THE LEADING UK CONSUMER ELECTRONICS TECHNOLOGY MAGAZINE

SERVICING. VIDEO. SATELLITE. DEVELOPMENTS

**DECEMBER 1995 £2.35** 

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## Servicing the Philips G110 chassis

Digital camcorder format

Luma signal processing in VCRs

Repairing MTI LNBs

Fault reports

TVs, VCRs, satellite and camcorders

Confessions of a TLO

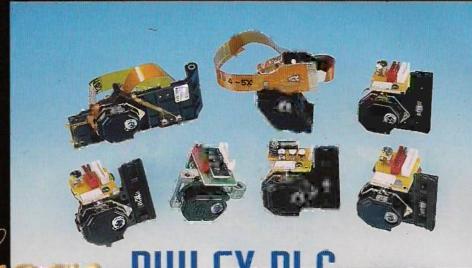






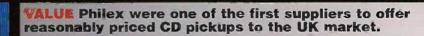






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# TELEVISION

**DECEMBER 1995** 

On sale November 15th

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#### The January issue will be published on December 20th

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8C159 BC160 BC171	8p 30p 10p	BD534 BD535	36p 38p	BU208 BU208A	70p 75p	OC45 OC200	50p 180p	2N3707 2N3710	9p 12p	7924 78L05 78L08	30p	BR351 35V/100V	185p	8283 8284	400p 440p	BA527 BA532	95p 100p	LA1210 LA1222	140p 80p
BC172 BC177 BC178	10p 14p	BD536 BD537 BD538	38p 40p 40p 50p	8U208A 8U208D BU209	130p 90p	R20088 R2010B S2000A3	100p 100p 175p	2N3711 2N3771 2N3772	12p 85p 90p	78L12 78L15	24p 24p 24p	88352 35V/200V 8R354	200p 220p	8287 8288 8748	260p 650p 700p	BA534 BA536 BA546	220p 150p 160p	LA1230 LA1364 LA1365	130p 200p 120p
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BD184 BD187 BD201	60p 30p 33p	BF617 BF760 BF763	30p 40p	BUX84 BUX85 BUX86	180p 50p 50p 30p	ZTX108 ZTX109 ZTX212	11p 12p 20p	8 PIN 14PIN 16PIN	5p 6p 7p	AN203	210p	75195 2114 2532	95p 185p 150p 200p	AN6332 AN6341 AN6344	320p 200p 440p	HA1388 HA1389 HA1392	320p 210p 120p	LC7132 LC7137 LF347	260p 400p 450p 110p
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#### LINEAR ICs / JAPANESE TRANSISTORS

