38	2SC1740	0.12	2SD762	1.27	BC149	0.04	BD238	0.11	BFW92A	0.48	CR3CM	2.62	M54543L	1.32	SN76227N	1.87	TA7241	2.30	TDA1770	0.00	TIP110	0.36
17088	2.38	2SC1741	0.17	2SD774	0.24	BC149C	0.04	BD239	0.29	BFX85	0.33	CR02AM	2.17	M54544L	1.87	SN76666N	1.26	TA7243P	0.00	TDA1870	2.64	TIP112	0.00
17089	3.39	2SC1815	0.14	2SD787E	0.26	BC157	0.13	BD241	0.41	BFY50	0.34	CV12E	2.78	M54548L	2.53	SN76705AN	1.70	TA7250	3.38	TDA1904	1.21	TIP112H	0.39
17127	1.77	2SC1826	0.72	2SD837	0.90	BC159	0.06	BD243	0.39	BFY51	0.34	CX109	7.05	M54644BL	3.31	SR2M	0.00	TA7267P	2.02	TDA1905	0.93	TIP120	0.57
1N4001	0.04	2SC1827	0.77	2SD841	1.61	BC160	0.42	BD243A	0.43	BR100	0.17	DTA124EF	0.13	M54648L	5.51	STA341M	2.38	TA7270	1.68	TDA1908A	1.14	TIP121	0.42
1N4002	0.07	2SC1845	0.20	2SD856	0.87	BC161	0.27	BD243C	0.37	BR101	0.90	DTA144EF	0.17	M54898AP	17.81	STA401	2.30	TA7270P	1.68	TDA1940	2.77	TIP126	0.48
1N4003	0.05	2SC1846	0.29	2SD869	2.00	BC167	0.42	BD244A	0.34	BR103	0.39	ER1400	2.15	M54885P	5.95	STA441C	3.62	TA7271P	1.90	TDA1950	1.86	TIP132	0.46
1N4004	0.07	2SC1923	0.14	2SD870	3.87	BC171B	0.14	BD244C	0.42	BR303	1.22	HA11235	1.68	B3730	2.38	STK0029	5.88	TA7273	3.21	TDA2002	0.85	TIP137	0.48
1N4005	0.06	2SC1942	3.33	2SD871	5.06	BC177	0.14	BD245C	0.72	BRX44	1.02	HA11244	3.83	MB3731	2.84	STK0039	7.45	TA7274P	2.72	TDA2003V	0.00	TIP2955	0.83
1N4006	0.06	2SC1959	0.11	2SD880	0.34	BC178	0.11	BD246C	0.71	BRY56	0.43	HA1124A	0.73	MB3732	2.47	STK0040	7.40	TA7280	2.11	TDA2004	1.27	TIP29C	0.30
1N4007	0.06	2SC1969	2.15	2SD882	0.43	BC182	0.06	BD278A	0.56	BSS38	0.23	HA11423	2.82	MC13002	0.00	STK0059	9.75	TA7281	0.00	TDA2005	1.27	TIP29E	0.41
1N4148	0.04	2SC1983	0.87	2SD898B	2.97	BC182A	0.00	BD317	0.87	BT120	1.20	HA11440	2.92	MC13002P	6.05	STK025	9.66	TA7299	2.34	TDA2006	1.06	TIP3055	0.77
1N4448	0.06	2SC2001	0.14	2SD904	5.95	BC182L	0.06	BD318	1.10	BT129	3.26	HA1166X	3.43	MC1310P	0.85	STK043	0.00	TA7313AP	0.62	TDA2009	2.29	TIP30C	0.17
1N5061	0.23	2SC2029	0.00	2SD973	0.38	BC182LB	0.06	BD380	0.34	BT139600	0.95	HA11713	1.24	MC1327AP	1.62	STK3042	5.08	TA7317P	0.93	TDA2020	3.72	TIP31	0.00
1N5402	0.09	2SC2073	0.51	74LS00	0.21	BC183	0.06	BD433	0.27	BT151/500R	0.97	HA11741	6.00	MC1330AP	1.26	STK3062	8.88	TA7325P	0.45	TDA2030	0.00	TIP31A	0.32
1N5404	0.12	2SC2078	0.70	7805	0.24	BC184	0.09	BD434	0.34	BT151800	1.15	HA11745	5.10	MC1350P	1.82	STK4131	7.79	TA7343AP	0.72	TDA2030H	0.61	TIP31B	0.30
1N5406	0.12	2SC2141	1.48	7805T022	0.00	BC184L	0.04	BD435	0.38	BU205	1.07	HA13001	1.34	MC1352P	1.45	STK4141	8.85	TA7358P	0.78	TDA2030V	0.73	TIP31C	0.39
1N5408	0.12	2SC2166	0.96	7808	0.30	BC184LC	0.10	BD436	0.32	BU208A	1.16	HA13108	2.76	MC1358P	1.59	STK4142	8.21	TA75358P	0.68	TDA2040	0.00	TIP32A	0.37
1N5410	0.04	2SC2168	0.85	7812	0.30	BC204	0.37	BD437	0.32	BU208D	1.87	HA13118	1.91	MC14493P	4.00	STK4162M	9.51	TA7607AP	2.11	TDA2170	2.55	TIP32C	0.38
1S1555	0.22	2SC2236	0.25	7815	0.30	BC207B	0.23	BD438	0.17	BU326A	0.00	HA13119	2.03	MC145288CP	2.22	STK4171	10.50	TA7609P	1.95	TDA2270	1.68	TIP33	0.00
1S2076	0.29	2SC2271	0.22	7818	0.41	BC212	0.06	BD441	0.41	BU406	0.65	HA13403	4.42	MDA2062	2.21	STK4181	12.85	TA7630	0.00	TDA2525	0.00	TIP33A	0.92
2N2219A	0.27	2SC2274	0.22	7905	0.34	BC212B	0.06	BD442	0.29	BU406D1.02		HA1374A	5.10	MJ2955	0.97	STK4181A	12.46	TA7630P	1.87	TDA2530	4.76	TIP33C	0.98
2N2222	0.17	2SC2274	0.22	7912	0.43	BC212L	0.06	BD510	1.34	BU407	0.53	HA1377	1.60	MJ802	2.29	STK4332	5.54	TA7640AP	0.98	TDA2540	0.38	TIP34	0.00
2N2905	0.21	2SC2314	0.33	AA119	0.36	BC213	0.11	BD529	0.97	BU407D	0.97	HA1388	2.63	MJE13005	0.82	STK4352	1.70	TA7676P	4.25	TDA2541	0.72	TIP34C	0.89
2N2926G	0.37	2SC2335	1.11	AA143	0.13	BC214	0.00	BD530	1.10	BU426A	0.96	HA1389	2.52	MJE2955	0.68	STK437	8.38	TA7680AP	4.52	TDA2560	2.55	TIP41A	0.38
2N3053	0.36	2SC2458	0.09	AC127	0.11	BC214L	0.09	BD535	0.43	BU426E	2.13	HA1392	1.61	MJE3055	0.51	STK4392	6.31	TA7698AP	5.93	TDA2576A	5.95	TIP41B	0.31
2N3054	0.98	2SC2482	0.34	AC141K	0.46	BC237	0.05	BD536	0.48	BU500	1.09	HA1397	2.63	MJE340	0.40	STK441	10.28	TA7705P	1.68	TDA2577	4.81	TIP41C	0.37
2N3055	0.59	2SC2547E	0.24	AC176K	0.30	BC237A	0.00	BD675	0.30	BU508A	0.95	HA1398	2.33	MJ237B	0.00	STK459	10.27	TA7769P	1.43	TDA2577A	4.25	TIP42A	0.34
2N3442	0.75	2SC2565	6.40	AC187	0.16	BC237B	0.05	BD677	0.32	BU508AF	1.27	HA1452	3.36	ML923	5.10	STK461	9.27	TA8205	3.65	TDA2578A	2.55	TIP42C	0.37
2N3702	0.11	2SC2570A	0.29	AC187K	0.33	BC238	0.11	BD707	0.51	BU508D	1.27	HM6232	10.36	MN1405VKF	11.08	STK4843	11.10	TA8210H	4.66	TDA2579	0.00	TIP47	0.51
2N3704	0.14	2SC2577	2.13	AC188	0.30	BC238B	0.05	BD839	0.51	BU508DF	0.95	HM6251	9.52	MN1435VX	14.35	STK5211	13.79	TA8215	3.81	TDA2581	10.15	TIPL791A	1.17
2N3773	1.02	2SC2581	2.45	AC188K	0.67	BC239	0.04	BD901	0.51	BU508V	1.16	HM7103	14.07	MN1435VXB	10.66	STK5322	5.59	TBA8691N	8.69	TDA2581Q	10.15	TIS43	0.66
2N3819	0.34	2SC2632	0.29	AD149	0.52	BC252B	0.07	BD902	0.51	BU526	1.41	ICH28I	1.24	MN650	2.50	STK5325	5.33	TAA550	0.00	TDA2582	1.66	TL011CP	1.36
2N3904	0.11	2SC2655	0.25	AD161	1.02	BC300	0.48	BD911	0.65	BU536	1.60	KA2101	0.60	MPSA42	0.23	STK5326	5.08	TAG626	1.05	TDA2591	1.15	TL071CP	0.38
2N4444	2.68	2SC2671	0.68	AD162	0.96	BC301	0.24	BD912	0.63	BU608	1.59	KBL08	0.47	MPSA56	0.12	STK5331	3.02	TBA120	0.53	TDA2593	0.75	TL494	1.49
2N6292	0.62	2SC2688	0.30	AF124	0.77	BC302	0.36	BDV65B	1.16	BU705	1.61	KSR1004	0.09	MPSA93	0.09	STK5332	2.74	TBA120AS	0.90	TDA2594	2.21	TMP47C432AP	
2SA1015	0.10	2SC2785	0.17	AF127	0.59	BC303	0.04	BDW84C	1.28	BU806	0.82	L200CV	1.13	MPSU10	0.00	STK5333	4.28	TBA120S	0.89	TDA2595	2.16		11.24
2SA1016	0.17	2SC2791	5.44	AF139	0.29	BC307	0.06	BDW93C	0.59	BU806A	0.00	LA1201	0.56	MR854	0.14	STK5372	5.28	TBA120T	0.59	TDA2600	3.08	TMP47C434N	
2SA1020	0.31	2SC3150	1.44	AF239	0.43	BC307A	0.06	BDW94C	0.46	BU807	0.51	LA1230	1.95	MSM5840H	15.36	STK5421	2.60	TBA120U	0.39	TDA2611A	0.64		16.58
2SA1020Y	0.30	2SC3153	2.37	AF279	0.34	BC307B	0.06	BDX32	1.70	BU826A	1.59	LA1385	1.45	MVS240	0.53	STK5422	5.74	TBA2800	0.68	TDA2611AQ	1.74	UC3844	1.78
2SA1095	7.44	2SC3156	6.50	AL102	2.55	BC308	0.06	BDY20	2.13	BU908	1.17	LA3161	0.40	NE545B	3.30	STK5451	5.27	TBA395	0.68	TDA2640	3.98	UPA81C	0.72
2SA1102	2.54	2SC3182	3.25	AN245	0.00	BC308A	0.09	BF115	0.41	BUK444	2.38	LA4140	0.37	NE555	0.21	STK5466	5.08	TBA520	0.85	TDA2652	14.32	UPC1181H	6.80
2SA1143	0.17	2SC3225	0.38	AN3821K	7.23	BC308C	0.06	BF179	0.31	BUT11	0.68	LA4182	1.75	NE555N	0.37	STK5471	4.51	TBA540	1.97	TDA2653A	3.26	UPC1182H	5.95
2SA1175	0.51	2SC3795	1.79	AN5265	1.34	BC327	0.10	BF184	0.41	BUT11A	0.85			NE592	1.85	STK5476	5.00	TBA540Q	0.77	TDA2680	5.10	UPC1185H	10.20
2SA1186	3.52	2SC3800	0.12	AN5435	1.45	BC327B	0.17	BF185	0.29	BUT11AF	0.85			NE646N	2.47	STK5481	5.61	TBA560C	0.68	TDA3190	1.27	UPC1188	3.83
																						UPC1212C	0.83

SPECIAL OFFERS – ENDS 30/04/93 OR WHILE STOCKS LAST

TDA 2600 x 2	3.95	TDA 3654 x 2	2.20
TDA 4601D x 2	2.95	TBA 120S x 5	1.55
BUT 11AF x 5	3.25	TDA 4601 x 2	2.50
BU 208A x 5	3.60	STK 5481 x 2	9.00
BU 508A x 5	3.50	TDA 3562A x 2	3.99
CO AXIAL AERIAL PLUG x 25	3.75	VIDEO FAULT FINDING GUIDE	9.99
'F' CONNECTOR (SCREW TYPE) x 25	3.00	TV FAULT FINDING GUIDE	9.26
		KBL08 800V 2A BRIDGE/R X 5	1.00

2SA1208	0.26	2SC388A	0.59	AN5512	1.65	BC328	0.07	BF194	0.22	BUT12A	0.85	LA4192	1.14	NP1106	11.86	STK5482	3.98	TBA570A	1.77	TDA3190P	1.36		
2SA1265	1.95	2SC458	0.00	AN5515	2.13	BC337	0.06	BF196	0.15	BUT56A	0.57	LA4220	1.29	OA47	0.25	STK6962	2.65	TBA651	1.01	TDA3300B	18.48	UPC1225H	0.00
2SA1286	0.34	2SC536	0.09	AN5521	1.65	BC337L	0.22	BF197	0.44	BUW11	1.03	LA4261	1.65	OA90	0.10	STK7216	5.53	TBA750Q	5.10	TDA3330	10.78	UPC1228HA	0.56
2SA473	0.71	2SC710	0.12	AN5612	2.97	BC338	0.06	BF198	0.17	BUW11A	0.90	LA4270	2.11	OA91	0.15	STK7226	8.17	TBA800	0.51	TDA3541	0.95	UPC1230	2.21
2SA562	0.17	2SC867A	5.25	AN5900	1.27	BC368	0.09	BF199	0.04	BUW41B	1.02	LA4282	6.85	R2540	2.77	STK7308	4.89	TBA810P	1.66	TDA3560	3.65	UPC1230H	2.80
2SA634	0.54	2SC945	0.10	AN6310	4.69	BC369	0.17	BF200	0.39	BUW81A	2.29	LA4422	1.27	R2540X	1.92	STK7348	4.67	TBA810S	0.66	TDA3561A	3.31	UPC1278H	2.13
2SA639S	0.64	2SD1051	0.48	AN6326	3.61	BC372	0.47	BF240	0.11	BUW84	1.11	LA4440	1.68	R2M 250	0.77	STK7356	5.59	TBA820	0.55	TDA3562A	4.21	UPC1318	3.57
2SA673	0.09	2SD1128	1.02	AN6341	2.29	BC546	0.00	BF244	0.39	BUX84	0.34	LA4445	1.29	R3297	0.00	STK7358	5.46	TBA820L	0.55	TDA3565	2.29	UC1335V	2.81
2SA684	0.21	2SD1138	0.82	AN6610	0.93	BC546A	0.06	BF245A	0.19	BUX85	0.60	LA4460	1.34	R4050	2.38	STR1096	4.67	TBA820M	0.34	TDA3566	3.40	UPC1351C	1.70
2SA733	0.17	2SD1207	0.26	AN6671K	5.35	BC547	0.11	BF245B	0.41	BUZ71	0.52	LA4461	1.29	R4051	2.95	STR40090	6.83	TBA920	0.51	TDA3571B	3.08	UPC1353	1.34
2SA769	1.02	2SD1265	0.77	AN7158	2.73	BC547A	0.04	BF255	0.11	BY127	0.15	LA4475	2.11	RB156	1.80	STR4090	16.80	TBA950	1.68	TDA3576	11.90	UPC1363C	1.06
2SA798	0.38	2SD1273	0.82	AN7161	3.23	BC547B	0.11	BF256	0.24	BY133	0.06	LA4476	2.29	RGP10	0.00	STR4211	5.95	TBA970	4.08	TDA3640	6.12	UPC1363CA	2.13
2SA872	0.14	2SD1275	0.68	AN7171K	3.98	BC547C	0.00	BF256LC	1.40	BY164	0.67	LA4500	1.68	RGP15	0.41	STR440	0.38	TCA270S	1.03	TDA3650	9.45	UPC1365C	1.70
2SA872A	0.20	2SD1276	0.85	BA145	0.11	BC548	0.00	BF257	0.36	BY179	0.00	LA4505	1.79	RGP15J	0.34	STR441	5.95	TCA440	1.95	TDA3651A	0.00	UPC1378H	1.19
2SA940	0.66	2SD1279	4.88	BA156	0.06	BC548A	0.29	BF258	0.04	BY184	0.39	LA4507	0.00	RGP30M	0.30	STR451	14.69	TCA660B	0.43	TDA3653AQ	1.92	UPC1391H	0.52
2SA952	0.14	2SD1292	0.41	BA157	0.07	BC548B	0.18	BF259	0.31	BY20320	0.00	LA4508	2.38	RM11C	0.38	STR50020	8.97	TCA800Q	1.65	TDA3653B	1.86	UPC1394	1.23
2SA958	0.44	2SD1308	0.77	BA158	0.07	BC548C	0.12	BF324	0.12	BY206	0.13	LA4520	1.11	S2000AF	1.19	STR50103	5.92	TCA910	1.21	TDA3654	1.66	UPC1420CA	5.29
2SA966Y	0.29	2SD1397	1.89	BA159	0.30	BC549	0.06	BF337	0.33	BY207	0.10	LA4700	3.52	S2055AF	1.81	STR54041	6.15	TCA940	3.40	TDA3810	2.55	UPC1488H	1.85
2SA970	0.17	2SD1398	2.13	BA317	0.06	BC556	0.00	BF338	0.40	BY210400	0.19	LA5112	5.89	S2530A	1.98	STR5412	5.95	TD3F900H	6.57	TDA4420	1.27	UPC2002	2.08
2SA984	0.21	2SD1426	2.38	BA318	0.04	BC556B	0.06	BF355	0.55	BY224600	5.10	LA5512	0.48	SAA1004	1.14	STR58041	6.37	TDA1004A	3.40	TDA4427	2.05	UPC324C	1.74
2SB1010	0.34	2SD1427	2.89	BA5102A	1.27	BC557	0.07	BF392	0.16	BY226	0.13	LA7223	2.54	SAA1121	11.22	STR6020	5.46	TDA1010	1.30	TDA4442	3.49	UPC4558C	0.43
2SB546	0.53	2SD1432	4.88	BA536	1.14	BC557B	0.06	BF393	0.17	BY227	0.14	LA7520	2.75	SAA1174	5.10	STR6020KIT	5.95	TDA1011	1.27	TDA4500	3.79	UPC574	1.07
2SB633	0.93	2SD1439	5.51	BA5406	1.61	BC557C	0.11	BF419	0.65	BY228	0.38	LA7800	1.27	SAA1250	2.82	T6064V	2.63	TDA1011A	1.32	TDA4501	5.08	UPC580C	2.55
2SB643	0.00	2SD1453	1.87	BA6109	1.43	BC558	0.00	BF422	0.15	BY229	1.64	LA7801	1.27	SAA1251	5.74	T6076V	4.23	TDA1013A	1.45	TDA4503	3.38	UPD1937C	3.15
2SB643S	0.20	2SD1497-02	7.05	BA6209	1.31	BC558A	0.06	BF423	0.10	BY229600	1.27	LA7820	1.57	SAA1293	0.00	T9013V	5.23	TDA1015	0.99	TDA4505E	4.64	X0065CE	1.70
2SB644	0.34	2SD1497-06	7.06	BA6219	1.45	BC558B	0.06	BF435	2.64	BY229800	0.07	LA7830	1.02	SAA1351	8.23	T9034V	1.45	TDA1020	1.27	TDA4600	1.70	X2402	5.08
2SB688	1.28	2SD1541	3.40	BA6222	1.19	BC559	0.11	BF450	0.19	BY238	0.31	LM1303N	0.88	SAA3027P	6.37	T9035V.	1.50	TDA1035SB	4.15	TDA4600/2	2.14	ZPY120	10.62
2SB772	0.43	2SD1555	2.47	BA656N	0.84	BC560C	0.21	BF458	0.30	BY255	0.14	LM1877	1.45	SAA5010	3.12	T9038V	6.09	TDA1035T	2.25	TDA46002D	4.23	ZTX650	0.51
2SB772Q	0.43	2SD1577	3.35	BA718	0.77	BC635	0.23	BF459	0.29	BY298	0.15	LM317T	0.52	SAA5012	3.31	T9053V	0.92	TDA1037	8.50	TDA4600F	1.70	ZTX753	1.09
2SB793	0.31	2SD1649	1.80	BAS11	0.32	BC637	0.15	BF469	0.34	BY299	0.12	LM324N	0.25	SAA5030	6.42	T9054V	0.88	TDA1044	1.43	TDA4601	1.56		
2SB819	0.48	2SD1650	2.47	BAV18	0.07	BC639	0.13	BF470	0.29	BY476A	0.68	LM339N	0.15	SAA5050	4.68	T9064	1.20	TDA1060	2.47	TDA4601D	2.42		
2SB861	0.97	2SD1876	4.88	BAV20	0.26	BC640	0.06	BF480	0.67	BYD14J	0.31	LM358	0.23	SAB3013	5.44	T9065V	4.66	TDA1082	4.25	TDA4605	3.01		
2SB891	0.38	2SD1877	2.12	BAV21	0.49	BC879	0.39	BF493S	0.34	BYD33G	0.70	LM358N	0.22	SAB3021	6.15	TA7063P	1.14	TDA1083	1.19	TDA4950	1.07		
2SC1008	0.17	2SD1911	4.45	BAW62	0.07	BC880	0.38	BF597	0.16	BYD33J	0.57	LM380N	0.82	SAB3035	6.35	TA7122BP	0.63	TDA1151	0.51	TDA7240A	1.53		
2SC1061	0.59	2SD234	0.94	BAX14	0.28	BCY70	0.07	BF757	0.43	BYV10-40	1.80	LM386	0.00	SAF1032P	5.17	TA7146P	5.86	TDA1170	0.99	TDA7270S	8.20		
2SC1096	0.50	2SD313	0.43	BB105B	0.24	BD131	0.28	BF758	0.32	BYV95C	0.36	LM393N	0.27	SAF1039	2.36	TA7176P	1.30	TDA1170N	1.23	TDA8140	2.38		
2SC1114	1.16	2SD350A	1.23	BC107	0.14	BD132	0.21	BF759	0.34	BYV96D	0.27	M192B1	1.06	SDA2112	13.35	TA7193AP	3.36	TDA1170S	1.16	TDA8153	5.10		
2SC1162	0.31	2SD401	3.46	BC107B	0.20	BD135	0.22	BF760	0.24	BYW56	0.17	M21C	1.40	SG264A	10.62	TA7193P	4.09	TDA1180	1.28	TDA8170	2.58		
2SC1213	0.14	2SD438	0.34	BC108	0.15	BD136	0.20	BF762	0.29	BYX55600	0.20	M293	14.63	SG613	10.79	TA7205	0.00	TDA1190Z	4.08	TDA8180	5.35		
2SC1214	0.44	2SD468C	0.00	BC109	0.12	BD137	0.45	BF869	0.25	CA1310E	0.78	M490	15.37	SGSIF344	5.51	TA7205AP	1.31	TDA1200	0.91	TDA8190	3.57		
2SC1306	1.16	2SD476	0.97	BC109A	0.12	BD139	0.29	BF870	0.23	CA3094	3.06	M491	7.94	SKE2G202	0.00	TA7205P	0.00	TDA1270	1.79	TDA9503	2.13		
2SC1318	0.10	2SD525	0.77	BC109B	0.15	BD140	0.24	BF959	0.10	CD4001	0.14	M494	0.00	SKE4F104	0.97	TA7207P	1.68	TDA1412	0.77	TEA1002	4.98		
2SC1364	0.29	2SD551	5.81	BC109C	0.20	BD168	0.76	BF960	0.27	CD4011	0.21	M50115AP	2.50	SKE4F210	0.87	TA7210P	1.50	TDA1470	0.00	TEA1009	1.24		
2SC1384	0.50	2SD613	0.63	BC117	0.14	BD175	0.29	BF966	0.61	CD4013	0.34	M51102L	1.77	SKE5F310	1.68	TA7214P	3.74	TDA1470P	0.00	TEA1014	1.87		
2SC1398	0.80	2SD636	0.14	BC119	0.38	BD179	0.34	BF970	0.30	CD4016	0.14	M51231P	2.55	SL1430	1.41	TA7217AP	1.27	TDA1506	4.59	TEA1039	2.02		
2SC1413A	1.36	2SD637	0.12	BC139	0.33	BD189	0.41	BFR39	0.35	CD4021	0.43	M51393AP	4.64	SL1431	1.70	TA7222	1.24	TDA1510	3.23	TEA2018A	1.43		
2SC1509	0.39	2SD667	0.26	BC140	0.21	BD190	0.31	BFR41	0.44	CD4052	0.22	M51515L	2.01	SL1432	1.97	TA7222AP	1.27	TDA1512	3.17	TEA2164	2.48		
2SC1520	0.54	2SD669	0.55	BC141	0.25	BD201	0.40	BFR79	0.00	CD4053	0.20	M51521L	0.54	SL471	1.70	TA7227P	2.02	TDA1515A	2.54	TEA2165	5.23		
2SC1573	0.26	2SD669A	0.81	BC147A	0.06	BD203	0.46	BFR90	0.61	CD4066	0.30	M5218L	0.42	SL490	2.31	TA7230P	1.35	TDA1516Q	3.33	TIC106D	0.55		

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

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	Part No.	Price
AIWA		
AV-66		
Video Head	VID 2546	£16.12
Pinch Roller	VID 1755	£3.83
Belt Kit	VID 7519	£2.03
Idler Replacement Set	VID 1001	£3.65
Idler	VID 1005	£2.12
Capstan Motor	VID 2160	£25.00
Tension Band	VID 1423	£3.65
Reel Table Rubber Tyre	VID 1335	£1.18
CTL Unit	VID 2637	£61.55
AV-77		
Video Head	VID 2546	£16.12
Pinch Roller	VID 1755	£3.83
Belt Kit	VID 7509	£1.33
Idler Replacement Set	VID 1000	£5.69
FWD Limiter	VID 1002	£3.83
Idler	VID 1004	£1.45
Idler	VID 1005	£2.12
Capstan Motor	VID 2118	£29.36
Tension Band	VID 1423	£3.65
CTL Unit	VID 2567	£47.83
AKAI		
VS-9800		
Video Head	VID 2511	£9.18
Pinch Roller	VID 1756	£3.23
Belt Kit	VID 7506	£1.61
Take Up Idler	VID 1025	£5.27
REW Idler	VID 1026	£6.71
FF Rubber Tyre	VID 1029	£0.85
FF Rubber Tyre	VID 1030	£0.85
Unloading Idler Rubber Tyre	VID 1207	£0.93
Capstan Motor	VID 2119	£25.34
Drum Motor	VID 2120	£20.20
Cassette Lamp	VID 1943	£0.27
Tension Band	VID 1391	£3.65
Repair Kit	VID 7911	£15.27
Take Up Rubber Tyre	VID 1028	£0.85
ALBA		
VCR-4000		
Video Head	VID 2713	£17.46
Pinch Roller	VID 1787	£3.74
Belt Kit	VID 7596	£3.81
Idler	VID 1049	£3.31
Cassette LED	VID 1981	£2.44
Tension Band	VID 1399	£2.04
AMSTRAD		
VCR-4600		
Video Head	VID 2676	£14.79
Pinch Roller	VID 1758	£3.15
Belt Kit	VID 7593	£1.61
Clutch	VID 1226	£4.76
Gear Holder	VID 1227	£13.14
RF Clutch	VID 1231	£7.78
Cassette LED	VID 1981	£2.44
VCR-5000		
Video Head	VID 2502	£15.61
Pinch Roller	VID 1758	£3.15
Belt Kit	VID 7592	£1.19
RF Clutch	VID 1225	£4.33
Clutch	VID 1226	£4.76
Gear Holder	VID 1227	£13.14
Cassette LED	VID 1981	£2.44
BANG & OLUFSEN		
VHS-65		
Video Head	VID 2506	£14.14
Pinch Roller	VID 1788	£3.15
Belt Kit	VID 7538	£1.36
FF x REW Idler Arm	VID 1020	£1.79
Clutch Plate	VID 1211	£8.52
Capstan Motor	VID 2147	£27.50
Cassette LED	VID 1981	£2.44
DECCA		
VRH-8300		
Video Head	VID 2511	£9.18
Pinch Roller	VID 1814	£3.15
Belt Kit	VID 7812	£1.02
Reel Idler	VID 1036	£2.63
Take Up Clutch	VID 1037	£2.38
Take Up Idler	VID 1038	£1.07
Brake Pad	VID 1361	£0.59
Reel Motor	VID 2169	£28.97
Capstan Motor	VID 2164	£33.80
Loading Motor	VID 2168	£10.82
Cassette Lamp	VID 1947	£0.44
Tension Band	VID 1389	£1.79
Repair Kit	VID 7913	£16.09
Take Up Reel Table Rubber Tyre	VID 1080	£0.68
Supply Reel Table Rubber Tyre	VID 1080	£0.68
FERGUSON		
3-V-30		
Video Head	VID 2647	£9.18
Pinch Roller	VID 1814	£3.15
Belt Kit	VID 7812	£1.02
Reel Idler	VID 1036	£2.63
Take Up Clutch	VID 1037	£2.38
Take Up Idler	VID 1038	£1.07
Brake Pad	VID 1361	£0.59
Reel Motor	VID 2169	£28.97
Capstan Motor	VID 2164	£33.80
Loading Motor	VID 2168	£10.82
Cassette Lamp	VID 1947	£0.44
Tension Band	VID 1389	£1.79
Repair Kit	VID 7913	£16.09
Take Up Reel Table Rubber Tyre	VID 1080	£0.68
Supply Reel Table Rubber Tyre	VID 1080	£0.68
3-V-36		
Video Head	VID 2647	£9.18
Pinch Roller	VID 1813	£3.15
Belt Kit	VID 7543	£1.02
Take Up Clutch	VID 1031	£2.11
Take Up Idler	VID 1038	£1.07
Reel Idler	VID 1039	£3.40
Brake Pad	VID 1361	£0.59
Capstan Motor	VID 2165	£25.16
Loading Motor	VID 2168	£10.62
Front Loading Motor	VID 2168	£10.62
Cassette LED	VID 1981	£2.44
Tension Band	VID 1389	£1.79
Remote Control	IR 9100	£11.01
Repair Kit	VID 7918	£12.51
Mains Transformer	VID 2223	£24.18
Take Up Reel Table Rubber Tyre	VID 1080	£0.68
Supply Reel Table Rubber Tyre	VID 1080	£0.68
Cassette Housing	VID 1099	£21.23
3-V-57		
Video Head	VID 2573	£17.81
Pinch Roller	VID 1813	£3.15
Belt Kit	VID 7540	£0.68
Clutch Mechanism	VID 1083	£15.00
Capstan Motor	VID 2188	£45.96
Loading Motor	VID 2167	£14.11
Front Loading Motor	VID 2168	£10.62
Cassette LED	VID 1981	£2.44
Tension Band	VID 1388	£2.13
Repair Kit	VID 7920	£21.85
Cassette Housing	VID 1315	£21.90

WE GUARANTEE THAT ALL VIDEO SPARES SUPPLIED BY US ARE OF THE FINEST QUALITY AND THAT ALL STOCKED ITEMS WILL BE DISPATCHED THE SAME DAY.