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Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price
LMETRO LMETRO LMETRO	50p 45p	STK443	680p 700p	STK5422 STK5431	550o	STR30119	400p	TA7784 TA8132AN	250p 200p	TDA1574 TDA1576	125p 170p	TDA3586 TDA3590	750p 300p	TDA8170 TDA8172	170p 250p	UPC1158I UPC1178I	1 250p	2SA937 2SA939	20p 140p 50p 60p
LMDens LMDens	40p 18p	STK457 STK459 STK460	470p 560p 660p	STK5434 STK5436 STK5441	500p	STR30123 STR30125 STR30130	5500	TA8205 TA8210 TA8215	250p 300p 300p	TDA1578A TDA1579 TDA1596	210p 200p 200p	TDA3591 TDA3592 TDA3640	360p 350p 350p	TDA8173 TDA8174 TDA8175	280p 300p	UPC11856	200p	2SA940 2SA942	50p 60p
LME47 LMT886 LMT850	55p 300p	STK461 STK463	620p	STK5451 STK5461	390p 500p	STR40090 STR41090	350p	TA8216H	300p 375p 250p	TDA1598 TDA1600	250p 275p	TDA3651 TDA3652	200p 500p	TDA8178 TDA8185	300p 400p 300p	UPC1186 UPC1187 UPC11886	80p 150p 1 350p	2\$A949 2\$A950 2\$A952	70p 18p
MARKET	290p 40p	STK465 STK501	720p 550p	STK5462 STK5464	300p	STR44115 STR45111	550p	TA8691N TA8718N	250p 550p 550p	TDA1670A	230p	TDA3652T TDA3653	X10 800p 150p	TDAS190 TDAS191	200p 425p	UPC1197 UPC1198	140p	2SA953 2SA954	50p 60p 75p
LM3939 LM2514 LM3915	160p 160p 160p	STK561 STK563 STK583	450p 415p 500p	STK5466 STK5467 STK5468	400p	STR50020 STR50092 STR50103	2 550m	TAA550 TBA120S TBA396	25p 40p 70p	TDA1701 TDA1771 TDA1870A	300p 250p	TDA3654 TDA3710 TDA3720	90p 300p 175p	TDA8192 TDA8196 TDA82148	275p	UPC1222 UPC1225F	130p 1 220p	2SA958 2SA963	60p 120p
LM3916	270p 200p	STX760 STX770	800p 400p	STK5471	330p 480p	STR50113 STR50115	500p	TBA520 TBA530	120p	TDA1872A TDA1904	200p 275p 80p	TDA3724 TDA3725	500p 500p	TDA8215E TDA8303	3 300p 350p	UPC1230 UPC1238 UPC1270F	200p 120p 250p	2SA965 2SA966 2SA968	40p 35p
M491881 M45481 M50115P	500p 700p 320p	STK772B STK780 STK1039	480p 575p 480p	STK5476 STK5478 STK5479	380p	STR51041 STR50213 STR53041	500p	TBA540 TBA560 TBA800	90p 90p	TDA1905 TDA1908A	80p 90p	TDA3730 TDA3740	400p 480p	TDA8304 TDA8305	500p	UPC1274\ UPC1277	250p	2SA970 2SA979	35p 55p 25p 35p
M50117P M50119P	500p 525p	STK1040 STK1049	640p 700p	STK5481 STK5482	520p 285p	STR54041 STR55041	350p 500p	TBA810A9 TBA820	40p 55p	TDA1910 TDA1940 TDA1941	225p 180p 300p	TDA3750 TDA3760 JDA3771	400p 350p 460p	TDA8340 TDA8341 TDA8380	200p 250p 200p	UPC1278 UPC1288\ UPC1298\	240p 230p	2SA984 2SA985 2SA988	25p 60p 25p
M50784 M50786	300p 500p	STK1050 STK1060	650p 700p 850p	STK5483 STK5486	440p 450p	STR56041 STR58041	550p 325p	TBA920M	35p 100p	TDA1941 TDA1950 TDA2002	175p 50p	TDA3791 TDA3800	300p 350p	TDA8390A TDA8405	650p 550p	UPC1318 UPC1335V	300p	2SA992 2SA993	30p 50p
M50790 M51161 M51381P	600p 300p 200p	STK1070 STK1080 STK2025	850p 840p 620p	STK5488 STK5490 STK5632	480p 450p 450p	STR59G41 STR60001 STR61001	475p 525p 550p	TBA950 TBA990 TC5020	100p 60p 200p	TDA2003 TDA2004 TDA2005	65p 150p 150p	TDA3803/ TDA3810 TDA3825	200p 200p 225p	TDA8415 TDA8417 TDA8421	650p 550p	UPC1350 UPC1363	115p 190p	2SA999 2SA1006	30p 90p
M51387P M51544	800p 150p	STK2028 STK2029	500p 480p	STK5725 STK5730	450p 450p	STR80145 STR81145	550p 600p	TC5081AP TC9106	80p 500p	TDA2006 TDA2007	70p 120p	TDA3840 TDA3843	300p 200p	TDA8245 TDA8432	500p 500p 550p	UPC13630 UPC13640 UPC1365	350p 250p	2SA1008 2SA1009 2SA1010	125p 200p 225p
M51848 M54623P M54563P	150p 200p 200p	STK2038 STK2048 STK2110	700p 950p 550p	STK6316 STK6324 STK6431		STRD1206	600o	TC9125BP	410p 750p	TDA2008 TDA2009	100p 160p	TDA3845 TDA3856	325p 400p	TDA8433 TDA8440	600p 300p	UPC13700 UPC1373	300p	2SA1011 2SA1012	80p 85p
M58484 M51516	500p 260p	STK2125 STK2129	580p 610p	STK6722 STK6732	725p 1000p	STRD1706 STRD1806 STRD1816	400p	TC9142 TC9143 TC9145	320p 300p 150p	TDA2010 TDA2020 TDA2030	150p 120p 80p	TDA3857 TDA3950 TDA4050	350p 225p 160p	TDA8442 TDA8443 TDA8451	200p 350p 400p	UPC13770 UPC1378 UPC1382	200p 180p 110p	25A1013 25A1015 25A1016	100p 15p 30p
M51518 M83712	200p 140p 130p	STK2139 STK2155	675p 900p	STK6822 STK6922	900p 500p	STRD3035 STRD4412	300p 500p	TC9148 TC149	200p 225p	TDA2040 TDA2048	140p 600p	TDA4092 TDA4100	350p 225p	TDA8452 TDA8453	200p 350p	UPC1384 UPC13870	425p	2SA1018 2SA1020	100p 30p
ME3713 ME3714 ME3715	270p 250p	STK2230 STK2240 STK2250	470p 740p 650p	STK6932 STK6962 STK6972	525p 275p 490p	STRD4512 TA7054 TA7061	190p 190p 115p	TC9150 TC9152 TC9153	425p 425p 300p	TDA2054M TDA2107 TDA2148	110p 250p 350p	TDA4190 TDA4200	145p 180p 360p	TDA8490 TDA8702 TDA8703	350p 275p 500p	UPC1394 UPC1397	120p 350p	2SA1021 2SA1023	35p 60p
MB3722 MB3730	280p 160p	STK3041 STK3042	650p 370p 375p	STK6981 STK6982	8 600p 600p	TA7066 TA7089	120p 300p	TC9156 TC9163	300p 375p	TDA2151 TDA2170	375p 260p	TDA4280 TDA4282	320p 360p	TDA8708 TDA8732	900p 400p	UPC14030 UPC14200 UPC14210	A 450p	2SA1026 2SA1029 2SA1036	90p 60p 60p
M83731 M83756 M83759	220p 160p 200p	STK3044 STK3062 STK3082	500p 500p 550p	STK7216 STK7217	420p 400p	TA7119 TA7120	150p 55p 60p	TC9164 TC9172P	400p 300p	TDA2220 TDA2270	200p 250p	TDA4290	200p 175p	TDA9045 TDA9080	400p 550p	UPC1423C	A 550p	2SA1037 2SA1038	50p 40p 25p
MB8719 MC1455	360p 45p	STK31021 STK31521	530p	STK7225 STK7226 STK7251	500p 600p 500p	TA7137 TA7140 TA7157	100p	TCA9940 TCEP100 TD62308AI	100p 100p 200p	TDA2320 TDA2501 TDA2503	80p 400p 200p	TDA4400 TDA4420 TDA4421 TDA4426	120p 300p 170p	TDA9403 TDA9503 TDA9513	180p 150p 300p	UPC1488H UPC1505C UPC1514C	150p 400p A 200p	2SA1048 2SA1051 2SA1060	25p 300p 120p
MCT496 MC3401	65p 45p	STK3156 STK4017	500p	STK7308 STK7309	500p 350p 400p	TA7193 TA7200	320p 200p	TD62382 TD62506	200p 200p	TDA2504 TDA2505	200p 300p 500p	TDA4427 TDA4431	200p 150p	TEA1002 TEA1007	650p 120p	UPC1515C UPC1520C	A 250p A 250p	2SA1069 2SA1076	150p 230p
NE556 NE558	20p 40p 80p	STK4019 STK4021 STK4024	380p	STK7310 STK7348 STK7356	470p 400p 425p	TA7205 TA7207 TA7208	110p 150p 125p	TD6304AP TD6306P	250p 300p 350p	TDA2506 TDA2510 TDA2514A	450p	TDA4437 TDA4439 TDA4440	300p 220p 180p	TEA1009	100p 280p	UPC1536C ZN423 ZN424	550p 100p	2SA1077 2SA1081	300p 80p
NE565 NE567	110p 115p	STK4025 STK4026	530p 480p	STK7358 STK7402	440p 580p	TA7214 TA7217	220o	TD6350P TD6359P TDA1001	200p	TDA2515 TDA2530	500p 450p 450p	TDA4442 TDA4443	240p 250p 220p	TEA1019 TEA1024 TEA1045	130p 150p 300p	ZN425 ZN426	100p 320p 260p	2SA1082 2SA1084 2SA1085	80p 100p 75n
NE571 NE592 NE5532P	290p 85p 140p	STK4028 STK40321 STK4036	550p 510p 470p	STK7404 STK7406 STK7408	400p 650p	TA7220 TA7222 TA7223	90p	TDA1001 TDA1002 TDA1003	200p 200p	TDA2532 TDA2540 TDA2541	120p 85p	TDA4445 TDA4450	220p 225p 250p	TEA1060 TEA1067 TEA1080P	225p 150p	ZN427 ZN429	560p 215p	2SA1091 2SA1094	75p 100p 190p
SAA1008	300p 450p	STK4038 STK4040H	680p 650p	STK7410 STK7554	675p 900p 600p 650p	TA7226 TA7226	300p	TDA1005A TDA1010A	150p 175p 80p	TDA2542 TDA2543	120p 110p 210p	TDA4453 TDA4480	2750 1	TEA1087	170p 40p 425p	ZN459 ZN1040 ZNA134H	190p 640p 2150p	2SA1095 2SA1096 2SA1102	300p 80p 130p
SAA1010 SAA1024 SAA1025	400p 250p 250p	\$TK404211 \$TK4044 \$TK4046	800p 800p 950p	STK7561 STK7562	1000p	TA7227 TA7230	170p	TDA1011 TDA1012	75p 120p	TDA2545 TDA2546A	120p 200p	TDA4482 TDA4500	300p	TEA1101 TEA1330 TEA1511	86p 150p	JAPANES		2SA1103 2SA1104 2SA1105	130p 140p 250p