	Part No.	Price
3-V-57		
Video Head	VID 2573	£17.81
Pinch Roller	VID 1813	£3.15
Belt Kit	VID 7540	£0.68
Clutch Mechanism	VID 1083	£15.00
Capstan Motor	VID 2188	£45.96
Loading Motor	VID 2167	£14.11
Front Loading Motor	VID 2168	£10.62
Cassette LED	VID 1981	£2.44
Tension Band	VID 1388	£2.13
Repair Kit	VID 7920	£21.85
Cassette Housing	VID 1315	£21.90
FV-10B		
Video Head	VID 2580	£19.73
Pinch Roller	VID 1817	£7.05
Belt Kit	VID 7564	£2.81
Idler Arm	VID 1091	£2.48
Reel Motor	VID 2193	£16.24
Capstan Motor	VID 2190	£24.72
Loading Motor	VID 2412	£6.37
Front Loading Motor	VID 2412	£6.37
Cassette LED	VID 1981	£2.44
Tension Band	VID 1386	£0.85
Repair Kit	VID 7921	£9.97
FV-12L		
Video Head	VID 2581	£25.62
Pinch Roller	VID 1817	£7.05
Belt Kit	VID 7564	£2.81
Idler Arm	VID 1091	£2.48
Reel Motor	VID 2193	£16.24
Capstan Motor	VID 2190	£24.72
Loading Motor	VID 2412	£6.37
Front Loading Motor	VID 2412	£6.37
Cassette LED	VID 1981	£2.44
Tension Band	VID 1386	£0.85
Repair Kit	VID 7921	£9.97
FIDELITY		
VCR-100		
Video Head	VID 2502	£15.61
Pinch Roller	VID 1758	£3.15
Belt Kit	VID 7593	£1.61
Clutch	VID 1226	£4.76
Gear Holder	VID 1227	£13.14
RF Clutch	VID 1231	£7.78
Cassette LED	VID 1981	£2.44
FINLUX		
VR-1030		
Video Head	VID 2558	£44.82
Pinch Roller	VID 1803	£3.83
Idler	VID 1006	£3.46
Tension Band	VID 1432	£5.87
Remote Control	IR 9034	£14.52
Repair Kit	VID 7930	£12.58
VR-2010		
Video Head	VID 2578	£62.15
Pinch Roller	VID 1827	£6.66
Belt Kit	VID 7588	£1.09
Idler	VID 1252	£5.20
Loading Gear	VID 1253	£7.23
Modification Set	VID 1254	£12.78
Tension Band	VID 1431	£4.85
Remote Control	IR 9034	£14.52
FISHER		
FVH-P520		
Video Head	VID 2500	£17.46
Pinch Roller	VID 1788	£3.15
Belt Kit	VID 7532	£1.35
Take Up Idler	VID 1015	£3.65
FF x REW Pulley	VID 1016	£0.93
Idler	VID 1023	£3.46
Tension Band	VID 1378	£2.76
Take Up Reel Table Rubber Tyre	VID 1293	£0.77
Supply Reel Table Rubber Tyre	VID 1293	£0.77
FVH-P530		
Video Head	VID 2500	£17.46
Pinch Roller	VID 1788	£3.15
Belt Kit	VID 7532	£1.35
Take Up Idler	VID 1015	£3.65
FF x REW Pulley	VID 1016	£0.93
Idler	VID 1023	£3.46
Tension Band	VID 1378	£2.76
Take Up Reel Table Rubber Tyre	VID 1293	£0.77
Supply Reel Table Rubber Tyre	VID 1293	£0.77
FVH-P720 x 720R x 721		
Video Head	VID 2500	£17.46
Pinch Roller	VID 1810	£3.04
Belt Kit	VID 7532	£1.35
Gear Idler	VID 1013	£4.51
Idler	VID 1014	£3.06
Loading Gear Set	VID 1230	£1.02
Cassette LED	VID 1981	£2.44
Tension Band	VID 1376	£2.38
Take Up Reel Table	VID 1295	£8.07
Supply Reel Table	VID 1294	£6.55
FVH-P722 x 725		
Video Head	VID 2501	£28.57
Pinch Roller	VID 1810	£3.04
Belt Kit	VID 7813	£1.19
Gear Idler	VID 1013	£4.51
Idler	VID 1014	£3.06
Loading Gear Set	VID 1230	£1.02

	Part No.	Price
3-V-57		
Cassette LED	VID 1981	£2.44
Tension Band	VID 1376	£2.38
Take Up Reel Table	VID 1295	£8.07
Supply Reel Table	VID 1294	£6.55
FVH-P900K x KV		
Video Head	VID 2501	£25.17
Pinch Roller	VID 1818	£3.86
Belt Kit	VID 7568	£3.15
Idler	VID 1093	£4.85
Clutch	VID 1094	£14.50
Cassette LED	VID 1981	£2.44
Tension Band	VID 1377	£2.47
Supply Reel Table	VID 1296	£11.30
FUNAI		
VCR-4600		
Video Head	VID 2676	£14.79
Pinch Roller	VID 1758	£3.15
Belt Kit	VID 7593	£1.61
Clutch	VID 1226	£4.76
Gear Holder	VID 1227	£13.14
RF Clutch	VID 1231	£7.78
Cassette LED	VID 1981	£2.44
VCR-5843		
Video Head	VID 2708	£25.04
Pinch Roller	VID 1758	£3.15
Belt Kit	VID 7615	£1.70
Idler	VID 1364	£2.55
Cassette LED	VID 1981	£2.44
GEC		
Y-4004		
Video Head	VID 2506	£14.14
Pinch Roller	VID 1788	£3.15
Belt Kit	VID 7538	£1.36
FF x REW Arm	VID 1020	£1.79
Clutch Plate	VID 1211	£8.52
Capstan Motor	VID 2148	£18.52
Cassette LED	VID 1981	£2.44
Tension Band	VID 1379	£2.38
Repair Kit	VID 7922	£17.24
GOLDSTAR		
GHV-8000 x 8200 x 8210 x 8215		
Pinch Roller	VID 1815	£3.15
Belt Kit	VID 7585	£1.36
Idler	VID 1052	£1.80
Bracket Centre	VID 1223	£13.51
Clutch Gear	VID 1228	£2.29
Limiter Roller	VID 1440	£1.36
Cassette LED	VID 1981	£2.44
Tension Band	VID 1399	£2.04
VCP-4100 x 4130		
Video Head	VID 2645	£21.23
Pinch Roller	VID 1815	£3.15
Belt Kit	VID 7585	£1.36
Idler	VID 1052	£1.80
Bracket Centre	VID 1223	£13.51
Clutch Gear	VID 1228	£2.29
Limiter Roller	VID 1440	£1.36
Cassette LED	VID 1981	£2.44
Tension Band	VID 1399	£2.04
VCP-4200 x 4326		
Video Head	VID 2645	£21.23
Pinch Roller	VID 1815	£3.15
REW Belt	VID 7234	£0.43
Cassette LED	VID 1981	£2.44
GRANADA		
VHS-EY1 x EY2		
Video Head	VID 2539	£14.75
Pinch Roller	VID 1822	£3.31
Belt Kit	VID 7605	£2.83
Reel Drive Unit	VID 1255	£8.71
Loading Gear A	VID 1268	£1.95
Loading Gear B	VID 1271	£1.36
Capstan Motor	VID 2404	£46.16
Cassette LED	VID 1981	£2.44
Tension Band	VID 1414	£3.52
GRUNDIG		
VHS-400		
Video Head	VID 2596	£15.75
Pinch Roller	VID 1757	£3.06
Belt Kit	VID 7567	£0.85
Idler	VID 1052	£1.80
Loading Gear	VID 1222	£1.57
Clutch Gear	VID 1228	£2.29
Limiter Roller	VID 1440	£1.36
Cassette LED	VID 1981	£2.44
Tension Band	VID 1400	£2.38
Remote Control	IR 8965	£22.53
VS-520 GB		
Video Head	VID 2595	£16.24
Pinch Roller	VID 1821	£3.52
Timing Belt	VID 1482	£0.16
Centre Pulley	VID 1482	£0.16
Cassette LED	VID 1981	£2.44
Tension Band	VID 1401	£3.83
HINARI		
VXL-30 x 35 x 4		
Video Head	VID 2518	£21.85
Pinch Roller	VID 1815	£3.15
Belt Kit	VID 7566	£2.38
Clutch	VID 1316	£6.21
Idler	VID 1317	£2.77
Loading Motor	VID 2167	£14.11
Cassette LED	VID 1981	£2.44

	Part No.	Price
HITACHI		
VT-11		
Video Head	VID 2504	£15.84
Pinch Roller	VID 1788	£3.15
Belt Kit	VID 7538	£1.36
FF x REW Idler Arm	VID 1020	£1.79
Clutch Plate	VID 1211	£8.52
Capstan Motor	VID 2147	£27.50
Cassette LED	VID 1981	£2.44
Tension Band	VID 1379	£2.38
Repair Kit	VID 7922	£17.24
VT-16 S		
Video Head	VID 2505	£25.56
Pinch Roller	VID 1788	£3.15
Belt Kit	VID 7538	£1.36
FF x REW Idler Arm	VID 1020	£1.79
Clutch Plate	VID 1211	£8.52
Capstan Motor	VID 2147	£27.50
Cassette LED	VID 1981	£2.44
Tension Band	VID 1379	£2.38
Repair Kit	VID 7922	£17.24
VT-33 x 330		
Video Head	VID 2504	£15.84
Pinch Roller	VID 1788	£3.15
Belt Kit	VID 7538	£1.36
FF x REW Idler Arm	VID 1020	£1.79
Clutch Plate	VID 1211	£8.52
Capstan Motor	VID 2148	£18.52
Cassette LED	VID 1981	£2.44
Tension Band	VID 1379	£2.38
Repair Kit	VID 7922	£17.24
VT-61 x 62 x 63 x 64		
Video Head	VID 2628	£24.98
Pinch Roller	VID 1818	£3.86
Belt Kit	VID 7583	£1.81
FF x REW Idler Arm	VID 1020	£1.79
Clutch Plate	VID 1211	£8.52
Capstan Motor	VID 2154	£28.45
Cassette LED	VID 1981	£2.44
Tension Band	VID 1379	£2.38
Repair Kit	VID 7924	£14.60
VT-8000 x 8500		
Video Head	VID 2509	£15.84
Pinch Roller	VID 1788	£3.15
Belt Kit	VID 7803	£0.77
Take Up Idler	VID 1015	£3.65
Wind Roller	VID 1016	£0.93
FF x REW Idler	VID 1023	£3.46
Capstan Motor	VID 2155	£52.02
Tension Band	VID 1381	£2.21
Remote Control	IR 9097	£16.81
Repair Kit	VID 7928	£13.72
Take up Reel Table	VID 1302	£13.80
Supply Reel Rubber Tyre	VID 1300	£0.85
VT-9300 x 9500 x 9700		
Video Head	VID 2509	£15.84
Pinch Roller	VID 1788	£3.15
Belt Kit	VID 7802	£0.94
FF x REW Idler Arm	VID 1019	£2.80
Play Idler	VID 1075	£3.98
FS Brake	VID 1212	£1.98
Capstan Motor	VID 2156	£50.55
Cassette Lamp	VID 1951	£1.82
Tension Band	VID 1382	£2.04
Remote Control	IR 9096	£16.95
Repair Kit	VID 7927	£15.67
Take Up Reel Table	VID 1303	£9.43
ITT		
VR-3813		
Video Head	VID 2511	£9.18
Pinch Roller	VID 1814	£3.15
Belt Kit	VID 7812	£1.02
Reel Idler	VID 1036	£2.63
Take Up Clutch	VID 1037	£2.36
Take Up Idler	VID 1038	£1.07
Brake Pad	VID 1361	£0.59
Reel Motor	VID 2169	£28.97
Capstan Motor	VID 2164	£33.80
Loading Motor	VID 2168	£10.82
Cassette Lamp	VID 1947	£0.44
Tension Band	VID 1389	£1.79
Repair Kit	VID 7913	£16.09
Take Up Reel Table Rubber Tyre	VID 1080	£0.68
Supply Reel Table Rubber Tyre	VID 1080	£0.68
VR-3893		
Video Head	VID 2647	£9.18
Pinch Roller	VID 1814	£3.15
Belt Kit	VID 7523	£1.27
Reel Idler	VID 1036	£2.63
Take Up Clutch	VID 1037	£2.38
Take Up Idler	VID 1038	£1.07
Roller Bar	VID 1363	£4.57
Brake Pad	VID 1361	£0.59
Reel Motor	VID 2169	£28.97
Capstan Motor	VID 2187	£47.57
Loading Motor	VID 2168	£10.62
Front Loading Motor	VID 2168	£10.82
Cassette Lamp	VID 1946	£0.59
Tension Band	VID 1389	£1.79
Repair Kit	VID 7914	£13.42
Take Up Reel Table Rubber Tyre	VID 1080	£0.68
Supply Reel Table Rubber Tyre	VID 1080	£0.68

	Part No.	Price
JVC		
HR-3300		
Video Head	VID 2511	£9.18
Pinch Roller	VID 1756	£3.23
Belt Kit	VID 7506	£1.61
Take Up Idler Large	VID 1025	£5.27
REW Idler	VID 1025	£5.27
Unloading Idler	VID 1027	£10.54
FF Rubber Tyre	VID 1029	£0.85
Unloading Idler Rubber Tyre	VID 1207	£0.83
Capstan Motor	VID 2119	£25.34
Drum Motor	VID 2120	£20.20
Cassette Lamp	VID 1943	£0.27
Tension Band	VID 1391	£3.65
Repair Kit	VID 7911	£15.27
Take Up Rubber Tyre	VID 1028	£0.85
HR-D110 x 111 x 120 x 121		
Video Head	VID 2647	£9.18
Pinch Roller	VID 1813	£3.15
Belt Kit	VID 7543	£1.02
Take Up Clutch	VID 1031	£2.11
Take Up Idler	VID 1038	£1.07
Reel Idler	VID 1039	£3.40
Brake Pad	VID 1361	£0.59
Capstan Motor	VID 2165	£25.16
Loading Motor	VID 2168	£10.62
Front Loading Motor	VID 2168	£10.62
Cassette LED	VID 1981	£2.44
Tension Band	VID 1389	£1.79
Repair Kit	VID 7918	£12.51
Mains Transformer	VID 2223	£24.18
Take Up Reel Table Rubber Tyre	VID 1080	£0.68
Supply Reel Table Rubber Tyre	VID 1080	£0.68
Cassette Housing	VID 1099	£21.23
MATSUI		
VX-850		
Pinch Roller	VID 1815	£3.15
Belt Kit	VID 7566	£2.38
Clutch	VID 1316	£6.21
Idler	VID 1317	£2.77
Cassette LED	VID 1981	£2.44
MITSUBISHI		
HS-307		
Video Head	VID 2606	£33.96
Pinch Roller	VID 1808	£3.15
Belt Kit	VID 7542	£1.26
Reel Idler Unit	VID 1040	£8.48
FF Idler Rubber Tyre	VID 1081	£0.77
Capstan Rubber Tyre	VID 1264	£1.36
Cam Gear A	VID 1274	£1.36
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Take Up Reel Table	VID 1312	£11.47
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Idler	VID 1057	£0.80
Idler Arm	VID 1220	£4.33
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Driving Gear	VID 1217	£0.50
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Idler	VID 1052	£1.80
Loading Gear	VID 1222	£1.57
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Idler	VID 1371	£8.12
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Belt Kit	VID 7547	£1.82
Idler	VID 1060	£1.61
Master Cam	VID 1265	£7.31
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Loading Motor	VID 2142	£16.78
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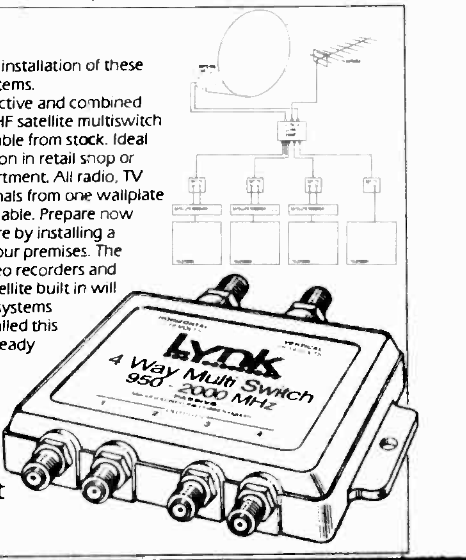

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TRADE COUNTER OPEN DAILY 9am-5pm — FAX NUMBER: 0902-29052 card. It appears that this card has now been pumped or stripped. Card Tricks of Switzerland will market alternative microcontroller cards from January. The conflict has moved into a new phase". This comprehensive book sells at £32 plus £2·50 UK postage.

The 1993/94 World Satellite Almanac by Mark Long is available at £69 plus £2·50 UK postage. It's the reference work for all that's happening in the satellite world, but of course things keep changing. So Mark Long's *The 1993-1994 World Satellite Annual* has been published as an official supplement at £41 plus £2·50 UK postage.

Truly excellent as these books are, the cost is perhaps rather high for those not professionally engaged in satellite telecommunications. Frank Baylin has broken through the price barrier with the *1993 World Satellite Yearly*. It provides a comprehensive reference work at a much lower cost, including data on all satellites at present in orbit or soon to arrive there, with detailed coverage of transmission techniques, encryption, digital compression/HDTV, satellite installation/reception problems and calculations, footprints etc. The book has 440 A4 format pages and is available at £38 plus £2·50 UK postage.

Retail orders for the above books should be sent to Swift Television Publications, 17 Pittsfield, Cricklade, Swindon, Wilts SN6 6AN – telephone number 0793 750 620. J. Vincent Technical Books, 24 River Gardens, Purley, Reading RG8 8BX (0734 414 468) is the official wholesale distributor in the UK.

Tim Anderson is marketing two computer discs in either Amiga or IBM PC compatible 3·5in. form. The first, called *DXWATCH*, contains two programs, DXWATCH and IDWATCH. DXWATCH itself is a database of worldwide Band I TV offsets plus small files with Band III and u.h.f. offsets. The program allows you to create your own files so that you could, for example, create files for each channel, each continent or whatever you like. IDWATCH is intended to help with picture source identification by referring to key words. As we all know test patterns are rare nowadays, so that signal identification is an increasing problem. This program contains station identifications and words that often occur on pictures, such as news and weather – the entries for The Netherlands for example include PTT NED, NOS, NOZEMA, Nieuws, Pauze etc. Users can add to these entries, building up a comprehensive database. This disc costs £8 including UK postage.

The second disc, *AMISCAN Version 2·0*, is a database for anyone interested in frequencies above 25MHz – scanner users for example. There are well over a thousand entries that can be searched, sorted, listed, edited and printed. Each entry contains frequency, channel number, mode, service, location, comments etc. Entries can be added or expanded for updating. Information on the disc includes worldwide 10m f.m. repeaters, many of the low v.h.f. signals heard during F2 and SpE openings, amateur radio beacons, European air-band frequencies, many TV offsets and much more. Cost is £7·50 including UK postage.

These discs can be ordered from Tim Anderson at 2 Burry Road, St. Leonards-on-Sea, East Sussex TN37 6QX. I found them easy to use and if I can cope anyone should be able to!

TEST CASE 364

The workshop never seems to run at full bore in late winter. Thus anyone who brings in a repair at this time of the year is likely to get very quick service from our team of highly-trained technical sleuths. On this bright and chilly morning they were engaged on such mundane tasks as filing service manuals and carrying out repairs to stock machines. Service Manager was casting a jaundiced eye over last month's accounts – gloomy reading indeed.

A car drew up in the yard. Its driver picked up a VCR from the passenger's seat and brought it into reception. As soon as it was booked in we had it hooked up on the bench and running. But not running very fast: the cassette loading operation was painfully slow, the cassette just about making it into the machine and down on to the spool turntables. Time to get the service manual out. The machine was an Hitachi VT430.

In this deck the front-loading operation is powered by the capstan motor which drives it, along with the tape reels, via a belt and a conglomeration of plastic cogs and pinions. So the first step was to replace the belt. This didn't have the slightest effect on the cassette loading and unloading operations, which where still performed very slowly. Real Technician, who had won the fight for the machine when it came it, decided to see how the capstan motor coped with its other tasks. Before doing so he discovered that tape lacing took place at normal speed – it's done by the loading motor, quite separately from the capstan department – while the drum quickly ran up to 1,500 r.p.m. So none of the other motors on the deck were afflicted. Back to the capstan.

In the play modes the tape ran very slowly and at an uneven speed. As a result the reproduced sound was slurred and had a heavy wow. In the search modes the tape moved hardly any faster than the normal play speed. Sometimes, when cue or review was selected, it would come to a complete standstill and the deck would then shut down. Similarly if pause was selected during play or record and then released the capstan would often fail to restart, the result again being deck shutdown. Fast forward and rewind were sluggish, with every sign that a three-hour cassette would take ten to fifteen minutes to transfer all the tape from one spool to the other.

Well, that seemed to be enough evidence, the finger of suspicion pointing at the capstan drive system. Real Technician again removed the reel-drive belt, then checked for any tightness in the reel-drive department, here called the clutch base assembly. Everything ran freely, and the reel brakes were seen to be coming off all right. What a pity that, with the belt still off, another similar test wasn't carried out! With the drive belt back in place the machine was once more set to play while further tests were made.

RT first had a look at the capstan motor's supply voltage. The A16V line was at almost 19V, but a look at the circuit diagram showed that it comes from an unstabilised 18V supply, so that was o.k. The 5V line was correct. The drive circuitry could have been in trouble but RT next found, the machine having run for fifteen minutes or so now, that the capstan motor's rotor and the on-board drive chip IC1601 were running quite hot. This was the clincher. He decided to replace the motor assembly. Was this a wise move, and would it have cured the trouble? Give some thought to this before turning to page 442 to discover the answers!

Repairing LED Clock Radios

Part 2

Ian Rees

In Part 1 last month we dealt with the clock and display sections. For space reasons Table 1 was held over and is included this time. It shows the control and supply pin connections for common clock chips. Now to the radio side of things.

Quick identification of the stages of an unfamiliar radio can be difficult. There's a colour code for the small coils used in radios of Far Eastern origin however and this can be a helpful guide to circuit layout. Details are as follows:

Circuit	*A.M.*	*V.H.F.*
Oscillator	Red	–
First i.f.	White	Orange
Second/third i.f.	White	Green
Fourth i.f.	–	Pink
Detector	Black	Blue

The tuned section of an m.w./l.w. ferrite rod aerial is colour coded plain/blue or black, the coupling coil green/red.

VHF Radios

As you would expect these days, single-chip radios are the norm. The only exception is the v.h.f. front end, which is basically the same as that used in other transistor designs. The chips are standard types, but the pin connections vary from one chip to another. Sometimes a separate audio chip is used.

Fig. 7 shows a typical v.h.f. radio section up to the audio output point. Q1 is an earthed-base r.f. amplifier which is followed by a self-oscillating mixer stage, Q2, which is again used in the earthed-base mode. The voltages shown are typical.

Weak reception is most likely to be caused by transistor Q1 being dead or dying. A quick test is to touch Q2's emitter lead with the end of a short length of wire used as an aerial. If this results in a louder signal than when Q1's emitter is similarly touched, replace Q1. Short-wave reception but no v.h.f. signals when the same wire is touched on Q2's collector lead suggests that this transistor may be faulty. Dry-joints on L2, L3 and L4 are common because they are pulled about at the factory when being set. The enamelled wire adds to the difficulty of soldering the leads, which are easily broken loose by movement. Note the wax mess in this area, used to dampen microphony and hold components in place. Small movement of components in the oscillator circuit will result in a large amount of detuning and should thus be avoided.

As elsewhere the ceramic capacitors used to decouple various points are never above suspicion. Loss of any supply should lead to checks on the relevant ones. Next in line are the relevant electrolytics. The LM1868 chip in the circuit shown receives its supply at pin 19. A decoupled 4V output is provided at pin 16 – this is an unusual arrangement that's difficult to spot without a circuit diagram. The demodulated audio output appears at pin 17.

AM Section

Fig. 8 shows the first couple of stages of a typical a.m. radio section. Once again a completely dead front end can be caused by failure of Q1, but remember that leakage in the 20nF base coupling capacitor will upset the biasing. Open-circuit coupling windings will be the result if the rod aerial is able to move. Litz wire becomes very brittle when solder is allowed to run up from its joints. If a winding is open-circuit, check farther back towards the coil: it's often possible to use a short fly-lead to remake the connection.

The value of the 5,000pF feedback capacitor in the emitter circuit sometimes has to be increased to 10nF or more to maintain oscillation in the l.w. band. This component can also cause low sensitivity – another cause of this is disconnection of the unmarked lead from the aerial rod's tuned winding to the gang.

The practice of decoupling to the positive side of the supply instead of to chassis can mislead if not expected. If

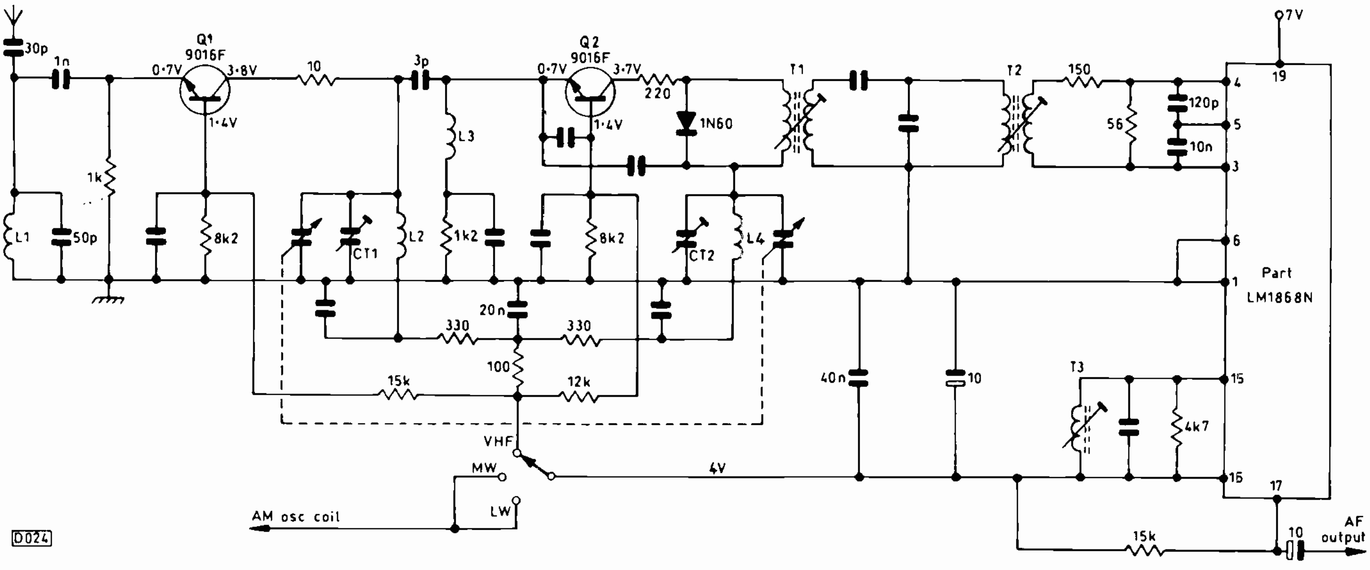

Fig. 7: Typical v.h.f. radio receiver circuitry.

Table 1: Pin connections for common clock chips.

IC	Hours Set	Mins Set	Alarm Set1	Alarm Set 2	Snooze Out	Snooze Set	Alarm Off	Alarm Out	50Hz In	Vss	Vdd
TMS1941	34	33	31	–	25	24	26	27	36	28	29
TMS1944	34	33	31	–	25	24	26	27	36	28	29
TMS1951	34	33	31	–	25	24	26	27	36	28	29
TMS1952	34	33	31	–	25	24	26	27	36	28	29
TMS3450	22	21	19	–	17	24	23	17	25	26	20
LM8361	36	33	31	–	27	26	32	27	35	28	29
LM8363	35	34	32	38	–	25	*	26	36	24	30
LM8560	22	21	–	–	17	24	23	17	25	26	20
MM5387	34	33	31	–	27	24	30	27	35	37	29
MM5402	34	33	31	–	27	24	30	27	35	23	28

*With the LM8363 pin 27 is alarm 1 off, pin 29 alarm 2 off.
TMS1941/1944/1951/1952 common collector; TMS3450/LM8560 duplex type.
LM8361/MM5387/MM5402 require separate oscillator.
LM8363 X2 alarm.

the 20nF capacitor that decoples the emitter of Q2 is leaky the supply will be connected across the 330Ω emitter resistor, giving the impression that Q2 is short-circuit. There will be no output from this stage if the transistor's base bias decoupling capacitors are faulty – the 20nF ceramic connected to the positive rail and the 10μF electrolytic connected to chassis. The unmarked capacitor that tunes the i.f. transformer's primary winding is within the screening can. Check this at the transformer's pins before removing the can. The very act of removing the can may clear the fault if there are dry-jointed connections here. Instability is once again usually caused by a faulty ceramic decoupling capacitor.

Failure of individual i.f. transistors is not uncommon. Check the operating conditions after replacement.

Fig. 9 brings us up-to-date with an a.m. circuit in i.c. form. The LM1868 is typical of a host of other chips that provide both a.m. and f.m. reception. As with the clock chip, it gives very little trouble. Don't consider replacing it until all other possibilities have been exhausted.

If there's no a.m. reception connect a scope to pin 8 to check whether the local oscillator is running. Turning the gang will confirm that tuning is taking place. A sinewave at around 70mV peak-to-peak should be expected here.

No l.w. or m.w. oscillation is often due to a faulty oscillator coil. Loss of l.w. only is most likely to be caused by a short in trimmer CT4 or the 120pF capacitor in parallel with it.

If the oscillator is o.k. try touching pin 7. This should produce a lot of noise but probably no stations. Leakage in the 20nF capacitor that couples the input to this pin will stop reception.

The wavechange switches are often not very good and may bridge internally as the contacts wipe backwards and forwards. Repair is possible if they are opened carefully but replacement is better. Note that the switch bodies may be used as links for the PCB print. If they are loose, whole sections of circuit can be affected. I add wire links to avoid this type of problem.

Tuning

If you do a lot of radio work you'll probably have made yourself a wand to check the ferrite rod's coil setting. It consists of a piece of ferrite rod an inch or so long with a length of wire soldered into a loop of about one inch diameter at one end. For convenience, tape this loop to the rod. In use, the non-loop end of the rod is brought up to the end of the set's aerial assembly. As it approaches, any improvement in a.m. reception would indicate that the aerial coil needs to be moved farther towards the centre of the rod aerial. By bringing the shorted loop around, any reception increase shows that the coil needs to be moved towards the end of the rod. Do this with the l.w. and m.w. coils separately. When no further improvement is possible, lock the coils with wax. This adjustment is done in conjunction with the aerial padders CT1 and CT2.

Before moving a wax-locked coil it's best to soften the wax with a soldering iron or hairdryer.

If the tuning gang operates intermittently when turned or is very noisy, tighten the four small nuts that hold it together – one at each corner. To gain access you might have to crack open the gang's casing. Aerosol switch cleaner can be sprayed into a noisy gang to clean the rotor's contacts. Don't use anything that might dissolve the insulation, and leave to evaporate. Check the v.h.f. and a.m. padder alignment after the repair.

Alignment is best carried out with a suitable a.m./f.m. generator and an output meter connected across the loudspeaker. Manufacturers use a wobbulator to align the f.m. circuits, but good results can be obtained using conventional peaking. If an f.m. generator is not available the discriminator or quadrature coils can be set up using an a.m. signal, tuning for a null.

Breakthrough between m.w. and l.w. experienced in some parts of the country can sometimes be reduced by reversing the connections to one of the aerial coils on the ferrite rod.

Muting

The circuit shown in Fig. 9 incorporates an audio muting arrangement. Muting is done by feeding a d.c. signal from the clock's alarm output to the base of transistor Q1. The alarm tone is fed in at a point after the slider of the volume control so that the control doesn't affect the alarm. No audio output can be caused by Q1 being defective. Anything that results in Q1 being off when the alarm tone is present will mean that an audio output is also heard. In other circuits muting is done by feeding a voltage to the i.c. Faults in this circuit can cause clock ticking – a symptom similar to that described when we dealt with the power supply. With

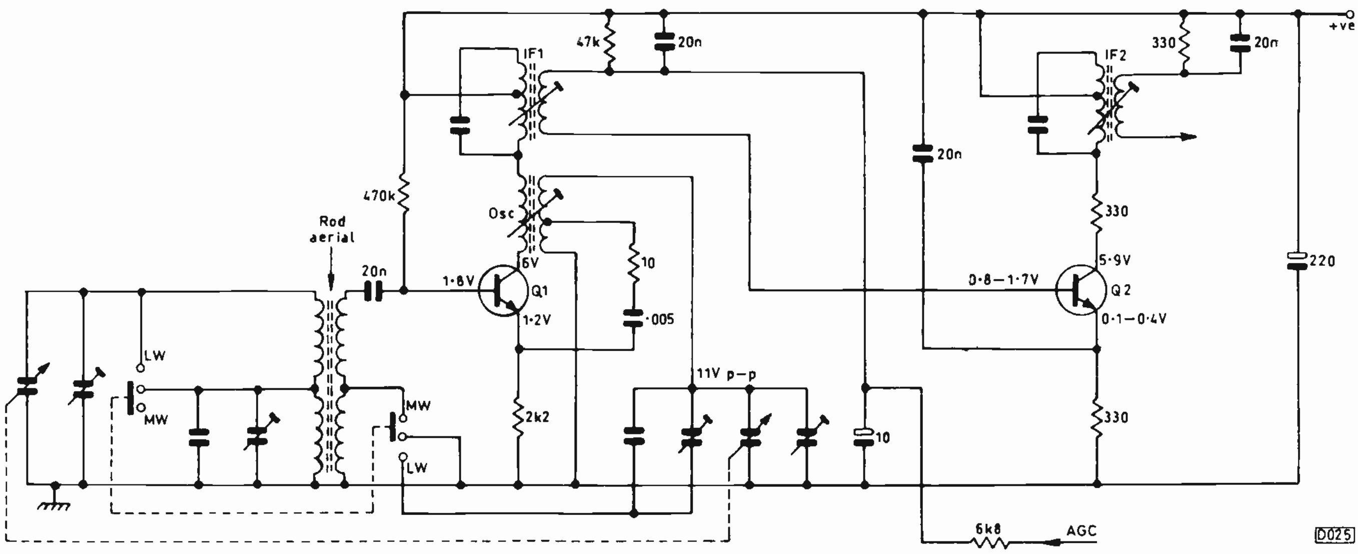

Fig. 8: Circuitry used in the first couple of stages of a typical a.m. radio receiver.