SAA1075 SAA1124	350p 200p	STK4048 STK4060	1280p 510p	STK7563 STK8050 STK8250	800p 750p 500p	TA7232 TA7233 TA7237	120p	TDA1013A TDA1015 TDA1016	110p 85p 140p	TDA2549 TDA2555 TDA2556	300p 175p 230p	TDA4501 TDA4502 TDA4503	400p 550p 300p	TEA2000 TEA2014A TEA2018A	275p 80p 200p	TRANSIS	UNS	2\$A1105 2\$A1106 2\$A1111	160p
SAA1250 SAA1251	280p 380p	STK4065 STK4101	650p 500p	STK8260 STKR280	1200p 1850p	TA7238 TA7240	400p	TDA1020 TDA1022	110p 330p	TDA2557 TDA2558	225p 500p	TDA4505 TDA4510	300p 270p	TEA2114 TEA2117	200p 450p	2SA490 2SA496	29p 45p 30p	2SA1112 2SA1115	90p 150p 30p
SAA1274 SAA1293 SAA3004	290p 550p 400p	STK4111 STK4112 STK4121	500p 500p	STK73410 STK73410 STK73605	1 500p	TA7241 TA7242 TA7243	190o	TDA1023 TDA1024 TDA1025	130p 150p	TDA2575A TDA2577A	100p	TDA4555 TDA4556 TDA4557	400p 370p	TEA5114A 11431	200p 45p	2\$A505 2\$A509 2\$A537	120p 35p	2SA1123 2SA1124	40p 60p
SAA3004 SAA5000 SAA5010	200p	STK4122 STK4131	480p 560p 600p	STR370 STR371	300p 400p	TA7245 TA7267	225p	TDA1028 TDA1029	320p 175p 200p	TDA2578A TDA2579A TDA2582	250p	TDA4560 TDA4600	450p 270p 140p	TL061 TL064 TL071	40p 80p 38p	2SA537 2SA544 2SA550	170p 650p 150p	2SA1127 2SA1133 2SA1141	50p 120p 200p
SAA5012 SAA5020 SAA5030	350p	STK413211 STK414111 STK4142	600p 420p 530p	STR380 STR381 STR383	390p	TA7269 TA7270	250p 170p	TDA1035 TDA1041E	160p 250p	TDA2590 TDA2593	170p	TDA460011 TDA4601	150m	TL074 TL083	80p 55p	2SA562 2SA571	30p	2SA1142 2SA1145	100p 40p
SAA5040A SAA5040B	280p	STK4151 STK4152	680p	STR384 STR440	410p 350p 700p	TA7271 TA7272 TA7273	260p	TDA1041P TDA1044 TDA1047	180p 110p 200p	TDA2594 TDA2595 TDA2600	200c	TDA4605 TDA4610 TDA4660	120p 220p 370p 370p	TL084 TMS1000-0 TMS1000NL	70p 41 400p	2SA603 2SA606 2SA608	100p 200p 15p	2SA1152 2SA1156 2SA1162	150p 90p 30p
SAA5050 SAA5231	850p 300p	STK4161 STK4162	650p 550p 900p	STR450 STR541	520p 600p	TA7274 TA7280	210p 190p	TDA1048 TDA1053	200p	TDA2611A	100p 300p	TDA4800 TDA4935	350p 300p 325p	TMS100-23 TMS1024	3 400p	2SA614 2SA634	150p 50p	2SA1169 2SA1170	500p 500p
SAA5243P SAB3013 SAB3035	200p	STK4171 STK417211 STK4181	680p	STR452 STR453 STR454	500p 500p 400p	TA7281 TA7282 TA7283	160p	TDA1054 TDA10598 TDA1060	40p	TDA2640 TDA2653A TDA2664	2250	TDA4940 TDA4950 TDA5330T	325p 120p	TMS1025 TMS3617N	350p S 350p	2SA636 2SA640	50p 60p	2\$A1176 2\$A1184	30p 120p
STA301A STA401A	200p 220p	STK4182H STK4191	750p 700p	STR455 STR456	500p 470p	TA7288 TA <b>7299</b>	220p 200p	TDA1062 TDA1072	1400	TDA2670	150p	TDA5600	300p 450p 250p	TMS37018 TMS3712 TMS3891	350p	2SA642 2SA673 2SA677	50p 15p 35p	25A1186 25A1198 25A1206	500p 40p 60p
STA403A STA405A STA431A	280p	STK4192 STK4231   STK4241	700p 700p 1050p	STR457 STR470 STR1096		TA7310 TA7312	120p	TDA1074 TDA1077	250p	TDA2690 TDA2730 TDA2760	200p 400p	TDA5700 TDA5708	200p 400p	TPU2732 TPU2735	1200p 900p	2SA677 2SA678 2SA683	28p 25p	2\$A1208 2\$A1209	70p 100p 120p
STA432A STA434A	220p 270p	STK4241V S <b>TK42</b> 72	1250p 500p 550p	STR1195 STR1229	350p	TA7313 TA7314 TA7315	175p	TDA1082 TDA1083 TDA1085	275p 95p 170p	TDA2780 TDA2791 TDA2795	2750	TDA5709 TDA5800 TDA5820	600p	U1118 U2118 U2548	250p 300p 150p	2\$A684 2\$A699 2\$A708	100p	2SA1210 2SA1215 2SA1216	120p 600p 550p
STA435A STA441C STA456C	270p	STK4273 STK4301 STK4311	500p	STR2005 STR2012	400n	TA7317P TA7324	120p 75p	TDA1087 TDA1092	60p	TDA2822M TDA2840	200p	TDA5850 TDA6200	175p 750p	U318M U321M	350n I	2SA711 2SA715 2SA719	280p 50p	2\$A1217 2\$A1220	100p 75p
STA471 STA901M	210p   280p	STK4332 STK4352	385p	STR2013 STR2015 STR2105	550p	TA7325 TA7328 TA7335	110p	TDA1097 TDA1151 TDA1154	40p	TDA3047 TDA3048 TDA3082	1300	TDA7000 TDA7010T TDA7050	120p	U329M U338M U420B	300p	2SA719 2SA720 2SA725	50p 20p	2SA1232 2SA1242	180p 80p
STK0025 STK0029	360p !	STK4362 STK4372	490o	STR3113 STR3115	225p	TA7336 TA7341	180p	TDA1170 TDA1180	85p 120p	TDA3083 TDA3190	200p	TDA7052 TDA7053	120p 200p	U427B U664B	70p	2\$A726 2\$A733	20p	2SA1244 2SA1246 2SA1249	120p 80p 100p
STX0039 STX0040 STX0049		STK4392 STK4432 STK4773	600p	STR3123 STR3125 STR3135	480p	TA7343 TA7357 TA7358	340p 7	DA1180A DA1190	190p	TDA3300B	480p	TDA7058 TDA7072	175p	U2401B U2829B	125p 130p	2SA747A 2SA748	425p 60p	2SA1261 2SA1262	100p 150p 110p
STX0050 STX0059	440p 620p	STK4793 STK4803	800p	STR3212 STR3214	275p 275p	TA7401 TA7607	250p 1	DA12009 DA1220 DA1235	3000	TDA3310 TDA3330 TDA3410	500p 1	TDA7077 TDA7211 TDA7220	150p	U4606B UC3842N UC3844	125p	2SA764 2SA769 2SA770	200p 80p 200p	2SA1263 2SA1264 2SA1265	280p 280p 200p
STK0060 STK0070 STK0080	1100p	STK4813 STK4833 STK4843	700p	STR3215 STR3315	275p	TA7608 TA7609	170p   7	DA1236 DA1251	240p 150p 150p	TDA3410 TDA3420 TDA3501	200p 1	TDA7222 TDA7230A	200p	ULN2002 ULN2003	70p 69p	2SA771 2SA777	90o	2SA1283 2SA1284 2SA1286	50p 60p
STK015	330p 3	STK4853 STK4863 STK4873	7300	STR4090A STR4142 STR4211	450p	TA7611 TA7612 TA7614	300p 1	DA1270 DA1327 DA1410	190p 200p	TDA3502 TDA3504 TDA3505	300p   1	TDA7233 TDA7240 TDA7241	175p	ULN2068 ULN2804 UPC20C	170p	2SA778 2SA781 2SA786	150n I	25A1290	60p 150p 450p
STK016 STK025	760p 3	STK4893	1000p	STR4211 STR4512 STR5015	400p 500p	TA7616 TA7621	300p 1	DA1412 DA1510	35p	TDA3506 TDA3507 TDA3510	260p 1	TDA7250 TDA7255	500p	UPC554 UPC555	130p 60p	2SA794 2SA798	30o   1	2SA1294 2SA1295 2SA1301	500o
STX050 STX077 STX078	520p S	STK4913 STK5314 STK5315	475p 3	STR5100 STR5214 STR5315	475p	TA7622 TA7628 TA7629	110p   1	DA1512 DA1514A DA1515A	450p	TDA3510 TDA3520 TDA3530	350p 1	TDA7256 TDA7272 TDA7273	170p I	UPC556H UPC571	80p 220p	25A814 25A817	60p 20p	2SA1302 2SA1303	280p 300p 400p
STK080 STK082	550p 5	STK5322 STK5324	500p 450p	STR5412 STR6020	350p 325p	TA7630 TA7632	200p T	DA1516Q DA1517	350o	TDA3540 TDA3541 TDA3560	200p 1 175p 1	TDA7274 TDA7275	60p ii 75p ii	UPC574 UPC575C2 UPC577	900	2SA836 2SA839 2SA844	110p	2SA1304 2SA1306 2SA1307	110p 110p 100p
STK084 STK085 STK086	900p   5	STK5325 STK5331 STK5332	370p	STR9005 STR9012 STR10006	400p 450p	TA7640 TA7641	90p T	DA1519 DA1519A	200p	TDA3561	260p 1	TDA7284 TDA7350	190p   650p   0	UPC592 UPC595	95p 190p	2SA872 2SA872A	25p 50p	2SA1309 2SA1315	50p 100p
STX0100 STX01000	900p S	STK5333 STK5335	1000p   3	STR11006 STR12006	400p	TA7658 TA7668 TA7680AP	100p T	DA1520 DA1521 DA1522	250p	TDA3581A TDA3562 TDA3562TFI	260p T	TDA7359 TDA7360 TDA7770	700p t	UPC596 UPC1001 UPC1018	190p 220p 170p	2SA886 2SA899 2SA907	45p	2SA1317 2SA1318 2SA1321	30p 20p 80p
STK420 STK430 STK433	400p 5	TK5337 TK5338 TK5339	296o 1	STR13006 STR15006 STR16006	500p	TA7688 TA7698	150p T 450p T	DA1524 DA1540	200p	TDA3563 TDA3564 TDA3565	350p T	DA8114 DA8115	225p   0	UPC1020 UPC1023	200p	2SA909 2SA913	500p	2SA1329 2SA1346	200p 20p
STK435	430p   5	TK5342 TK5361	245p 5	STR20005 STR20012	450p	TA7699 TA7705 TA7750	300p 7 200p T	DA1541 DA1542 DA1543	250p 17	TDA3566	280n T	DA8140 DA8143 DA8145	160p l	UPC1025 UPC1026 UPC1028	95p	2SA916 2SA921 2SA933	30p	2SA1352 2SA1353 2SA1356	100p
STK437 STK439	460p   5	TK5372 TK5421	260m 15	STR20015 STR30110	450p 1	TA7757 TA7769	200p   T	DA1571 DA1572	300p 1 175p 1	TDA3567 TDA3570 TDA3580	375p T	DA8153 DA8160	250p t	JPC1031H JPC1032	150p	2SA934 2SA935	30p   2	2SA1358 2SA1370	100p 130p 100p
	100	1	-	100	-		STATE OF THE PARTY IN	THE WAY	and the	SHAKET !	STATE SALES	BONES OF	NAME OF TAXABLE						

					JA	PA	IN	ESI	ET	RA	NS	SIS	TO	RS					
Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price
2SA1371 2SA1380 2SA1381	100p 75p 100p	2SC1008 2SC1010 2SC1012	20p 225p 75o	2SC1730 2SC1735 2SC1739	10p 70p	2SC2270 2SC2271	60p 30p	2SC2750 2SC2751	300p 270p	2SC3277 2SC3280 2SC3281	280p 200p	2SC3893 2SC3895 2SC3897	225p 400p 400p	2SD836A 2SD837 2SD838	60p 55p	2SD1279 2SD1288	600p 175p	2SD1815 2SD1825	100p 60p
2SA1382 2SA1385	120p 180p	2SC1013 2SC1014	170p 140p	2SC1740 2SC1741	800p 10p 35p	2SC2274 2SC2275 2SC2278	15p 50p 70p	2SC2752 2SC2767 2SC2769	140p 300p 400p	2SC3284 2SC3293	200p 600p 85p	2SC3907 2SC3927	250p 250p	2SD841 2SD844	300p 110p 200p	2SD1289 2SD1291 2SD1292	250p 400p 60p	2SD1843 2SD1846 2SD1849	100p 350p 325p
2\$A1386 2\$A1423 2\$A1489	400p 30p 300p	2SC1030 2SC1047 2SC1050	150p 20p 280p	2SC1755 2SC1756 2SC1758	90p 35p 30p	2SC2290 2SC2291	1800p 40p	2SC2773 2SC2774	700p 500p	25C3298 2SC3299	50p 120p	2SC3950 2SC3953	120p 60p	2SD845 2SD850	250p 170p	2SD1297 2SD1302	300p 20p	2SD1850 2SD1858	325p 40p
2SA1491 2SA1493	300p 500p	2SC1060 2SC1061	70p 85p	2SC1775 2SC1781	10p 20p	2SC2295 2SC2298 2SC2307	60p 35p 300p	2SC2785 2SC2786 2SC2787	80p 20p 10p	2SC3300 2SC3303 2SC3306	400p 100p 130p	2SC3973 2SC3987 2SC3996	210p 220p 1200p	2\$D856 2\$D858 2\$D863	48p 250p 23p	2SD1308 2SD1309 2SD1310	80p 140p 140p	2SD1877 2SD1878 2SD1879	250p 230p 275p
2SA1516 2SA1535 2SB324	280p 175p 40p	2SC1070 2SC1096 2SC1098	65p 40p 120p	2SC1789 2SC1809 2SC1810	100p 40p 250p	2SC2308 2SC2312	10p 300p	2SC2791 2SC2792	500p 220p	2SC3307 2SC3309	600p 150p	2SC4006 2SC4020	100p 280p	2SD864 2SD866	200p 120p	2SD1313 2SD1326	1000p 200p	2SD1884 2SD1886	300p 450p
2SB546 2SB560	45p 25p	2SC1106 2SC1114	180p 415p	2SC1815 2SC1819	10p 70p	2SC2314 2SC2316 2SC2320	70p 150p 10p	2SC2793 2SC2808 2SC2810	700p 40p 360p	2SC3316 2SC3317 2SC3323	280p 350p 480p	2SC4023 2SC4056 2SC4106	325p 350p 200p	2SD866A 2SD868 2SD870	140p 260p 190p	2SD1328 2SD1347 2SD1348	60p 70p 65p	2SD1887 2SD1910 2SD1911	450p 280p 300p
2S8561 2S8562 2S8566	50p 25p 90p	2SC1115 2SC1116 2SC1124	280p 290p 270p	2SC1826 2SC1827 2SC1829	60p 60p 500p	2SC2324 2SC2329	120p 480p	2SC2812 2SC2814	40p 40p	2SC3327 2SC3331	60p 25p	2SC4123 2SC4124	450p 250p	2SD871 2SD879	300p 60p	2SD1350 2SD1376	150p 125p	2SD1913 2SD1929	50p 60p
2\$8596 2\$8598 2\$8598	55p 50p 30p	2SC1161 2SC1162 2SC1164	110p 30p 600p	2SC1833 2SC1834 2SC1844	40p 50p 50p	2SC2331 2SC2333 2SC2334	50p 200p 80p	2SC2824 2SC2825 2SC2826	75p 900p 200p	2SC3333 2SC3345 2SC3352	120p 100p 200p	2SC4169 2SC4236 2SC4237	60p 550p 650p	2SD880 2SD882 2SD892A	40p 25p 100p	2SD1379 2SD1380 2SD1384	100p 100p 50p	2SD1939 2SD1941 2SD1959	75p 500p 280p
2SB600 2SB646	500p 40p	2SC1165 2SC1166	750p 100p	2SC1845 2SC1846	15p 35p	2SC2335 2SC2344	75p 150p	2SC2827 2SC2832	200p 300p	2SC3353 2SC3355	260p 50p	2SC4242 2SC4301	170p 550p	2SD894 2SD895	35p 200p	2SD1390 2SD1391	350p 250p	2SD1961 2SD1978	50p 50p
2\$8647 2\$8648 2\$8649	20p 45p 35p	2\$C1170 2\$C1172 2\$C1173	180p 150p 40p	2SC1847 2SC1855 2SC1856	45p 85p 25p	2SC2347 2SC2363 2SC2360	60p 120p 120p	2SC2834 2SC2837 2SC2839	400p 250p 40p	2SC3356 2SC3358 2SC3361	120p 50p 50p	2SC4742 2SC4769 2SD198	275p 300p 140p	2SD896 2SD900 2SD905	200p 400p 450p	2SD1392 2SD1395 2SD1396	150p 150p 120p	2SD1984 2SD2012 2SD2125	450p 50p 225p
2S8688 2S8703	90p 90p	2SC1195 2SC1212	210p 35p	2SC1865 2SC1870	700p 700p	2SC2361 2SC2362	150p 50p	2SC2853 2SC2877	70p 120p	2SC3376 2SC3377	300p <b>50</b> p	2SD199 2SD200	195p 180p	2SD916 2SD917	130p 300p	2SD1397 2SD1398	120p 120p	2SD2333 2SJ48	300p 425p
2S8705 2S8707 2S8716	200p 200p 20p	2SC1213 2SC1214 2SC1215	15p 15p 25p	2SC1875 2SC1881 2SC1890	70p 15p	2SC2365 2SC2369 2SC2371	280p 100p 25p	25C2878 25C2879 25C2883	20p 3200p 60p	2SC3378 2SC3383 2SC3387	120p 80p 550p	2SD201 2SD257 2SD313	260p 195p 25p	2SD921 2SD923 2SD946	320p 360p 120p	2SD1399 2SD1400 2SD1402	300p 280p 150p	2SJ49 2SJ50 2SJ56	425p 425p 700p
2S8718 2S8727 2S8754	60p <b>200</b> p	2SC1216 2SC1222	200p 15p	2SC1904 2SC1906	125p 15p	2SC2373 2SC2383	210p 50p	2SC2898 2SC2899	200p 50p	2SC3393 2SC3399	80p 50p	2SD315 2SD325	75p 30p	2SD947 2SD950	100p 300p	2SD1406 2SD1407	<b>60p</b>	25J74 2SJ75	60p 280p
2SB755 2SB772	310p 25p	2SC1226 2SC1252 2SC1278	75p 850p 110p	2SC1907 2SC1909 2SC1913	20p 250p 90p	2\$C2389 2\$C2407 2\$C2408	45p 110p 120p	2SC2909 2SC2911 2SC2912	60p 80p 120p	2SC3400 2SC3401 2SC3402	35p 50p 40p	2SD330 2SD348 2SD357	65p 300p 40p	2SD951 2SD957A 2SD958	290p 520p 60p	2SD1408 2SD1409 2SD1412	125p 170p 75p	25J76 25J77 25J79	220p 350p 225p
2S8774 2SB775 2S8791	50p 100p 280p	2SC1279 2SC1306 2SC1308K	30p 90p 350p	2SC1921 2SC1923 2SC1929	15p 10p 180p	2SC2412K 2SC2440	50p 200p	2SC2921 2SC2922	650p 480p	2SC3409 2SC3412	400p 800p	2SD358 2SD371	40p 240p	2SD965 2SD970	35p 170p	2SD1413 2SD1415	50p 190p	2SJ103 2SJ108	75p 60p
2SB795 2SB825	60p 135p	2SC1312 2SC1317	40p 15p	2SC1940 2SC1941	110p 27p	2SC2458 2SC2459 2SC2470	10p 50p 65p	2SC2928 2SC2929 2SC2934	550p 280p 75p	2SC3416 2SC3417 2SC3419	30p 90p 120p	2SD380 2SD381 2SD388	650p 50p 150p	2SD973 2SD973A 2SD985	70p 120p	2SD1417 2SD1425 2SD1426	125p 260p 160p	2SJ115 2SJ117 2SJ119	525p 550p 700p
2SB861 2SB882 2SB886	110p 180p 90p	2SC1318 2SC1325 2SC1327	10p 400p 20p	2SC1942 2SC1944 2SC1945	350p 350p 350p	2SC2481 2SC2482	120p 20p	2SC2937 2SC2938	250p 235p	2SC3420 2SC3422	80p 75p	2SD389 2SD400	50p 14p	2SD986 2SD1012	120p 40p	2SD1427 2SD1428	180p 220p	2SJ161 2SJ162	650p 680p
2S8950 2S8951	180p 190p	2SC1328 2SC1342	15p 15p	2SC1946 2SC1947	1500p 450p	2SC2484 2SC2484 2SC2491	120p 185p 200p	2SC2939 2SC2944 2SC2958	400p 300p 50p	2SC3423 2SC3446 2SC3447	60p 150p 200p	2SD401 2SD402 2SD415	50p 120p 55p	2SD1020 2SD1021 2SD1022	40p 120p 400p	2SD1429 2SD1430 2SD1431	410p 280p 400p	2SK19 2SK40 2SK49	45p 50p 50p
2SB1009 2SB1077 2SB1109	110p 180p 55p	2SC1345 2SC1346 2SC1358	15p 100p 270p	2SC1957 2SC1959 2SC1967	70p 10p 1300p	2SC2495 2SC2498	1900p 50p	2SC2962 2SC2979	800p	2SC3456 2SC3457	200p 125p	2SD424 2SD426	350p 150p	2SD1024 2SD1030	130p 75p	2SD1432 2SD1433	400p 750p	2SK55 2SK68	100p 100p
2SC182 2SC372 2SC380	75p 25p 10p	25C1359 25C1360 25C1364	15p 70p	2SC1969 2SC1970 2SC1971	160p 100p	2SC2500 2SC2502	25p 200p	29C2987 29C2988	250p 150p	2SC3459 2SC3460 2SC3461	180p 180p 350p	2SD427 2SD438 2SD467	350p 35p 15o	2SD1031 2SD1046 2SD1047	70p 200p 180p	2SD1438 2SD1439 2SD1441	140p 165p 280p	2SK73 2SK106 2SK107	75p 40p 40p
2SC382 2SC388A	50p 60p	2SC1383 2SC1384	25p 25p 20p	2SC1972 2SC1973	400p 600p 150p	2SC2519 2SC2527 2SC2534	300p 150p	2\$C2995 2\$C2999 2\$C3001	60p 50p 1400p	2SC3486 2SC3468	225p 70p	2SD468 2SD471	15p 20p	2SD1047 2SD1051 2SD1060	130p 130p	2SD1445 2SD1450	200p 50p	2SK118 2SK125	50p 100p
2SC394 2SC403 2SC454	60p 25p 15p	2SC1393 2SC1394 2SC1398	20p 15p 55p	2SC1983 2SC1984 2SC1985	75p 150p 100p	2SC2535 2SC2538	300p 100p	2SC3012 2SC3019	300p 320p	2SC3481 2SC3482	300p 275p	2SD525 2SD526	50p 70p	2SD1062 2SD1063	150p 200p	2SD1451 2SD1452	260p 350p	25K133 25K134	650p 415p