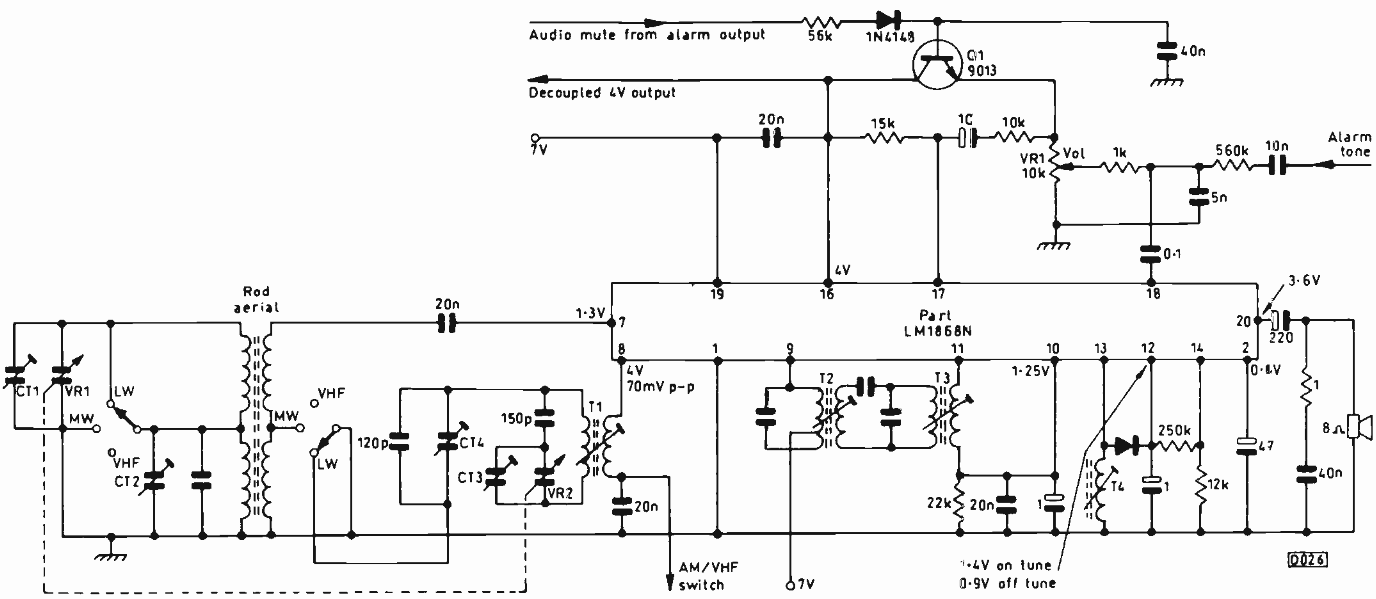

Fig. 9: A.M. receiver circuitry in chip form.

cheaper models the audio and tone occur together, the user being expected to turn the volume to minimum to kill the audio output. A variation on this is to use a switch on the volume control to turn the audio off and on.

Audio Problems

Where the audio signal enters the chip from the volume control but little or nothing is heard check the electrolytic capacitor connected to pin 2 (Fig. 9). With any i.c. that's used in the audio department the associated electrolytic capacitors can be bridged or better replaced during fault tracing. No or uncontrollable volume occurs when the tags of the volume control break loose from the print or their own rivets. Loss of the volume control's chassis connection will result in some chips muting themselves even when the wet finger test is applied directly at the audio input. Spray may cure a noisy volume control. With edge-type controls I prefer to retension the wiper as well.

The small loudspeakers used are prone to failure. The magnet becomes unstuck or goes off centre, the speech coil leads fracture or the coil goes open-circuit. Speaker replacement is the only cure. Rattle is sometimes caused by case resonance, a loose item on the cone or the speaker being incorrectly fixed. A speech coil that scrapes against the polepieces produces a static-type interference on loud sounds.

What sounds like speaker distortion is often caused by r.f. oscillation in the audio section. Try connecting an 0·1μF capacitor across the loudspeaker to see whether this provides a cure. With some sets this symptom arises only after the warm-up period. Scoping the output to the speaker will show that an r.f. envelope is present. The problem seems to arise quite often when a TBA820 chip is replaced with its KA equivalent.

Problems can arise when a PCB is mounted closely behind a speaker and the manufacturer has fitted a piece of insulation to the back of the speaker. Another problem is that solder spikes can short to the speaker tags or case when the set is reassembled.

Pointer Drives

Finally a few words on station pointer drives – dealing with these has as long as I can remember been one of the most hated jobs in radio servicing. These marvels of string have given many an engineer a hard time. I still have nightmares about a Rigonda valve radiogram drive system that became unstrung when my then young son spun the dial when the gang was disconnected. Steel cords took hours to work out and refit.

Fortunately the systems used with clock radios are usually simpler. Many have a push-pull arrangement with flexible plastic rods, or a simple direct drive with a calibrated knob.

The old problems remain where the drive-cord method is used. The worst fault is likely to be when a pulley snaps off its fixing. A new shaft can be made by drilling and replacement, with a suitable bolt melted in.

If a cord diagram is not available and complete restringing is required I prefer to have the gang either open or closed. Starting with the spring under tension (assuming that it's on the drum) I head off around the pulleys, bearing in mind the direction in which the cord has to move in relation to the pointer. About three turns around the drive shaft is enough – take care that adjacent turns don't overlap each other when the shaft is turned in the reverse direction, with the characteristic ping and shudder of pointer. Note also that the direction of the turns should coincide with the pointer movement. End up finally back at the drum. Leave pointer fitting to the last – this will enable the last bit of slack to be taken up. Put a spot of glue or varnish on the pointer and all knots to lock them in place. Nylon drive cord in all sizes can be obtained from a boat chandler – it's sold for sail repair.

An easy way to raise the tuning drive drum without unstringing the cord is to release its centre screw. Gently swing the drum upwards, giving it a couple of twists against the lay of the cord. It can then be taped to the PCB, out of the way. Provided you've not moved the gang or the drum it can be refitted in the reverse order.

Some radios have an arrangement with which the drum can be disengaged from the drive. This makes life simpler, provided that care is taken about their relative positions during reassembly.

Teletopics

NIMBUS DEVELOPS LONG-PLAY CD

Nimbus Technology and Engineering of Monmouth has developed a double-density CD with twice the playing time of a conventional disc. The system, known as CD2X, is based on the use of a special mastering lathe developed by Nimbus and Dr. Jonathan Halliday. Its longer playing time has been made possible by reducing the pit size, track pitch (from 1·6 microns to 1·2 microns) and reading speed (by a factor of 1·4). Despite these changes the new discs can be read by a conventional red laser. Nimbus says that CD2X discs can be played by some of today's CD decks, though with some of the newer ones the optical system will need to be tweaked to focus on the smaller pits.

CD2X is seen primarily as a replacement for VHS and the LaserDisc. Nimbus has developed a small video adaptor box that plugs into a CD player's digital output socket. It contains a video expansion chip, type CL450, developed by C-Cube Microsystems. This is used to decode the MPEG-compressed video signal from the disc. Nimbus says that some players may have the chip built into them.

The new discs will play around two and a quarter hours' of video with f.m. quality sound. Picture quality is claimed to be better than that of VHS. The playing time can be reduced to 75 minutes, offering wide-screen, broadcast-quality pictures. An additional bit will have to be added to the sub-code to tell the player that the disc is an LP one (today's machines recognise playing times only up to 99 minutes, 59 seconds).

Nimbus is confident that CD2X will be accepted by video companies but doesn't expect music companies to market LP audio discs. CD2X could also be used to store more Photo CD pictures, and can be used as a CD-ROM to store up to 1·2Gbytes of data. The new system doesn't provide interactive operation and is therefore not seen as a rival to CD-I. CD2X discs could be on sale within a year. Nimbus has also developed quadruple-density discs, known as CD4X, but these require the use of a blue laser and are more expensive to produce.

HDTV

The MAC system as a way of achieving the goal of HDTV in Europe has to all intents and purposes been abandoned, though a formal decision to drop MAC cannot be taken until the next meeting of EC telecoms ministers in May. The new EC industry commissioner Martin Bangemann has said that Europe will have to follow the US lead when it decides on a digital HDTV standard later this year. Mr. Bangemann sees no point in starting a further global TV standards battle. There has been a further delay in the USA however, where a decision has been postponed for five months or so while the FCC carries out a further series of tests on the four remaining contenders for selection as the HDTV standard.

Meanwhile the partners in VADIS (Video-Audio Digital Interface System), a pan-European digital TV project, have agreed to expand its aims to include digital HDTV. The VADIS project has developed compression systems that reduce the data rate for a standard digital picture source from 216Mbits/sec to around 4-8Mbits/sec with little reduction in quality. The compression system will make it possible to offer digital audio-visual services from a variety of sources, including telecommunications networks and satellite, terrestrial and cable TV channels. The work is being co-ordinated with the second phase of the international coding standards being developed by the ISO/IEC, known as MPEG. When applied to HDTV pictures the compression techniques will reduce the data rate from 1,152Mbits/sec to around 12-25Mbits/sec. The new work involves the development of a multi-layer picture compression scheme that's matched to European requirements. VADIS members include the BBC, BT, National Transcommunications (NTL), Philips and Thomson.

SATELLITE TV

SES, which operates the Astra satellite system, has decided that its fourth and fifth satellites, due to be launched in 1994 and 1995 respectively, will incorporate digital TV capacity. This will enable Astra to offer a 180 TV channel system from 1995. SES believes that the arrival of digital TV is much nearer than some suppose. It considers that the next two years will be the testing time, and that digital TV decoders could be made available as early as next year.

The latest *Financial Times* Satellite Monitor, conducted by Continental Research, estimates that some 65,000 satellite TV systems were installed in the UK in January. This compares with 70,000 in January 1992. Continental Research estimates that 17,000 were upgrades, replacements or renewals after a break in subscription. It forecasts that by 2000 some 9·5 million homes in the UK will be equipped for satellite TV reception.

A new range of multi-function integrated receiver-decoders designed and developed by the Pace Micro Technology research and development team is being launched at Cable and Satellite '93. They include the DMAC/D2MAC/PAL MRD950 with integrated Eurocrypt M and S decoding facilities, 120-programme capacity, concise on-screen multi-language graphics, dual LNB inputs, a comprehensive parental lock facility and automatic 16:9 widescreen format selection. The top-of-the-range MRD960 has the added convenience of a dual card reader for increased ease of use.

NEXT GENERATION VCRs

Japanese consumer electronics companies led by Matsushita and Sony are holding talks with the aim of reaching agreement on a new standard for the next generation of VCRs, which will use digital techniques for video storage. The use of digital techniques offers the prospect of virtually perfect pictures no matter how many copies are made. It's hoped that foreign manufacturers will support the standard, facilitating the introduction of digital video technology in the consumer market.

SUCCESSOR TO FM

The trade and industry secretary Michael Heseltine has launched a 'national forum' to promote digital audio broadcasting (DAB). The forum will involve broadcasters, equipment manufacturers, retailers and the providers of services. DAB is expected to replace f.m. broadcasting over a 15-25 year period starting with the first commercial DAB services in 1995. A preliminary technical specification, developed under the European collaborative research programme Eureka, has been submitted to the European Telecommunications Standards Institute. Those participating in the project include the BBC, Philips and Thomson.

DOLBY NEWS

According to Dolby its SR.D six-channel digital stereo sound system is now on fifteen major titles, including Malcolm X, The Bodyguard and Dracula. The new system is compatible with equipment that uses Dolby's older stereo, four-channel and mono sound systems. Yorkshire TV's programme Bad Influence, broadcast on January 28th, was this company's first production to use Dolby Surround sound. Dolby Laboratories has moved to Wootton Bassett, Wiltshire SN4 8QJ (0793 842 100).

BUSINESS NEWS

JVC is to close one of its German manufacturing plants in order to reduce mounting losses. In announcing a 27 per cent pre-tax profits fall in the quarter to the end of December, after discounting the effect of an extraordinary gain in 1991 (otherwise the profits fall amounts to 62 per cent), Sony says that VCRs and camcorders suffered the largest fall in sales, of nearly twelve per cent. Audio sales fell by six per cent while TV sales rose by ten per cent on the strength of worldwide demand for computer displays. The surprise announcement by Matsushita that its president Akio Tanii has resigned has shocked the Japanese business community.

Philips is to increase co-operation with Grundig, its 31·6 per cent owned, loss-making affiliate, in an effort to boost both companies' consumer electronics activities. According to Philips "drastic cost reductions can be achieved only if both companies avoid duplication of efforts, especially in development and manufacturing". Philips has an agreement, dating from 1984, to finance Grundig's losses.

VIDEO NEWS

JVC has launched a budget camcorder, Model GRM3, at £599: features include a x8 zoom lens, video light and wired remote control. Nokia has just released three new VCRs: two of them have a built-in VideoPlus timer system. The Grundig GV201 at £360 includes text programming with Startext and an automatic cassette identification and play time indication system (ATTS).

Sharp has launched an LCD projection TV system, Model XV710P, at £1,800. It can handle PAL, SECAM and NTSC signals and can project an image with a diagonal size up to 100in. Sockets are provided for S video, composite video etc. It uses a newly-developed metal-halide lamp which costs about £180 and has a maximum useful life of around 4,000 hours. For the brightest and clearest picture a 60in. polarising screen (Model XUPP60S) is available at about £1,290.

Simple ESR Meter for Electrolytics

Ray Porter, M.Sc., C.Eng., M.I.E.E.

In an article in the January issue I described the way in which the effective series resistance (ESR) of an aluminium electrolytic capacitor can increase so that it no longer acts as a low-impedance component. This explains why a fault is often cleared by replacing an electrolytic capacitor even though its value, when checked with a capacitance meter, is close to that marked on it. In view of this I decided to design a simple meter to measure the ESR of electrolytic capacitors. Its range suits the ESR values of PCB-mounted electrolytics. By checking against standard values (see Fig. 3) you can reject lossy capacitors.

The tester makes use of an operational amplifier as a negative-resistance oscillator. Since the operation of negative-resistance operational-amplifier circuits doesn't seem to be well known a short explanation of the relevant theory is provided later.

Circuit Description

The circuit produces a negative resistance to cancel the ESR of the capacitor being tested so that there is continuous series resonance with a fixed inductor. Fig. 1 shows the circuit diagram of the meter. The negative resistance is produced by IC1b: Cx is the capacitor under test and L1 the fixed inductor. VR1 enables the negative resistance to be adjusted. Rotate it until oscillation stops: the ESR value can then be read from a scale fixed to VR1.

When there is no negative resistance present L1 and Cx form a series resonant circuit that's damped by L1's resistance and Cx's ESR. This circuit will ring when energised by an impulse. IC1a is used as an oscillator to produce a squarewave output at a frequency of a few Hz. This output is differentiated to produce the spikes (impulses) that energise the resonant circuit. When the capacitor's ESR and the resistance of R1 are cancelled by the negative resistance the ringing becomes a continuous oscillation. LED D1 is then on. When the oscillation is stopped by reducing the value of the negative resistance the LED goes off.

If a short-circuit capacitor is connected to the tester the LED comes on with full brightness. When the resonant circuit is oscillating the LED is illuminated on only the positive-going half cycles: it therefore glows at half brightness.

IC1d provides a half-supply voltage reference for IC1b. S1 varies IC1b's gain, changing the negative resistance to provide 0-1, 0-10 and 0-100Ω ESR ranges.

Construction

The circuit was built on a piece of stripboard which, with a PP3 battery, fits easily into an ABS box. L1 was wound around the four pillars on the inside of the box's lid – see Fig. 2. It consists of 42 turns of 30 s.w.g. enamelled copper wire. This results in a coil with a resistance of 3·2Ω and an inductance of 90μH. A different wire gauge could be used, but its resistance plus that of R1 must equal 10Ω.