2SC458 2SC460	10p 10p	2SC1400 2SC1403	50p 500p	2SC1986 2SC2001	100p 15p	2SC2540 2SC2542 2SC2545	1900p 300p 55p	2SC3025 2SC3026 2SC3030	500p 550p 300p	2SC3486 2SC3502 2SC3503	276p 100p 50p	2SD545 2SD549 2SD551	18p 120p 300p	2SD1064 2SD1065 2SD1069	250p 160p 150p	2SD1453 2SD1455 2SD1457	140p 250p 165p	2SK135 2SK147 2SK150	415p 160p 150p
2SC495 2SC496	15p 45p 25p	2SC1407 2SC1413 2SC1419	50p 150p 50p	2SC2002 2SC2003 2SC2004	15p 20p 20p	2SC2546 2SC2547	25p 65p	2SC3037 2SC3038	125p 125p	2SC3504 2SC3505	120p 240p	2SD555 2SD560	500p 50p	2SD1071 2SD1073	450p 350p	2SD1459 2SD1468	120p 60p	2SK163 2SK168	40p 40p
2SC497 2SC515	85p 100p	2SC1429 2SC1444	50p 275p	2SC2021 2SC2022	10p 110p	2SC2550 2SC2551 2SC2552	70p 60p	2SC3039 2SC3040 2SC3042	260p 300p	2SC3506 2SC3507 2SC3509	250p 650p 750p	2SD571 2SD575 2SD600	20p 530p 30p	2SD1088 2SD1094 2SD1110	150p 520p 225p	2SD1479 2SD1487 2SD1491	200p 225p 100p	2SK176 2SK192 2SK195	800p 45p 150p
2SC535 2SC536 2SC558	30p 20p 275p	2SC1446 2SC1447 2SC1448	55p 70p 100p	2SC2023 2SC2026 2SC2027	180p 30p 200p	2SC2553 2SC2555	200p 120p	2\$C3057 2\$C3058	150p 2500p	2SC3518 2SC3519	120p 250p	2SD601 2SD602	40p 60p	2SD1111 2SD1113	20p 225p	2SD1494 2SD1496	300p 350p	2SK197 2SK214	140p 170p
2SC563 2SC605 2SC619	120p 100p	2SC1449 2SC1450	120p 200p	2SC2028 2SC2029 2SC2037	75p 120p	2SC2562 2SC2563 2SC2564	200p 230p	2SC3068 2SC3070 2SC3074	50p 35p 200p	2SC3531 2SC3549 2SC3552	225p 200p 300p	2SD612 2SD613 2SD636	50p 70p 10p	2SD1128 2SD1133 2SD1135	200p 100p 75p	2SD1497-0 2SD1497-0 2SD1505	230p 12 350p 120p	2SK216 2SK218 2SK240	200p 400p 140p
2SC641 2SC644	100p 80p 10p	2SC1454 2SC1470 2SC1472	250p 120p 40p	2SC2053 2SC2055	50p 120p 150p	2SC2565 2SC2568	260p 120p	2SC3075 2SC3077	150p 120p	2SC3568 2SC3584	200p 200p	2SD637 2SD638	15p 15p	2SD1138 2SD1140	50p 40p	2SD1507 2SD1509	60p 100p	2SK312 2SK315	750p 70p
2SC647 2SC681 2SC683	300p 250p 35p	2SC1473 2SC1474 2SC1475	15p 45p 60p	2SC2058 2SC2060 2SC2061	20p 60p 75p	2SC2570 2SC2571 2SC2577	30p 350p 110p	2\$C3086 2\$C3089 2\$C3101	150p 130p 750p	2SC3595 2SC3605 2SC3606	220p 60p 100p	2SD639 2SD640 2SD655	20p 350p 18p	2SD1142 2SD1148 2SD1159	350p 175p 90o	2SD1511 2SD1519 2SD1521	100p 250p 70p	2SK320 2SK323 2SK386	120p 130p 600p
2SC708 2SC710	100p	2SC1505 2SC1507	80p 45p	2SC2068 2SC2071	60p 140p	2SC2578 2SC2579	170p	2SC3112 2SC3114	35p 40p	2SC3607 2SC3636	150p 280p	2SD661 2SD666	60p 25p	2SD1160 2SD1163A	150p 220p	2\$D1541 2\$D1548	350p 450p	2SK405 2SK413	450p 500p
2SC711 2SC730 2SC732	15p 350p 40p	2SC1509 2SC1514 2SC1515	35p 35p 60p	2SC2073 2SC2075 2SC2078	40p 60p 95p	2SC2580 2SC2581 2SC2588	175p 225p 600p	2SC3116 2SC3117 2SC3122	75p 120p 50p	2SC3659 2SC3668	400p 600p 120p	2SD667 2SD668 2SD669	20p 120p 35p	2SD1168 2SD1169	75p 270p 280p	2SD1554 2SD1555 2SD1556	170p 170p 400p	2SK415 2SK429 2SK511	500p 180p 450p
2SC733 2SC735 2SC738	15p 40p	2SC1520 2SC1541 2SC1545	45p 110p	2SC2085 2SC2088	100p 60p	2SC2590 2SC2591	40p 50p	2SC3148 2SC3149	185p 180p	2SC3675 2SC3678	100p 280p	2SD673 2SD676	350p 250p	2SD1173 2SD1185	350p 400p	2SD1564 2SD1565	100p 75p	2SK513 2SK531	325p 350p
2SC739 2SC761	15p 150p 110p	2SC1567 2SC1568	120p 40p 35p	2SC2092 2SC2094 2SC2097	100p 1200p 2300p	2SC2592 2SC2603 2SC2610	200p 10p 60p	2SC3150 2SC3151 2SC3152	125p 230p 130p	2SC3679 2SC3680 2SC3685	180p 380p 450p	2SD716 2SD717 2SD718	80p 180p 85p	2SD1186 2SD1187 2SD1189	400p 250p 55p	2SD1571 2SD1572 2SD1576	170p 100p 250p	2SK534 2SK537 2SK538	700p 900p
2SC762 2SC783 2SC790	150p 85p 50p	2SC1569 2SC1570 2SC1571	55p 40p 50p	2SC2099 2SC2118 2SC2120	2500p 1100p 10p	2SC2611 2SC2621	30p 70p	2SC3153 2SC3156	230p 350p	2SC3687 2SC3688	600p 550p	2SD722 2SD725	240p 270p	2SD1190 2SD1191	150p 120p	2SD1577 2SD1579	250p 120p	2SK539 2SK555	350p 1100p 400p
2SC792 2SC805	380p 225p	2SC1573 2SC1580	25p 600p	2SC2131 2SC2141	550p 60p	2SC2625 2SC2626 2SC2631	190p 600p 20p	2SC3157 2SC3158 2SC3159	200p 260p 200p	2SC3692 2SC3715 2SC3717	150p 480p 120p	2SD734 2SD741 2SD743	15p 120p 130p	2\$D1192 2\$D1196 2\$D1197	90p 150p 150p	2SD1589 2SD1590 2SD1591	50p 100p 310p	2SK556 2SK557	500p 400p
2SC828 2SC829 2SC839	20p 15p 20p	2SC1583 2SC1586 2SC1617	25p 540p 340p	2SC2153 2SC2166 2SC2168	40p 80p 120p	2SC2634 2SC2636	10p 40p	2SC3164 2SC3169	350p 160p	2SC3729 2SC3746	450p 100p	2SD756 2SD757	100p 120p	2SD1207 2SD1210	40p 280p	2SD1593 2SD1595	125p 160p	2SK566 2SK695 2SK719	475p 550p 300p
2SC870 2SC898	100p 275p	2SC1623 2SC1624	50p 60p	2SC2168 2SC2200	70p 250p	2SC2637 2SC2640 2SC2653	120p 1800p 100p	2SC3170 2SC3173 2SC3175	300p 180p 150p	2SC3747 2SC3752 2SC3781	120p 250p 150p	2SD758 2SD762 2SD763	140p 100p 140p	2SD1211 2SD1218 2SD1223	120p 75p 75p	2SD1608 2SD1609 2SD1632	70p 500p	2SK724 2SK725	600p
2SC930 2SC941 2SC943	15p 15p 160p	2SC1626 2SC1627 2SC1628	55p 15p 75p	2SC2221 2SC2228/ 2SC2229	650p 4 60p 15p	2SC2654 2SC2655	180p 75p	2SC3178 2SC3179	175p 70p	2SC3783 2SC3787	300p 100p	2SD768 2SD772	180p 200p	2SD1225 2SD1227	120p 40p	2SD1637 2SD1647	50p 40p	2SK727 2SK735	800p 600p
2SC944 2SC945 2SC950	140p 10p 40p	2SC1634 2SC1669 2SC1674	50p 100p 15p	2SC2230 2SC2233 2SC2235	80p 100p 60p	2SC2656 2SC2660 2SC2665	550p 100p 200p	2SC3181 2SC3182 2SC3199	200p 120p 40p	2SC3789 2SC3790 2SC3795	75p 120p 175p	2\$0773 2\$0774 2\$0777	20p 30p 400p	2SD1229 2SD1237 2SD1246	250p 300p 20p	2SD1649 2SD1650 2SD1651	260p 180p 150p	2\$K758 2\$K787 2\$K794	300p 900p 500p
2SC959 2SC980	225p 40p	2SC1675 2SC1678	90p 80p	2SC2236 2SC2237	20p 540p	2SC2668 2SC2671	10p 100p	2SC3209 2SC3210	120p 550p	2SC3798 2SC3807	220p 120p	2SD784 2SD786	850p 100p	2SD1247 2SD1248	40p 270p	2SD1663 2SD1666	450p 90p	2SK872 2SK903	650p 500p
2\$C982 2\$C983 2\$C1000	20p 120p 20p	2SC1683 2SC1684 2SC1685	100p 30p 30p	2SC2238 2SC2240 2SC2258	45p 15p 30p	2SC2681 2SC2682 2SC2688	170p 70p	2SC3211 2SC3212 2SC3225	220p 260p 50p	25C3811 25C3832 25C3833	80p 200p 250p	2SD787 2SD788 2SD789	20p 30p 20p	2SD1251 2SD1263 2SD1264	180p 90p 55p	2SD1667 2SD1668 2SD1677		2SK1057 2SK1058 2SK1117	600p 800p 250p
2SC1001	950p	2SC1729	900p	2SC2259	60p	2SC2688 2SC2690 2SC2705	27p 75p 50p	2SC3244 2SC3246	45p 50p	2SC3853 2SC3854	220p 250p	2SD789 2SD792 2SD794	400p 33p	2SD1264 2SD1265 2SD1266	75p 180p	2SD1730 2SD1732	350p 400p	2SK1118 3SK45	225p 100p
S	EE O	THE	R P	AGE		2SC2710 2SC2712	50p 20p	2SC3259 2SC3260	350p 220p	2SC3855 2SC3857	220p 500p	2SD795A 2SD811	140p 450p	2SD1267 2SD1271	55p 55p	2SD1739 2SD1740	275p 125p	3\$K51 3\$K59	100p 100p
	F	OR N	10R	E		2SC2716 2SC2719 2SC2721	50p 25p 120p	2SC3261 2SC3262 2SC3263	230p 280p 280p	2SC3858 2SC3870 2SC3883	550p 200p 280p	2SD819 2SD820 2SD821	200p 250p 550p	2SD1271A 2SD1272 2SD1273	225p 200p 50p	2SD1748 2SD1760 2SD1762	90p 80p 50p	3\$K74 3\$K77 3\$K81	50p 50p 50p
GR	AND				INC	2SC2738 2SC2740	200p 450p	2SC3264 2SC3269	390p 50p	2SC3884A 2SC3886A	300p 400p	2SD822 2SD826	290p 30p	2SD1275 2SD1276	50p 60p	2SD1773 2SD1783	160p 100p	3SK85 3SK88	160p 7 <b>0</b> p
AIL		AIA	UA	HUI		2SC2749	350p	2SC3270	50p	2SC3890	150p	2SD836	60p	2SD1277	190p	2SD1796	180p	3SK121	150p

Man			REPL	ACE	MENT	VIDE	EO HEA	DS		
## 2000 A. M. P. C.	Model P	rice	STATE OF THE PERSON NAMED IN	CONTRACTOR OF STREET	Market Street, Square Street, Square,	A CONTRACTOR OF THE PERSON.			Model	Price
Company   Comp	AV66/AV77		VCR8103, VCR8107 VIP300A MKII		4913, VRP3833	650p	AG2100, AG2200	700p	VHR1500, VHR2500	2100p
Manual Content	G900	1500p	FVHP420, 510, 520, 530,	615, 618, 620, 721, 722, 730, 830.	VP3826, 3906, 3916, 3926 3948	5, 3946, 1560p	NV730, NV770 4 HEAD NV366	1550p 1850p	VHR7900	2450p 3000p
March   Marc	205, 220, 240, 244, 245, 247, 245 301, 304, VSP6, VSP62	8, 250, 301, 1 <b>200</b> p	905, 906, 908, 910, 911, 5000, 5001, 5005, 5050, VBS3500, 7100, 7500, 76	915, 916, 918, 5075 1100p 500, 9900,	VR3976 VR3977	2100p 2700p	NV788 NV810, NV830	2800p 2400p	VC390, VC393, VC496 VC488	
See 19 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	WP77, VP96, WP7100, VP7296, V WS3800	S9700, 1200p	VBS7000, VBS7100, VBS FVHP500, 711, 715, 721,	\$9000 <b>2000</b> p . <b>722</b> , 730, <b>830</b> ,	VR3995, 3997 VR3917 VR3730, VR3731, VR3745	1800p 1400p 2500p	NV870, NV890, NV970 NVG33, NVG46, NVL23, N NVL28	3600p VL25, 1800o	VC789, VC790	2900p
Proc.   Proc	VSSE VSSE VSSE, VSSE, VSSS, VSSS.	1350p , VS55,	FVHP725, 830, 980 FVHP990	2500p 2700p	VR3520, 3701, 3719, 3720 9720	), 3721, 3769, 2000p	450, 465 NVG18	, NV250, <b>290</b> , 1500p 1800p	387, 388, 471, 477, 481, 4 3300, 8381, 9100, 9300, 9	82, 483, 486, 400, <b>9500</b> , <b>9600</b> ,
Control   Cont	WSS12, VSS15, VSS16- VSAE	2800p 2300p 1200p	FVHD40, FVHD140, FVH	P1, FVHP10,	VR3968		NVG50, NVG300 NVG45	, NVD48 1800p 2850p 1800s	VC582, 583, 651, 681, 750 684, 402, 500, 571, 573, 5	0, 780, 781, 683, 80, 584, 600, 682.
Miles	VSE VSE VSS VSF800. VSF860	2400p 2250p 3600p	HOS200, VCR600, VCR6	100, VR900,	HR2200, 3300, 3320, 3330 3660, 3750, 3860, 4100, 3	292 8900 8901.	NV688 NV600	2400p 1600p	8481 VC6000, 6200, 6300, 7300	1100p 0,7700,7750,
### 1960 Sept. 1960 Se	VS20, 22, 24, 25, 26, 27, 422, 426 VSF10, VSP9	6, 427, 1250p	VTR1000	1100p	13V22 HR3660, 7600, 7610, 7650	600p ), 7700, HRD 110, PS 100, 9904	AG6100, AG6200, AG6300 NVG7, NVG9, NVZ30	2600p	VC793 VC473, 785, 786	3000p 2200p
### CHANGE AND CHOOK STORY AND	VS109, VS603, VS606, VS607	2500p	8000 3HSSDB GVH51, GVH122, VCP40	00, VCP4100,	3V36, 3V38, 3V39, 3V49	875n	NVG15, NVG400 NVM7, NVMC20	2600p 3800p	VC585, VC885 VC90ET	2000p 3900p
MILESTED   1998   199	VCR4000, VCR5000, VCR6000	1650p	GHV1232, 1233, 1241, 12 1245, 1246, 1290, 1291,	242, 1243, 1244, 1295, 1296, 1891.	1 8948, 3V42, 3V44, 3V45, 3	V46.3V47.	N9011, 9012, 9013E, 9014E	9014G.9015.	SIEMENS	
Part	VCR4500, VCR5200, VCR9000,		VCP400, VCP4130, 4300, 4306, 4310, 4311, 4315,	, 4301, 4305, 1316, 4320, 4321,	HRD154, 170, 171, 210, 21 350, 521, 522, 526, 526, 52	11, 217, 320, 321, 27, 550, 8950	9054, 9055, 9063, 9065, 906 DX1000, 1600	56, 906, 1200n	FM363 FM364	1300p 1350p
### APP 1990   1	WCR6000, 6100, 6200, 8600, 860. DD8900, 8904, TVR4	2,8700, 1100p	G.E.C. 4000H, 4001H, 4002H		PV21, FV26 HRD565, HRD566, 3V48 HRD725, HRD755, 3V43	1300p 2200p 3V53 2950p	9120 PVC600,740,744,754,763	2400p E, 764, PV2300,	FM394, FM464 FM462, FM561	2800p 1600p
### 1950   10.00   10.	VCR4700		V4005H		8930, 8931, 8933, 8940, 31 8945	/29, 3V30 700p	N380, N381, N830, N831, N N834, N835, N836	1832, N833, 700p	FM484, FM485, FM602, F FM624	M604, FM622, 1800p
Ministry	ANA		CS1, DS2 VHSAH1	1100o	FV31 FV37, FV43H, HRD860 BR7000E, BR7000S	1500p 3500p 2600p	N896 N896 N8052 N9530 DX2000	3000p 3150p	FM600	
Section   Proceedings   Procedings   Proced	BARD		VHSAN3 VHSAY3	800p 1200p	HRD455 HRD520	2000p. 1400p	·PVC2300, 2400, 740, 744, 7	1700p 60,764 1400p	DSR-19R (FOR SL-T 9ME) DSR-21R (FOR SLC 8-C9)	2600p
Dec.   Story   Company	3504. 8923, 8924, 8925, 8929, 89	650p 35, 8943,	VHSBP1 VHSBY3	2600p	HR4100 HRD750, HRD830	1000p	460, 9-460, V100, 140, 200,		SLF1UB, SLF1E) 2 PIN SL SLC33E, SLC44PS, SLF30	C24PS, PF, SLF60PS,
## SEC 1965   10050	8909, 8912 9530, 8331, 8933, 8940	800p 800p 2300p	VHSEH2 VHSEY1, VHSEY2 VHSFG2, VHSFG4	1600p 1400p 1300p	3V32, 8942, HR7655 HRD180, 190, 230, 610, 3V	59 FV12L	V1001, 1005, 1015, 1025, 10 1055, 1065, 1105, 2005	035, 1041, 1250p	DSR-438 (FOR SLC7 RAN SL5100, SL3000) 1 PIN SL	GE, SL <b>5000,</b> C6E,
Married   17000   17	8947, 8948 8950	2000p 1500p 1700p	VHSTJ1, VHSTJ2, VHST. VHSYJ2	J3, VHSWJ3,	HRD376, HRD430, HRD47 FV13H HRD530, HRD706, FV14T	0, 3V58, 2300p	V101, 102, 103, 112, 141, 14 301, 302, 350, 500, 3005	2, 200, 300,	SL3000, 8000, 8080, SLC5 SLT7ME	£, 1600p
PRIVED   1712-25   1712-	V <del>1.5</del> 82	7000p	VHSYH2	1600p	HRD330, 337, 440, 637, 64	1,660. 2800p	V380	2300p	SLK95, SLT50ME	2900p
## CHANGE   THE PROPERTY   THE PROPE	RTY100, 200, 202, 211, 214, 222, RTX100, 200 RTV301, RTX250, RTV333	800p 800p	4312, 4605, 4905, 4912, 4	913, P4833, TR4912	KV901, KV903, KV905		VH3, VH555, VH600, VH700	, VH844,	V63	
## 17.50   19.00   19.	#TV310, 311A, 312, 317, 319, 320	1850p 1100p	184913, 184914, 184943 4935, 4943, 4963, 4985, 4 TR4935, TR4985, TR4993	650n i	LOGIK VR960		PHILIPS	700p	V8600, V8700 V21, V31, V33, V50, V51, V	3000p
\$170.00 (170.0	RTV328 ETV424	1850p 3500p	4920, 4927, 4930 4946, TR4906, TR4916 TR4994	1700p 1600p 2300p	LOEWE	1400p	VR6711 4 HEAD 6920, VR6440	1800p 2500p	V55, V57 V71, V73, V74, V75, V77, V	700p 80, V81, V82,