With the coil as specified above a 1,000μF capacitor in

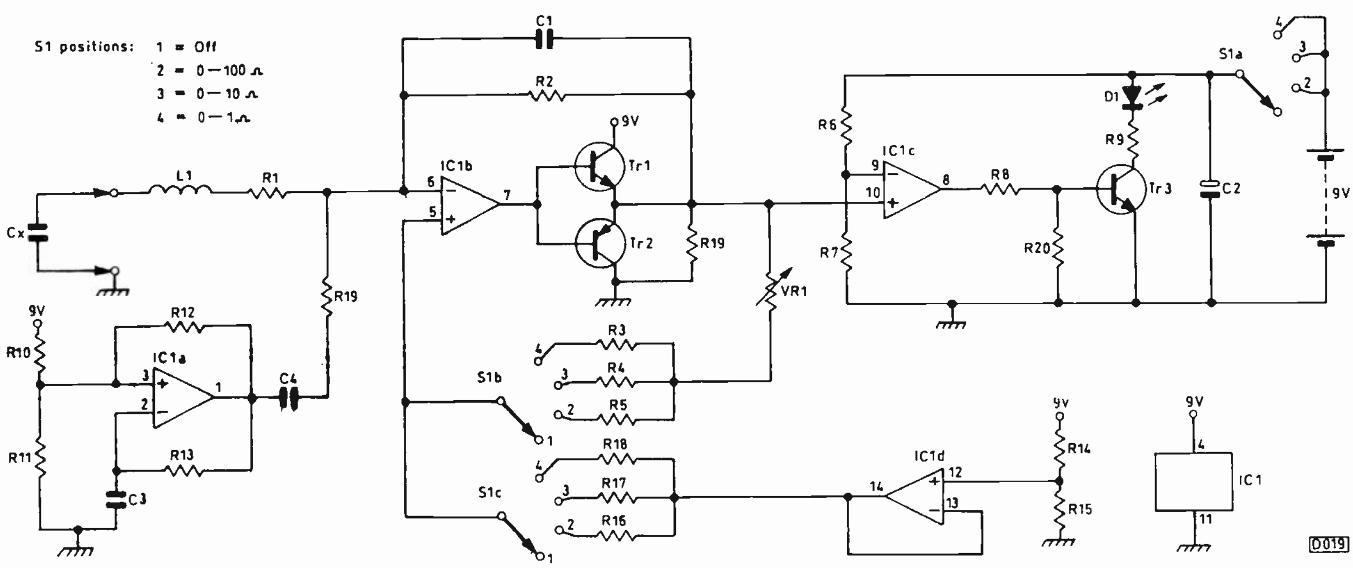

Fig. 1: Circuit diagram of the ESR meter.

position Cx produces oscillations at 70Hz. A 1μF capacitor increases the frequency to 10kHz. When testing the circuit I connected a crystal earpiece via a 100nF capacitor to R19 to check for oscillation. The clicks of a square wave can be heard when VR1 is set far away from the position that stops oscillation. As the critical setting of VR1 is approached the pure sound of a low-amplitude sinewave is audible.

Calibration

Start by using a known good 1,000μF capacitor with a voltage rating of at least 25V in position Cx. Adjust VR1 until the LED goes off. Mark the scale 0·1Ω. Now add known-value resistors in series with Cx and adjust VR1 until the LED just goes off. Mark the scale with the new total resistance value. You may find it convenient to use increments of 0·1Ω on the 1Ω range and suitably larger increments on the other two ranges.

Interpreting the Results

Fig. 3 shows typical ESR values, based on manufacturers' data and allowing for the fact that ESR measured at 10kHz is usually one third of that measured at 1kHz. The ESR values with 10V normal grade capacitors can be seen to be four times those with low-ESR 63V types. Thus when a low-ESR type has deteriorated to the point where its ESR is the same as that of a normal electrolytic its internal heating will have quadrupled!

If you find that the measured ESR value is more than twice that shown in Fig. 3 the capacitor is past its best. ESR values for capacitors with voltage ratings other than those specified in Fig. 3 will be between the relevant lines on the graph.

Negative Resistance with an Op Amp

When a voltage increase is applied to a negative resistance there's a current decrease, i.e. I = –V/R.

Two operational-amplifier configurations exhibit negative input resistance. They are shown in Figs. 4 and 5. The one to use depends on the source resistance of the circuit to which it's connected. This is because the circuits use negative and positive feedback simultaneously, the source being part of the feedback potential dividers. If the proportion of

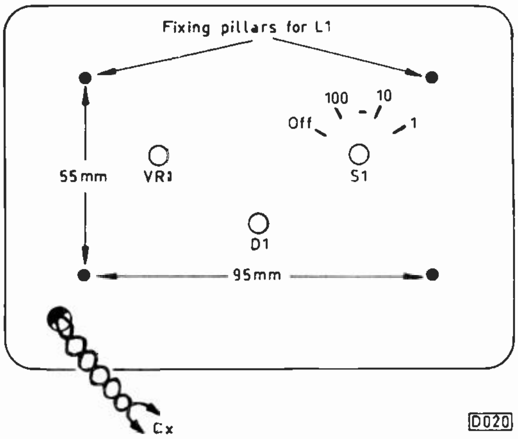

Fig. 2: Front panel layout.

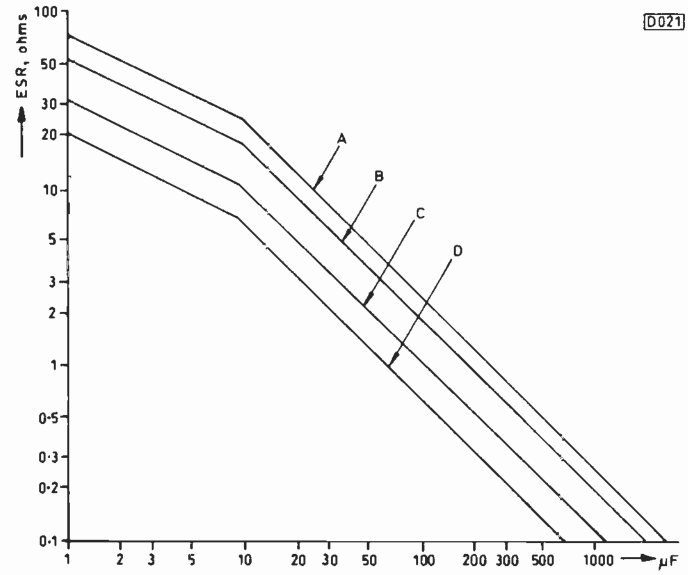

Fig. 3: Typical ESR values, A 10V normal grade, B 25V normal or 10V low-ESR grade, C 100V normal or 25V low-ESR grade, D 63V low-ESR grade.

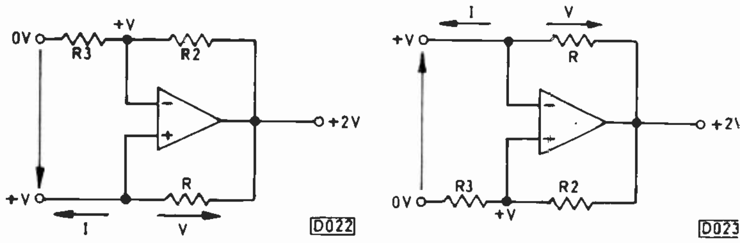

Fig. 4 (left): Negative-resistance op-amp circuit when the source resistance is less than R.

Fig. 5 (right): Negative-resistance op-amp circuit when the source resistance is greater than R.

the output fed back to the non-inverting (+) input in Fig. 4 is too large or the stage gain in Fig. 5 is too great unwanted oscillation will occur and the circuit won't function as a negative resistance.

Conventional current notation is used in the following explanation. In Fig. 4 the values of R2 and R3 are equal. Thus when +V is applied to the input the output rises to +2V. The voltage across R is then V and its direction is such that I must flow out of the input. So the circuit's input resistance is V/–I = –R, which means that the input resistance is of magnitude equal to R but negative in value.

The same analysis can be applied to the circuit shown in Fig. 5. Remember that these circuits will be stable only when the source resistance is as shown, and that operation as described is possible only when the operational amplifier's normal voltage and current ratings are not exceeded.

Components list

R1	6·8Ω	R8	47k	R15	150k
R2	1k	R9	560Ω	R16	1·1k
R3	1M	R10	120k	R17	2k
R4	100k	R11	120k	R18	11k
R5	10k	R12	33k	R19	10k
R6	270k	R13	2·2M	R20	10k
R7	470k	R14	150k	All 0·25W 5%	

VR1 100k

C1 2·2nF C2 220μF, 15V C3 0·1μF
C4 10nF

IC1 TL084CN Tr1 BC547 Tr2 BC557
Tr3 BC547 D1 Red LED

L1 14m of 30g enamelled wire – see text
S1 3-pole 4-way switch
ABS box, stripboard

Camcorner

Reports from Brian Storm and David C. Woodnott

Panasonic NVMS2B

This camcorder would play back a tape quite normally if the record tab was removed but a virgin tape would be greeted with high-pitched whistling that drowned out the sound track. In these machines the tab switch enables Q6003, which then feeds 9V to various places including the 2SB1219 transistor Q4005 that produces the delayed 9V record voltage. The problem was that Q4005 was passing about 2·5V to the record circuits even when no switching voltage was applied to it. A replacement cured the fault – it's a surface-mounted device. **B.S.**

Panasonic NVMC5

This rather elderly camcorder came in with a request for an estimate for head replacement and a service. Despite the machine's apparent age the mechanism was clean and sparkling, with no signs of wear and tear. When our test 'C' cassette was played back however we found that the output from one head was missing. As I suspected, replacement heads produced no improvement. So attention was turned to the head amplifier pack and the flexible connector from the drum to the pack. Removing and resoldering the connecting pins cured the fault completely. **B.S.**

Panasonic NVMC20

This camcorder was accused of bloody–mindedness: it would sometimes refuse a tape, just ejecting it then leaving the cassette door open! It performed beautifully on test of course, showing no inclination at all to misbehave. After a call to Panasonic a nice man called Phil assured me that a replacement mode switch would cure the problem. It's part no. VES0416 and did the trick. **B.S.**

Sony CCDF340E

The symptoms were no sound and intermittent VTR functions. Neither fault was difficult to cure. The no sound fault was cured by replacing the microphone preamplifier chip IC585. A damaged flexi board was the cause of the intermittent VTR functions (how do they get damaged?). **D.C.W.**

Ferguson FC28

The fault report said "won't always switch on and, when working, won't always switch off". I thought that this was probably a mechacon reset problem but inspection revealed nothing more than a faulty power switch (SW617). Note that with these machines the response to a selected mode, e.g. power on/off, play etc. is not always instant – a sort of "soft" response to commands is often evident (or is it me?). **D.C.W.**

JVC GR65E

No autofocus was the problem with this one. The motor assembly proved to be at fault, with a jammed gearbox. The initial drive from the motor is via a belt that's connected to a reduction gear (a sealed unit). It was this item that had failed, possibly because the slipping clutch assembly, which is the final part of the autofocus drive to the lens assembly, was locked tight and was unable to slip when required. Manual focus adjustment probably caused the gearbox failure. **D.C.W.**

Sony CCDF450E

I suppose we all get caught out sometimes by diving in too deeply. The symptom with this machine was intermittent playback functions, including fast-forward/rewind search. Recording was o.k. After some abortive in-depth investigations I discovered that the power switch (camera/player) made intermittently poor contact in the play mode. A replacement put matters right. **D.C.W.**

Panasonic NVMS1

Sound recording via the microphone was o.k. when listened to using the headphones but there was no output from the A/V out connector (the picture was o.k.). Playback sound was also available only via the headphone socket. The cause of the trouble was that the 2SD1328 audio mute transistor Q4013 was short-circuit emitter-to-base. Note that it's mounted at the opposite end of the main PCB to most of the audio circuitry. **D.C.W.**

JVC GRA30E

Two of these came in at the same time from the same source with the same fault – no functions, with the emergency mode indication E01 in the viewfinder. This means that the 8V supply is missing. Amongst other uses it appears as the r.f. unit supply at the AV output socket. The cause of the trouble was a faulty AV lead, which had been tried with both cameras. Unfortunately there's no fuse in this line to protect the main d.c.-d.c. converter. So two converters had to be replaced, which was a costly exercise. In view of the fact that it's an easily produced fault it is surprising that better protection wasn't incorporated. **D.C.W.**

Sony CCDV88E

This machine would shut down intermittently in the play mode and just sit there looking at you. Careful inspection at the instant of failure revealed that just before the shut down occurred the capstan motor's speed rapidly increased. We decided to investigate the capstan FG circuit and found a dry-joint at pin 16 of IC503, the capstan FG waveform shaper. **D.C.W.**

Fugix M890

This machine is a clone of the Sony CCDTR75E. The problem was an intermittent trigger button – the sub-trigger button worked all right. Unfortunately the trigger button switch is available only as part of the complete control assembly, which includes wide/telephoto toggle, play, record, pause etc. and all the operation keys. A replacement is costly, especially when only one key function has failed. **D.C.W.**

TV Fault Finding

Reports from Philip Blundell, AMIEIE, Richard Newman, Paul Hardy, Chris Watton, John Edwards, Michael Dranfield, Brian Storm, Steve Cannon, Alfred Damp, and Geoff Fardon

Philips K40 Chassis

This set had no sound or vision – there was just a blank raster. Tracing back through the signal path with a signal generator I obtained activity when injecting a signal at the output of the TDA2541 i.f. chip but none when applying the signal to its inputs. The voltages at the input pins were different: they should both be at 5·2V but pin 16 was low, with a 1·5kΩ leak to chassis. The other input (pin 1) didn't have this leak. Disconnecting pin 16 proved that there was internal leakage via the chip so a replacement was fitted – to no effect! What else that could cause a low resistance from pin 16 to chassis was connected to the chip? Nothing seemed to be likely until I looked in the SGS data book and found that pins 2 and 15 have decoupling capacitors connected to them. The one connected to pin 15, C2115 (22nF), was leaky. **P.B.**

Philips CP90 Chassis

When checking this chassis for dry-joints one place where you might not think to look is in the i.f./sync can. Dry-joints can occur in this can, especially around the TDA2579 chip. **P.B.**

Philips NC3 Chassis

There was a blank raster though sound was present and the on-screen display worked. A check on the waveforms around the TDA3565 colour decoder chip showed that the sandcastle pulses were present and a video signal went in, but nothing came out. Voltage checks then showed that the brightness control pin was high – 2·5V instead of 0·6V at the maximum brightness setting. A new TDA3565 was required. **P.B.**

Philips 2A Chassis

The power supply was dead. Checks showed that there was 0·6V at the base of the BUT11AF chopper transistor and over 300V at its collector, but the circuit wouldn't oscillate. As there were no shorts across the secondary windings of the chopper transformer attention was turned to the snubber network connected to the primary winding. D6663 (1N5062) was found to be leaky – 150Ω both ways. **P.B.**

Philips G110 Chassis

When the power supply in this chassis breaks down Philips supplies a complete repair kit. You must replace all the parts supplied. I recently had one of these sets come in from another dealer who said that although he'd fitted the power supply kit the set would shut down after an hour or so, just as though it had been switched off. Sure enough the set did exactly as he said. When I checked the 140V supply I found that there was virtually no voltage here while the supply from the mains bridge rectifier was down to about 20V (instead of 280V). Two of the bridge rectifier diodes were going open-circuit when warm. I replaced all four and had no further problems after that. When I spoke to the dealer he said that he hadn't bothered to change the diodes, although they are part of the kit, because they had measured all right. A lot of frustration could have been avoided if he had heeded the manufacturer's instruction to change all the parts in the kit. **R.N.**

Questar CTR14

This set was dead. I'd seen it about a year before for a similar fault and had had to replace R652 (390kΩ) which had been open-circuit. It again had to be replaced, but this time the STK7348 went short-circuit at switch on, taking with it R651 (27Ω, 2W), R653 (1·5Ω, 2W) and C655. Everything was fine when these items had been replaced. **P.H.**

Contec KT8135

There was no luminance. The cause was a poor plug and socket connection for the luminance drive on the c.r.t. base panel. **P.H.**

Hitachi C14P218 (G7P Mk 2 Chassis)

This 14in. portable was stuck in standby. A check at the collector of the BUT11AF chopper transistor Q903 produced a reading of some 300V, so obviously the mains bridge rectifier diodes etc. were o.k. Two series-connected 82kΩ resistors, R902 and R903, provide a start-up bias for Q903. They are at the front, right-hand corner of the chassis and were both open-circuit.