### PRINSON PR	RTX260, RTX720, RTV330 RTV454, RTV740	2300p 5000p	GRUNDIG		OC50, OC55, OC60, OC65		VR6642		V80, V93 V5470, V5480	1450p 1300p
STATE   Proceedings   Process   Pr	RTV520, RTV530 RTV535, RTV560, RTV570 RTV635, RTV660, RTV820, RTV7:	1800p 2000p 30 3000p	530, 546 BARCELONA, MV\$400, 4 SE5100, 6100, 6110, 9100	1600p 40, 500, 600, TVR4500, 4510	9225, 9258 9245, 9251, 9254	1225p	8V6900AS N830EA, RV300, RV310, RV	320, RV330,	V880MS V700G	2600p 3700p
## 1700 ## 170	CR1800 ETV321, RTV322	4100p 1700p	5510, VS400, 440, 500, 50 610, 5186, VS6190, 700, 9 MADRID, SE5140, VS540	6,510,518,600, 00 1400p VS5480 3000p	9272, 928217 9252 928017, 928077, 928097, 9	2700p 2500p	REDSON		V9680 V300G, V301, V305, <b>V309</b> 6	2900p
#TVB10 (400) 5300 (400	RTV348 RTV404, RTV414	2700p 3000p	930, 940 VS120	0, 630, 640, 790, 2400p 2300p	928117 9253 9281	1700p 2500p 2700p	2A10, 2A70, 2B20		V110, V120, V130, V140, V	210.
VSSE00   10000   VSSE00   VSSE00   10000   VSSE00   VSSE	RTV750, RTV800, RTV900 RTV810	3500p 4400p	VS160, VS740 VS170	4400p	VR3761	2100p	6A10, 6A70 BA10, VR6038 CVR6083, VR600, 66007, 600	2300p 3150p 08, 6009,		1100p
VRPSO 3559b VRPSO	WRH50		MVS710, 720, 910, 5E712	0, 9120, V\$710,	VCRL3, VX730, VX750	1200p 1450p	PVR6058, 6070, 8070, VR200 6012, 7000, 9010	00, 6000, 6010, 800p	A890	
MTTBURISH   1200p   VR50A, VR30B, VR30E, VR40A   100p   VR50A, VR30B, VR30E, VR40A   1300p   VR50A, VR30B, VR30E, VR40A   1300p   VR50A, VR30B, VR30E, VR40A   1300p   VR50A, VR30B, VR30E, VR40A   VR50B, VR30E, VR40A   VR50B, VR50B, VR30E, VR40A   VR50B, VR50B	VRP25 VRP30	1000p	VXL2, 3, 4, 20, 35	1000p	VX735A, VX765, VX850	1750p	VR6004, 6005, 6011, 6013, 6 6022, 6023, 6024, 7004, 7011	014, 6020, 1, 7014, 7720,	7921, 7926, 7931, 7970, 97 VR400, 410, 450, 510, 519,	0 1250p 520, 529, 540,
Control   Cont	VR10		VXL8 VXL7	1200p 1300p	H\$303, H\$304, H\$320, H\$1	700 1500p	VR6018, VR7018 VR6028	2450p 2300p	A930, 932, 935, VR2931, 29 4935, 4940, 4942, 4945, 59:	35, 2941, 3935, 35, 7932 1400p
## MSA9 HSE31, HSE32, HSE31  ## MSA9 HSE32, HSE31  ## MSA9 HSE31, HSE32, HSE31  ## MSA9 HSE32, HSE32  ## MSA9 HSE32, HSE31  ## MSA9	912, VCR12, VCR30, VCR32, VCR5	4000.	VTV200	1100p	H\$307 H\$319	2300p 2300p	VR100, 605, 705, 805, 905, 10	000, 1100,	<b>A94</b> 0, VR192 <b>5</b> , 1930, 1940, 440, 449, 530, 535, 539, 549	1950, 2960, 9, 550, 630, 650,
SSS28   SSS20   SSS2	VCP11 RAF DECCA	1800p	VI/, VI7/, VI18 VI19	2200p	HS349, HSE31, HSE32, HS HS411	2250p 331 2250p 2900p	VR3300X, VR3600X, VR3850 VR3800	14000	VR1980, VR7980, VR980 VR2915	3150p 1100p
\$2300 pt	\$400, 8500	650p	VT100, 110, 111, 112, 113, 125, 128, 220, 225, 400, 46	115, 118, 120, 5, 410, 413, 414	HS338 HSE10, HSE11, HSE20, HS	2200p E21, HSE41,	VR2000, VR3300, VR3600 SALORA	1400p	VR7979	
#837 WB36 2306	EVR101 VR70, VR71, VR74, VR81, VR90,	2300p	626, 725, 726, <b>728</b> VT3000	1400p 650p	HS300, HS301, HS302, HS3 HS273	310,	SV7300, ŠV8200, SV8300, S' SV7400, 8400	V9200 1500p 1600p	TX8000, V309, 316, 320, 32 4100, 4200, 4300, VX305T,	306T, 309BL,
2450p   S88   3450p   S88   34	VR96, VR96 VR97 VR90, VR92	2300p 3300p 850p	VT77, 680, 6500, 6700, 680 8030, 8040, 8100, 8300, 85 93 <b>00</b> , 9500, 9700, 9900	00, 7000, 8000, 00, 8700, 9000, 1000p	HS337, HS347 HSE12, HSE22, MX1 HS411EZ, HS411GZ	2100p	SAMSUNG	1200p	TX8500, V318, 342, 343, 35 1210, 4230, 4260	1, 352, 353, 1250p
2522, 2534, 3122	EDISON	2450p	VT8, 9, 56, 57, 570, 575, 57 588 VT65	6, 580, 585, 3200p 2400p	HSB11, HSB21 HSE50	2100p 3300p	6600, VX510, 511, 520, 616, 6 614, 619, 629, 710, 712, 720, 972, SV716, 717, SVX303, 30	526, 627, 717, 730, 970, 971, 15, VB510	/340 /357, VK309LP	1100p 2300p
VC523 VK2532 VK2631, VK251 1800p VC5252 VK2531 VK2541 1800p VC5252 VK2532 VK2531 VK2532 VK2532 VK2531 VK2532 VK2532 VK2531 VK2532 VK253	2532, 2934, 3122 VX2132, VK2512	650p 2300p	425, 426, 428, 430, 431, 43 VTL30, 301, VTM630, 635,	5, 438, 535, 536, 636 1900n	NV300, 322, 333, 390, 2000 7000, 7500, 7800, 7850, 817	2010, <b>3000</b> , 0, 8200, 8400,	520, 610, 616, 617, 619, 620, 710, 971, <b>V152</b> 0, 616, 621, 62 910	626, 627, 629, 6, 900,	/364, V4400 /368, V6000, V8540	2000p 3150p
## 1525-55   245.0p   VT53.0	WC2530, VK2532, VK2631, VK2541 WC2532 WC2537	1700p 1	V 1640 VT 168, VT 150, VT 260, VT 4 HEAD)	1200p 138 (4 2300p	NV777, NV330 NV8050, NV8051 AG1000, AG1050, NV260, N	1500p 2800p (V280, NV460,	/K770, VK8225	1900p	/430,530,4340 /450	2450p 2300p
## 100, VIP1000, 1400, 3000, 5000, 5000, WC# 100, 5000	2G-2545 2G-2639, VKH2439	2450p 3300p	VT530 VT522, VTM620, VTM622, VTM722, VTM822	VTM720,	NV470, NV480 AG6010, AG6015 AG6640	1800p 2 2500p V	TC5000, 5400, 6000, 6500, \	/PR5000,	/K308P	650p
\$2300, \$200, \$10, \$2000	E11, 1100, VIP1000, 1400, 3000, 50 VCR4000, 4500, 4800, 5200, VCR5	000, 600,	VT660E	2600p	NV630 NVD80, NVH65	380, 725p 5 3400p V	/TC2000, 5100, 5150, 5300, 5 370, VTCNX10, VTCNX15, 2 /PR5800	5400, 5350, 20, 30, 1800p	CDANDAT	ALTD
	WCR4500, VCR5400, VCR5800 WCP5480, 5843, 9007, VIP2500A, 3 5000, 150	1200p 3000A, 2000p	1V4000, HV7000, HV8000;		NVF51 NVG19	4200p 9 2300p V	455, 9500 /HR1110, VHR1150, VHR130	1900p 1900p 10, VHR1700,		
	VCR6000, VCR6100, VC	R6800, \	/R3605, 3905, 3935, 3943,	3954, 3958.	31, 40, 130	1600p V	/HR3200, 3270, 3100, 3150, 3	3300, 3400,		