Another fault you get with these sets is that the screen goes very bright then the set trips. The cause is that a capacitor near the line output transformer becomes dry-jointed because a part of the cabinet back pushes against it, eventually forcing it from the panel. The capacitor concerned is C711 (47µF), which is the reservoir capacitor for the h.t. supply to the RGB output transistors. I cut the offending portion off the inside of the cabinet back – it doesn't seem to have any purpose. **C.W.**

Matsui MB10

"Dead on mains" the report said and a quick check with the bench 12V power supply proved that the set was otherwise o.k. So off with the back and into the chopper power supply on the left-hand side. The primary supply was present but there was no oscillation. I noticed a capacitor on the print side of the panel: it was not shown in the circuit diagram and was connected between the h.t. line and the collector of the chopper transistor. A check showed that it was short-circuit, thus preventing any current flowing in the chopper transformer's primary winding. A replacement restored mains operation – it's a 4,700pF capacitor with a voltage rating of 2kV. **C.W.**

Toshiba T211T4BA

When I switched this set on it seemed to work all right but as soon as I changed channel it began to search tune down-

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BC327-25	£0.07	BU208	£1.00
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BC441	£0.25	BU406	£0.90
BC461	£0.25	BU406D	£1.50
BC547	£0.07	BU407	£0.50
BC548	£0.07	BU426A	£1.00
BC549	£0.07	BU500	£1.00
BC557	£0.30	BU508A	£1.00
BC559B	£0.07	BU508AF	£1.70
BC639	£0.18	BU508D	£1.00
BC640	£0.30	BU806	£0.75
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BF198	£0.07	TIP47	£0.98
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BR101	£1.40	IN4002	£0.06
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BRY56	£0.75	IN4006	£0.08
BT116	£2.50	IN4007	£0.08
BT128P	£4.50	IN4148	£0.10
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BY179/SK2/08	£1.10	RHI	£1.30
BY184	£0.65	RM11C	£0.45
BY189	£2.00	SG264	£8.50
BY190	£2.00	SG613	£12.00
BY223	£2.00	SKB/02	£0.60
BY206 (BYB96R)	£0.55	SKB/08	£1.20
BY210/800/BYV96	£0.55	SKB2/02	£0.90
		SKB2/08	£1.10
BY227	£0.20	SKE1/02	£0.60
BY228	£0.50	SKE1M15	£0.65
BY229	£1.15	SKE2G2/02	£0.75
BY299	£0.50	SKE2G3/04	£1.30
BY96D	£0.30	SKE4F1/04	£0.45
BYV96D	£0.55	SKE4F1/06	£0.45
BYW56	£0.50	SKE5F3/10	£2.20
BYW96E	£0.50	SR2M	£0.75
BYX10	£0.50	T9053V	£1.40
BYX55/600	£0.55	T9064V	£1.50

ASK FOR SEMICONDUCTORS NOT LISTED

VIDEO HEADS

AMSTRAD

3HSSR-VCR7000 (Saisho/Orion) £16.00
PSF1-VCR4500,5200,9000 .... £15.00
PSF2-VCR4600,4700 .... £14.00
PSF3-VCR6000 .... £16.00

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FERGUSON

3HSSV-2 Head universal £7.50
3HSSVA-3V42,44,45,46 etc £17.00
3HSS4VB-3V32/HR7655 .... £22.00
3HSS4VC-3V48/HRD565 .... £24.00
3V48,58,59,65,FV10,11,12,13,14,20,21,26
And most other Fergusons .... POA

HITACHI

3HSSHA-VT8000,9000 series £15.00
3HSSHB-VT11,33 etc £15.00
10082-VT120,220 .... £22.00
10081-VT130,135 .... £25.00

PANASONIC

3HSSN-2 Head universal £7.50
3HSSU1N-NV100,370,380/Philips VR6460 .... £11.00
3HSSU2N-NV230,470,480,G9,10,11,15PX £17.80

VIDEO HEADS Continued

3HSSU3N-NV430,460 .... £14.70
3HSS3N-NV777,330 .... £18.50
3HSS4NB-NV730 .... £19.00
3HSS4NA-NV366 .... £24.00
NVG30,33,40,45,46,130, & most other Panasonics .... POA

SANYO

3HSSSY-VHR1100,1110,1300 .... £18.00
3HSS3SY-VHR1500 .... £28.50

SHARP

3HSSSP-VC9300,9500,9700,381,481,482,483,486 etc £15.50
3HSSSPB-VC581,583,651,670 etc £14.50
VC7000,8000 series (Brass) £42.00

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Hinari VXL5,6,20H £15.00
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Orion VC150,180,VH1,2,3 etc £16.00
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Toshiba V93 .... £19.00

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Clutch Assembly 3V42,43 .... £14.00

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FOR PARTS NOT LISTED

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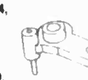

Makes & Models: Hinari VXL4, Matsui VX730,735,735A,755, 770,800A,810,820,880,990. Saisho VR1100,1200,1200HQ, 1600,2500,3200,3300,3300X,3500, 3600,3700

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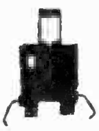

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Philips Pinch Roller for models VR6180, 6185, 6285, 6362, 6367, 6467, 6468, 6470, 6561, 6670, 6760, 6761, 6870 .... £6.00

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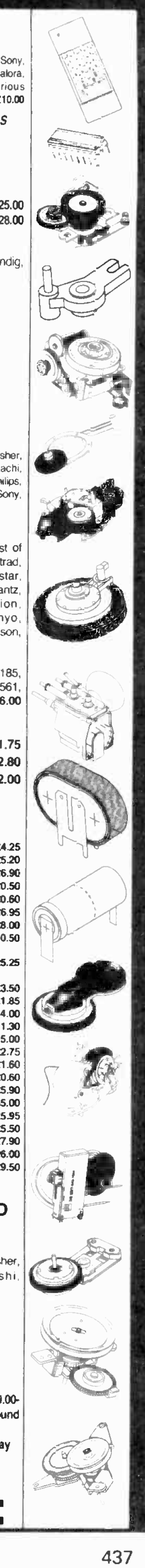

A Z ELECTRICS

wards. If the down button at the front of the set was pressed the search would stop for a short time then start again. A new 47C232AN4984 tuning chip (ICA11) cured the trouble. **C.W.**

Finlux 3029 (3000 Chassis)

This monster set suffered from what could be described as "line spacing": the top quarter of the picture was o.k., but towards the bottom of the screen every other line appeared to be blanked out. A fault in the field output stage seemed likely so several components in this area, including the field output chip, were replaced. All to no avail until we came to CK8 (0·1μF, 63V). Replacing this cured the problem. It's a small, white square-shaped capacitor positioned beneath the field output chip's heatsink. **J.E.**

Hitachi CPT2188 (Salora K Chassis)

This set was dead. There was a distorted waveform at the base of the line output transistor and an almost identical waveform at its collector – a check showed that its base-collector resistance was only 85Ω. We didn't have the original type (2SD1577) in stock so we decided to try a BU508A instead. The 2SD1577 has an insulated body, so its heatsink is soldered to chassis. The BU508A was therefore mounted on the heatsink using a conventional mica insulator, spacer and bolt system. A long test run showed that the transistor ran cool. **J.E.**

Tashiko 20F862

When this set was switched on the standby indicator flickered briefly but the set otherwise remained dead. The cause of the fault turned out to be C701 (47μF, 450V). For good measure we replaced C506 (47μF, 450V) as well. **J.E.**

Salora K Chassis

For tripping out when changing channel, also the field output chip IC501 having a very short life, check choke L601 in the line output stage. In the set we had in L601 looked as if it had got very hot and clearly had shorted turns. **M.Dr**

Hitachi CPT2656

This set wore a Finlandia badge but we were able to match it up with one of our Hitachi service manuals. Over a period of eight months it has been back to the workshop on several occasions, but each time it failed to display any fault during a soak test. The customer's complaint was that the bottom part of the picture was missing. Despite replacing many components in the field output stage the set kept on coming back. It was difficult to know what to do as we'd not seen the fault. On its latest visit however the fault put in an appearance: after about an hour the bottom of the picture began to cramp up while the top widened out. By feeding a crosshatch pattern signal to the set we could see that the actual symptom was change in linearity. A slight touch on preset RTB573 (470Ω) cured the fault. So a replacement linearity potentiometer was fitted and the set was handed back to the customer with confidence. **M.Dr.**

Panasonic TX21T1 (Alpha 2 Chassis)

The complaint was about an intermittent whistling noise when the set was first switched on. Sure enough a high-pitched whistle came from the set when I switched it on, stopping as soon as I touched it and then not to return until next day. In fact any attempt to touch the set cured the fault until next day. Many days later the cause of the fault was traced to a dry-joint on the line output transformer's over-winding – the point that provides sync between the line output stage and the chopper power supply. **B.S.**

Ferguson TX10 Chassis

We don't get many TX10s in these days. This one gave us some real grief however. It had been in for almost a fortnight, running on soak test, and the fault complained about was just beginning to put in an appearance. At switch on first thing in the morning there was field bounce. For only five minutes mind, then it would work perfectly for the rest of the day. Even switching it off and leaving it for a good few hours didn't seem to make any difference: the set would fault only between 9 and 9·15 a.m. We'd tried freezer of course, but this didn't give us any definite clues. Then one morning the fault showed up for a lot longer than usual and also developed further: there was intermittent field rolling and the line sync jittered. Well it was now or never, so on to the bench it came.

We replaced the TDA2578A timebase generator chip IC742 as this was the obvious thing to do. It didn't help, but at least the fault was still present. As both the line and field sync were affected I suspected that the cause of the fault was around the input to the sync separator. A scope check was made on the video waveform at pin 5 of the TDA2578A chip and at first glance it looked fine. This point is biased by R759 and R753, which are close-tolerance components and have given us trouble before. But replacements made no difference. Upon closer examination of the video waveform the line sync pulses did seem to be rather thin, if you know what I mean, so maybe there was a fault earlier in the video processing. This seemed a bit of a long shot. I couldn't compare waveforms, and the one we had wasn't far removed from the oscillogram shown in the manual. But to prove a point I found a signals panel and transplanted it into the set. Sync lock was now perfect and, looking at the scope, the pulses had certainly put on weight. The original panel was refitted and scope checks showed that the video waveform was faulty right back to the i.f. panel. When this was swapped over the fault had cleared. Now the set was on rental, so I contemplated leaving it with the good panel installed. But as there was only half an hour till lunch time I thought that I might as well continue. I'd been at it all morning, and might as well get some satisfaction by tracing the cause of the problem to component level – and anyway I wasn't going to cheat!

I thought it was only going to be the i.f. chip. How wrong can you be? Replacing it made no difference, but use of freezer and the heat gun now made the fault come and go. Its cause was finally traced to the electrolytic capacitor C35 (1μF) in the a.g.c. feed to the SL1432 i.f. preamplifier chip. A replacement sent me off to lunch with a beaming smile. **S.C.**

Panasonic TC21R1 (Alpha 2 Chassis)

The reported fault was no picture. E.H.T. was present but there was no raster. When the first anode voltage was increased I saw that the cause of the symptoms was field collapse. A new field output chip made no difference and its supply was intact. Now the first thing to suspect with a faulty Panasonic set, once the obvious items have been ruled

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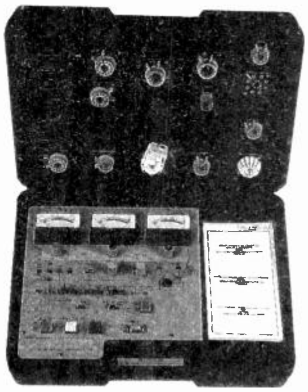

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out, is a defective 10nF ceramic capacitor. I looked at the circuit diagram and the first one I came across was C403, which is connected to pin 2 of the TDA2579 timebase generator chip. A check showed that it read just over 100Ω in circuit. When a new one had been fitted we had full field scanning. If I had a pound for every 10nF ceramic capacitor I've replaced I'b be laughing. **S.C.**

Philips 2A Chassis

This set ticked quite noticeably in standby. Everything else was perfect, but the ticking wouldn't go. I was convinced that the cause of the trouble was in the power supply, and after a long and finally rewarding search the culprit turned out to be C2690. It's a 1μF, 100V non-polarised capacitor that's connected between the earthy side of the chopper driver transistors and the non-isolated chassis. **S.C.**

Mitsubishi CT21M1BM

The red LED was illuminated but apart from that the set wouldn't come on at all. I removed the back with some trepidation, being rather a novice when it comes to Mitsubishi sets. Fortunately the power supply looked to be reasonable and conventional. After checking the output voltages it seemed that the cause of the problem was absence of the 12V supply. This comes from a 12V regulator, and I soon found that there was an input to this device but no output. The standby control line acts on this regulator, and I thought I'd try my luck here.

This line leaves the power supply and goes directly to the POW pin of the microcontroller chip IC701. After probing around in this area with the meter I found that the set would kick up. Dry-joint time, it seemed. The legs of crystals are usually a favourite, whether it be a remote control unit, a Nicam panel or a microcontroller chip. Sure enough both legs of the 4MHz crystal CF701, which is connected to pins 28 and 29 of IC701, were dry-jointed. Resoldering them provided a speedy cure, thankfully. **S.C.**

Toshiba 2512DBT

The reported fault was of whistling Nicam reception. In fact Nicam reception was pretty dire, with crackling and popping in addition to a permanent high-pitched whistle. As expected, the f.m. sound was perfect. By chance I noticed that moving the scan coil flylead or the Nicam signal leads aggravated or alleviated the problem. It transpired that the line scan current was interfering with the digital data signal going to the Nicam panel. Redressing both sets of leads completely solved the problem. **S.C.**

Grundig CUC2410 Chassis

This set was dead: the power supply would try to start, but with little success. After a cold check on all relevant resistors and fitting a new TDA4600 chopper control chip we eventually traced the cause of the fault to C633 (100μF, 25V) which was open-circuit. **A.D.**

Matsui 2890/Saisho CM2880TX

There was field collapse, the white line being very bright indeed. Had this additional factor registered with us time wouldn't have been wasted looking for a fault in the field output stage. The cause of the fault was in the video output supply, where D406 was short-circuit and the series safety resistor R440 was open-circuit. **A.D.**

Hitachi G8Q Chassis

There was an intermittent start-up fault with this set. When cold it would sometimes come on only in standby. But if the mains switch was held the set would eventually come on correctly. The cause of the fault was traced to the start-up thermistor TH902. **A.D.**

Amstrad TVR2

Several of these sets have come in either dead or intermittently dead. In just about every case the cause has been that C1507 (1μF, 50V) was either leaky or open-circuit.

An exception came in the other day. Although the job ticket said that the set was dead it wasn't the 1μF capacitor. The cause of the problem was that the mains relay wasn't being energised because there was no 5V output from the power supply. In fact the fault had nothing to do with the TV side of the combination: a fuse in the VCR section had blown. **A.D.**

Supra STV1401R

This colour portable was dead. There was 350V at the input to the STR5412 regulator chip IC104 but no output at pins 2 and 4. Replacing this item restored normal operation. **G.F.**

Saisho CT142RX

There was an intermittent fault with this set. The picture would go very dark, with very prominent colour. It was as though the luminance delay line was open-circuit. Additional symptoms were a three-inch vertical band, predominantly red, and faint flyback lines.

We found that the tube base panel was very sensitive to being touched. The cause of the trouble was poor joints on three of the pins of the ribbon cable that goes to connector plug/socket CD803. **G.F.**

Hinari TVA1

After the initial start-up this set was very intermittent/temperamental about coming out of standby. Just about everything in the power supply seemed to be sensitive to heating/freezing, including the relay. The fault cleared when a new STR5412 chip was fitted. **G.F.**

Matsui CTV2055

There was an over-bright picture with flyback lines. When the first anode and brightness settings were reduced there was shading from the left-hand side of the screen. We found that the h.t. supply to the RGB output stages was low at only 113V instead of 190V. The reservoir capacitor C120 (4·7μF, 350V) was open-circuit. Incidentally this set is a Fidelity clone. **G.F.**

Bush 2020

This set suffered from an intermittent fault. There would sometimes be a blank screen, but on occasions this would have a thin red line across it, as if there was field collapse. The fault was so intermittent that it could take anything from minutes to weeks for it to recur. We found that touching the board almost anywhere when the set was warm would produce the fault, which was thus very difficult to localise. Eventually we found a bad joint on C307, which is partially hidden by a plastic support strut. **G.F.**

The Universal Transistor

Gene Turnbull

Even though conventional transistors have largely been ousted by integrated circuits there are more types – though fewer of each – in use than ever before. To reduce stock-holdings, by both manufacturers and the service industry, research is being carried out by a Korean company, Taegu Semiconductor Inc., on a single device to replace all those in current use.

The most promising prototype has been given the development number UR1, and the aim is that it should be a workable substitute for both npn and pnp transistors in applications ranging from switch-mode power supplies to s.h.f. front-ends, taking in timebase, audio and logic switching roles. The device currently being tested has two bases, one for pnp configuration and the second for npn operation. The unused base is connected to the collector for an hFE (gain) of 40 and to the emitter for an hFE of 200, thus covering the tolerance spread of most transistors. Other characteristics of the device are Vcbo 1,400V, Ic 5A and fr (typical) 14GHz.

Production transistors will be supplied with optional mounting kits, one of which adapts the device for surface mounting where this is required. Another one consists of a TO3 bracket, for use in place of BU208 and similar power transistors. A heatsink is required for high-power applications like these, but not for use in place of devices such as BC171s or BFQ33s. It has been calculated that high-power applications will account for less than half of the universal transistors used so, like the mounting kit, the heatsink will be marketed as an optional extra.

Price is of paramount importance with this type of product. If world sales reach the expected level, it's hoped that a trade price of £1·49 (UK equivalent) can be achieved. At this level Taegu Semiconductor expects to attract orders from all the major setmakers as well as service and repair shops in Europe, the Far East and America. A spokesman for the company claimed that the saving in stockholding, data books and equivalents lists would run to millions of dollars annually in the USA alone.

Taegu has several similar projects on hand in its research laboratories. One is a range of semiconductor-based replacement modules for thermionic valves, using high-voltage power f.e.t. technology. Each package will be similar in shape and size to the valve it replaces, with identical plug-in base connections. KT66 and 6V6G types are expected to find a large market amongst valve amplifier enthusiasts, who will be able to get the "valve-sound" characteristic they like without the risk of breakage or the need to pay for cathode heating power in an increasingly energy-conscious world. Other advantages of solid-valve technology are greater reliability, lower price and ready availability from Korea. Many conventional valve types are scarce and difficult to obtain now. The EF86, a low-noise audio preamplifier, is a typical example. Its solid-state equivalent, the SEF86, will use spin-off technology from the UR1 universal replacement transistor described above.

Also under development, but not yet available even in prototype form, is a universal integrated circuit. For economic and logistic reasons, it's unlikely that this will be designed as a replacement for all i.c.s – it's too difficult to price a chip that can act as either a simple quad-inverter or a VCR system-control microcomputer. If and when the device becomes available, it's most likely to be in the form of a 4-bit programmable microcontroller with a minimum of 100 pins. Not all applications will require use of all these pins, nor all four bits, especially as the CPUs used in domestic electronic gear generally work with serial control bus lines like the I2C. Here the spare pins are used to configure the i.c. as required, for control of a washing machine, a VHS VCR, an edit controller or a remote control gun for example. One of the most difficult aspects of the design of an i.c. like this is the arrangement of the lead-out pins and assigning it a type number.

Apart from the i.c. device, for which no production date has been quoted, the products are expected to come on stream at the beginning of the second quarter of next year. Distribution in the UK and Europe is likely to be in the hands of a Scandinavian company, Luflirpa, that will set up a network of agents and wholesalers.

ANSWER TO TEST CASE 364

– SEE PAGE 426 –

Two questions were posed at the end of this month's puzzle. Their answers are no, it wouldn't have been a wise move to replace the troublesome Hitachi VT430 VCR's capstan motor, and yes a replacement motor would have cured the problem!

How can we reconcile these two answers? Well, no sooner had Real Technician got the capstan motor out of the machine and gone to the component storage racks to look for a replacement than coffee break time came around and Television Ted, who also knows a thing or three about video machines, joined RT for a breather. On hearing about the faulty motor Ted asked to see the body before it was committed to the dustbin. When he turned the rotor he found that it was as stiff as a rusty winch!

When the motor's rotor and stator were separated the upper bearing surfaces were found to be covered with a dry, black substance that looked like hardened grease. A fibre pencil and a rag soaked in solvent were used to remove it from the shaft, while a solvent-saturated cotton bud on a stick was used to clean it off the sleeve. The bottom bearing seemed to be unaffected but was similarly cleaned. Both bearings were given a tiny dose of lubricant.

When the serviced motor was refitted the machine's performance was transformed. All functions worked properly and the motor ran cool.

Why is it that some VCR makes and models suffer from this problem while others are completely free of it, though all of them have a barrier ring just above the upper bearing to prevent the ingress of dirt?

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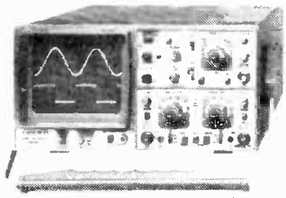

SPECIFICATION
- 2 Channels
- Bandwidth: DC - 20MHz
- Sens: Ch.1, Ch.2, 1mV/cm
- Timebase: 0.1s - 20ns/cm
- Triggering: DC - 40MHz
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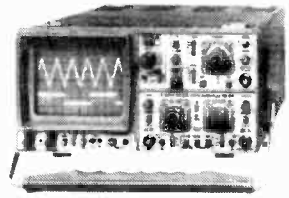
- Triggering: DC - 80MHz
- Active TV - Sync - Separator
- After delay trigger
- Sweep delay
- Delay line
- Trigger LED indicator
- Calibrator: 1KHz & 1MHz Sq. Wave
- Component tester



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- Triggering DC - 130MHz
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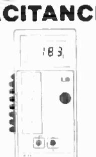

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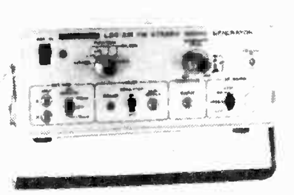

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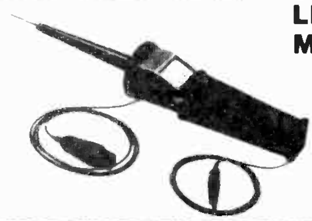

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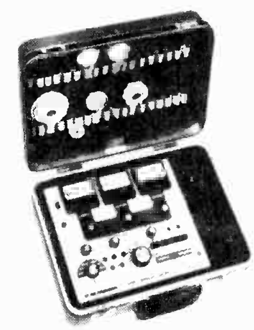

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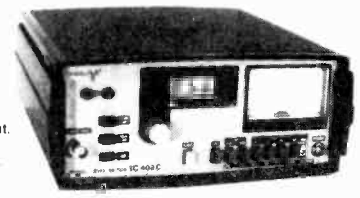

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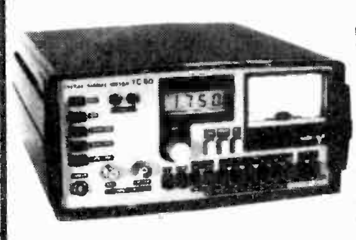

FEATURES
- Five bands:
  - Low VHF : 45-110MHz
  - High VHF : 110-300MHz
  - Hyper VHF : 300-470MHz
  - VHF : 470-862MHz
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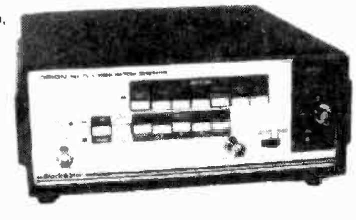

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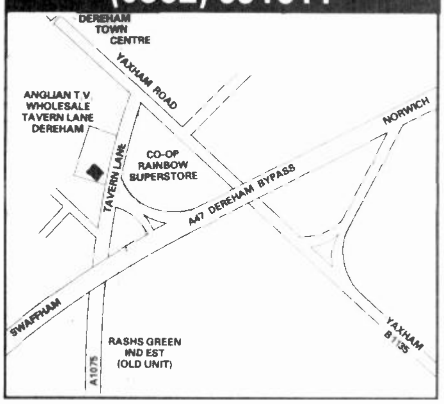

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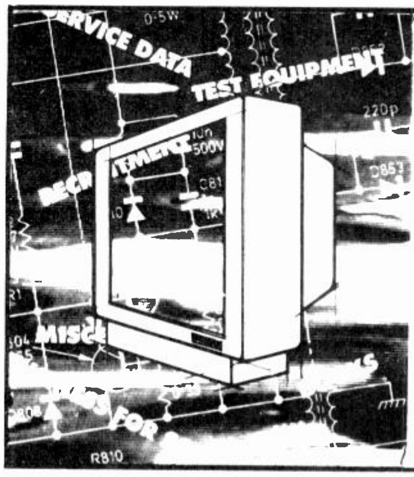

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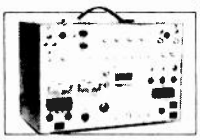

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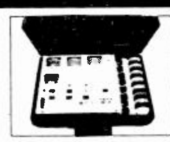

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v/cap. GEC–Decca type £7.00
7 Push button for CVC5 ITT £8.00
KT3 12 Push button unit £2.00
KT3 (Export) 12 P.B.u £2.00
6 Push button Unit Thorn £1.00
6 Push button GRC £6.00
6 Push button PYE 731 £6.00
Hearing aid unit £3.00
Rank Z718 4 P/B/Unit MECH £4.00
7 Button Unit GEC with Lamps £7.00
697 Push Button Unit £6.00
Z916B panel £5.00
T513AP panel £5.00

TT14 GEC TEX-DECODER
13 IC Panel with cable form £9.50

PHILIPS
Decoder SAA IC 5020-5030
5040B-5050
K40 Text Panel £8.00

ICC5 TUBE BASE ON PALEL £5.00
ICC5 DECODER PANEL £15.00

K35 Decoder £8.00
K35 Sound OP £4.00
Thick Film Daughter Kt3 33122-127-43891
£3.00

12 CH. K30 Tex Rec Front Panel with
I.C. £5.00

Plug in
K4 Focus Pot K40 £1.00

Fidelity Tube Base with transistor & focus
pot £1.50

TX10 Tube Base on Panel £3.00

PHILIPS HAND SET
K35-K4-K40, etc £10

Universal Tripler
with small focus pot. Green type £7.00

THORN CASSETTE HOUSING
PAS26805U £18.00

LITHIUM BATTERY
BR-2/3 Volts 20p

TUNER. SAT 2000 KHC £8

MIXED FUSES
1¼ AND 20mm and
Black Print Type
100 off £2

Voltage Regulators
+5V/UA78PO5SC 30p
–8V/79M08c 30p
+6V/78M06c 30p
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LM 340T 5 0 50p
+12V/LM 340T12 50p
+18V/MC78M18 20p
+24V/78M24 30p
MC 7724cp 40p
MC 7824 40p

Power Supply for
Sinclair Spectrum +2 £5.00

Bush Thyristor RCA 76122 £1.00
Transformer 240v/20v-500Ma 75p
Chassis type Transformer
240v/12 Volts 500m/a 75p
CVC 20 tube base £2.00
Tube Base Rank & G11 £1.20

BRIDGES
KBL 005 30p
KBL 02 30p
KBP 04 30p
W02 15p
W004 15p
W005 20p
800V Bridges 2½ Amp 30p

K30 Drawer Ass with pots cable forme
£1.00

TX10 Drawer Ass £3.00

Modulator for Ferguson Sat Receiver
5.5Meg or 6Meg £1.75

Radio Telescopic Aerial £1.00

100 Coax Plugs EACH 14p

De-solder pump + 2 nozzles Philips
£4.00

Flat Red LED and Green 5p

K30 Thermistor 232266298009 75p

De-solder Pump £2.50

Gas Soldering Iron £12.00

Hill Meter Leads. S/Rubber and
Probes £4.00

85-4538-3 Tatung GEC 8 Button Unit Print
Type 1990 to 1992 £5.00

Philips Handset IC £3.00
SAA3010P £3.00
MAB8461/WO63 £3.00

MAB 8420P-C031 £3.00
MAB 8400B-6 £3.00
MAB 8440P-D070 £3.00
MAB 8440P-D033 £3.00
MAB 8440P-D056 £3.00
MAB 8441P-T001 £3.00
MAB 8441P-T132 £2.00

M58484P £2.00

FERGUSON ICs
Ferg-TX982 £3.00
TMP47C 634N 2685 £3.00
ST6391B1/B2 ICC7 £4.00

CMC 301 front panel £5.00
CMC 303 front panel £5.00

International Rectifier EHT Diodes G770/HV34 6KV
6A/600V Stud Diodes 20p
6A/1000V Stud Diodes 20p

3 for 8p
BTW 92/800R £3.00
24A473 PNP C/P 10p

CMC 302 Panel with TC mains switch
etc £5.00

Turntable Satelite Modulator £1
Sound 5.5MHz MPM 1000T £1
Sound 6.0MHz MPM 1040 £1

Safe Block £5.00

FEROX
RF Filter Clamp for CoAx Cable Cost
£2.50
(25p each)

Ferguson TX85 £2.00
TX86 £2.00
Switch Mod Transformer £2.00
TX98 £2.00

ICC5 Ferguson Switch Mod Trans
3112-338-32642 £4.00

ICC5 L.O.P.T.
DST 88B243
DST 85B243 £10.00 each
Thorn Mixed £10.00

Ferguson Hand Set
ICC5 Mod £8.00
IK2000 £8.00

KT3/K30 T/Text £12.50
KT3/K30 Full remote £15.00
Pye & Philips handset KT3-K30 chassis
No RC5150-RC5176-RC5071-RC5177
Special Price £13.00
RC4001 KT3 and Teletex £14.00
TX10 Hand Set Text £12.50
TX9 with Text £12.50
TX9 & TX10 button print £2.00
TX10 Focus Pots £5.50

Mains Stand By Switch with Coil £1.00

PHILIPS
UNIVERSAL HAND SET £12.00 RC5
KT3 – K45 – £10.00

We have all parts for Philips Handsets

RC5353 £15.00
RC5300 £12.00
Philips RC5 £10.00

TEXT-TYPE
Replace Hand Set for
Philips KT3-K30. K4 etc £12.50

THORN HAND SETS
9000 – 9600 – TX9 – TX10 – TX100
Text and Non-Text £10.00

PHILIPS
RC5171 (HAND SET) £12.00

K35-K4 HAND SET
Repaired for £5.00

SANYO
MAGMTRON
Type 2M218H £10

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Condenser
1.5 MFD 2KW £3

10 Panels Ferguson
Mixed from TX9 to ICC5 £20

TV Aerial Ring Type 40p

TX100 Remote Hand Sets £6

Philips Video Remote Hand Set
Works most sets. No L.C.D. Display £6

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RF-IF-Module 5829 02 58 £6

SEL-ITT HF-Module 2 UK 5828-04-10 £6

01 M4- 412-001-RU1 £3
8 Way Pre sets for TX10-TX100

01 V6-251-002 Text Panel ICC5
Ferguson £10

Sharp Tuner and IF 1810587 PAL1 UK £3

Tuner IF UE30-BO 3 Amstrad £3

GRUNDIG TRIPLER
BG-2032-642-3002
£5

TOSHIBA REMOTE CT9123
£4

TV GAMES COMBINER SWITCH
£1

AMSTRAD SANKYO CAPSTAN MOTOR 6,000
£3

AMSTRAD LOADING MOTOR 6,000
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HAND SETS FOR 6000 SERIES AMSTRAD FOREIGN ORIGON
£4 WITH LED

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£3

TOSHIBA T/V TUNER. IF ENV 57836 G2F
£3

PHILIPS K35 ETC 12 WAY SWITCH WITH KNOBS
50p

60.40 SOLDER 500G
£3.75

AMSTRAD 4.600 FOREIGN ORIGON HAND SET
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AMSTRAD VIDEO FRONTS WITH FLAP LONG CHASSIS ALL MODELS MADE IN 1991 TO 1992 AND DECCA PRO LINE
£4

AMSTRAD – LONG CHASSIS AND SHORT CHASSIS POWER SUPPLY
£4
MODELS 1991 TO 1992

DOUBLE DECKER SWITCH MODE
£8
POWER SUPPLY

DOUBLE DECKER CHASSIS. ALL PANELS
£5 each panel

AMSTRAD LONG CHASSIS DISPLAY PANEL 1992 TO 1993
£4

AMSTRAD TUNER UE33-B01 £3
IF £2

PHILIPS INFRA RED RECEIVER IN-CAN 1990
50p