SOLEN.	IOII	DOL	I EDC	MAD	DELT	WITC
HII/	ICH	KUL	LERS /	VCK	BELI.	KIIS

		PINCH	KUL	LEKS /	VCH	BEL	i Kiis		
Model	Price	Model	Price	Model	Price	Model	Price	Model	Price
AKAI VS10, VS9300, V59500,	VS8700, VS9800.	VHSTJ1, VHSTJ2, VHSTJ VHSWJ1, VHSWJ3, VHS		N.E.C. N830, 831, 832, 833, 895	165p	FM558, FM558, FM5 FM574, FM578	60, FM562, FM564, 165p	FERGUSON 3292, 3V00, 3V01, 3V16, 3V	/22,8900,8901,
VP7100, VP77 VS1, VS2, VS3, VS4, VS	5, VS6, VS8,	VBXYB3 VHSEH3, VHSES2	185p	PVC2300, 2400, 740, 744, 766	746, 760, 764, 165p	FM601, 603, 605, 607	7, 608, 617, 619, 620. 28, 630, 632, 634, 636.	8904, 8906 3V23, 8923, 8924, 8929 3V29, 3V30, 8930, 8931, 89	120p 65p
VS9 VS105, 112, 115, 116, 12 244, 245, 247, 248, 250,	166p 26, 205, 220, 240, 512, 515, 516,	VHSF34 VHSFP2	165p 165p	DX1000, 1600, 2000, 3000 9014, 9016, 9033, 9034, N 9055, 9066, 9110, 9120, 9	9053, 9054,	SOLAVOX	165p	3V31, 3V32, 8941, 8942 3V35, 3V36, 3V38, 3V39, 3 8944	V49, 8943,
VSX9 VS201, VS301, VS303, V VS806, VS807, VP58-P8	/S304, VS603,	GRUNDIG BARCELONA, MADRID, I	VIVS500, 510,	9610 ORION	165p	NCVR1000, NCVR50	00 155p	3V42, 3V43, 3V44, 3V45, 3 3V54, 3V56, 3V57, 8945, 8 3V43, 3V44, 3V58, 3V65, 8	75p V48, 3V53, 947, 8948 60p
VS125, VS155, VS165, V VS250, VS512	/S220, VS240,	600, 620, 680, 710, 720, 9 SE5110, 6140, 6100, 6110 9120, TVR4000, 4510, 551	, 7120, 9100, IO. VERONA.	VH1, VH2 VC150, 180, VH3, 33, 200, 250, 254, 288, 300, 303, 3	165p , 201, 205, 212,	SCNY SLC5, 6, 7, SL3000, 8 SLJ10, SLT6ME, SL1	8000, 8080, 8200, F7ME 165p	3V43, 3V44, 3V58, 3V65, 8 FV11, FV12, FV13, FV14, F FV22, FV26, FV32, CV141L	V20, FV21, 65p
VS22, 23, 25, 35, 37, 38, 425, 426, 427, 462, 465, VSA77	53, 66, 75, 422, 467, 485, 965, 967, 165p	VS500, 505, 510, 520, 530 610, 620, 630, 640, VS650 710, 720, 740, 790, 800, 8	, 540, <b>550</b> , 600, 1, 660, 6 <b>80</b> , 700,			SLC9, 20, 24, 30, 33, 11, 20, 26, 30, 60, 100	44, SLHF100, SLF1, 0, 200, SLF60PS,	PV31R FIDELITY	110p
VSF260, 261, 262, 265, 2 410, 440, 400, 455, 480	270, 274, 280, 290, 490, 497, 560,	930, VS940, 5180, 5480, 6 MVS400, 440, 400, 410, 4	190, 5690 165p 40, 441, 400, 456.	2948, 3030, 3312, VHF2A, COMBI15000, 16000, HVI NEVH, NEVHM, NEVHMI	_ 1VP230RC. 1	SLF90E, SLHF150, 8 SLT20ME, SLT30ME BMC100, BMC200, E	SLT50ME 165p	HQS200, VCR600, VCR6100	180p
AMSTRAD	165p	460 VS120 VS150	165p 165p 165p	VCP, VH04, 30, 103, 300, 400, 416, 512, VH530, 532, 630, 635, 640, 666, 730, 7	2, 535, 536, 600, 35, 744, 774, 790,	SLV201, 202, 301, 30 802	72, 401, 402, 801, 165p 75, 300, 353, 373, 410.	VCR100 VTR1000	160p 100p
VCR4000, 4600, 4700, 53 8600, 8602, 8603, 8604, 8800, 8804, 9000, 9340,	8700, 8704, 8714,	VS180, 200, 220, 226, 262 310, 315, 320, 326, 345, 3	, 265, 267, 300.	800, 820, 850, 888, 893, 9 974, 1012, 1040, 1050, 10 1120, 1204, 1440, 1500, 1	00, 930, 940, 942, 60, 1070, 1100,	415, 474, 656, 715, S SLV255	LV757,777 165p 165p	VR2005, VR2010, VR2020, VR2025.	
3, 4 VCR7000	165p 165p	GOLDSTAR GHV51, 1221, 1232, 1240	1241 1242	2151, 2308, 2204, 2400, 2 2960, 2970, 3060, 3060, 4	500, <b>2600, 2700,</b> 000, 4008, 4010,	TELEFUNKEN A920, 930, 932, 935,	940 950 990 990	VR2040 VR2008 VR3009	105p 160p 140p
AIWA AV66, AV77	165p	1243, 1244, 1245, 1246, 8 8215, GHVP1240, 1241, 1	000, 8200, 8210, 247, 1248, 1290,	4012, 4015, 4020, 4300, 5 220, 225, 245, VR821, 925 2959, 2957, 2966, 2979, 2	, 1032, 2949,	1200, VR925, 930, 94 1920, 1925, 1930, 19	10, 950, <b>971, 97</b> 5, 980. 40, 1 <b>950, 2920</b> , 2925.	FISHER	TOTAL TOTAL
G700, G900	165p	1291, 1295, 1296, VCP400 4200, 4300, 4301, 4305, 4 4315, 4316, 4320, 4321, 4	306, 4310, 4311, 325, 4326 180p	VXL20, 25, 30	165p	3935, 3945, 3950, 39	41, 2960, 2970, 2671, 65, 3975, 4935, 4940, 00, 7921, 7926, 7929,	VBS7000 VBS9000 FVHP520, FVHP530, FVHP	245p 120p 420 60p
VCR3000X, VCR4000 VCR5000, VCR6000	185p 185p	HINARI		PHILIPS VR6460, VR6820 VR2020, VR2021, VR2022	166p	7931, 7932, 7970, 79 VR1935, VR2915	71, 7979, 7980 166p 165p	FVHP615, 618, 620, 622, 7 721, 722, 725, 730, 840 FVHP905, 906, 908, 910, 9	10,711,720, 80p
AUTHENTIC NB50	165p	V20H, VXL5, VXL6, VXL7 VXL10, VXL11, VXL19 VXL2, VXL3	, VXL8, VXL9, 165p 165p	VR2024 VR6711 VR6540	165p 165p 165p	VR1970, VR1980 VR400, 410, 440, 449 549, 610, 640	165p	918 VBR330, VBS7500, VBS76 VBS9900	80p
BLAUPUNKT RVT100, 200, 202, 222, 2	224, 301, 306, 307.	VXL4, VXL20, VXL35	165p	DV856, 586, VR702, 703, 6880, 6948	6485, 6589, 6785, 165p	VR520, 529, 530, 535 650, 920	5, 539, 550, 620, 630, 165p	VBS3500	75p
309, 311, 312, 315, 316, 404, 414, 434, 444, 478,	317, 319, 320, 328, 707, RTX100 165p	HTACHI V77, 11, 14, 16, 17, 19, 33 88, 330, 680, 6500, 6800,	, 34, 35, 38, 39, 5000, 5500, 7000.	VR445, VR6442, VR6542, VR6943 DV464, VR2220, 2300, 23	165p	THOMSON SV1000, TX8500, V3	20, 321, 323, 326, 342.	FUJITSU HS760, HS750, VGX715, V	GX7200 160p
RTV211, 214, 321, 322, 3 260 RTV324, 326	165p 165p	8000, 8300, 8500, 9300, 9 9900	500, 9700, 1 <b>65</b> p	2340, 2350, 2414, 2480, V 2489, 2490, 2498, 2840, 6	R2485, 2486, 462, 6463, 6464,	400, 510, 520, 530, 5	60, 364, 368, 410, 430, 40, 620, 630, 640.	FUNA! V1, V25, VCR4600, 4800, 5 6400, 6600, VIP3000, VIP56	200, 5400, 5600, 200 160p
RTV330, 454, 520, 530, 5720, 730, 740, 800, 810,	535, 560, 660, 670,	VT8, 52, 57, 61, 62, 63, 64 100, 110, 111, 113, 115, 1 130, 135, 138, 145, 150, 1	18, 120, 122, 125, 68, 176, 220, 225,	6560, 6660, 6860, 6861, 6 N-1700, VR2870 VR2025, VR6580	165p 165p	4200, 4210, 4230, 42 4400, 5500, 5540, 60 TX8000, V309, 316, 3	357 <b>, 309</b> , 410, 411,	VCR4530, 5840, 5843, 680 8103, VIP150, 6000	7, 6803, 8007, 160p
DAEWOOD VCR12, VCR32, VCR52	165p	250, 255, 258, 260, 400, 4 415, 418, 420, 425, 426, 4 438, 400, 498, 510, 518, 5	05, 410, 413, 414, 28, 430, 431, 435.	VR6548, VR6648 PRESSURE ROLLER ASS 40205, DV186, 190, 286, 2	165p EMBLY PS403-	3801, 4100 V333, V340 VX300, 301, 302, 305	165p 166p 5, 306, 312, 3301 165p	G.E.C. 4005	100p
VCR30, VCR500 DECCA	165p	580, 585, 588, 640, VTD66 775, VTL30, VTLC50, VTN	80, 665, VTF770. 4620V, TM625,	471, 562, 582, 571, 761, V 302, 303, 305, 6180, 6182	R201, 202, 203, , 6185, 6285,	TOSHIBA		V4064 GOLDSTAR	100p
VR8300 VRH8495OK (Pressure F PS403-40205	165p (Antier Assembly) 350p	626, 630, 635, 636, 640, 6 725, 726, 728, VTM730, 7 745, 746, VTS80, 85	45, 646, <b>720, 722.</b> 31, <b>735</b> , <b>736</b> , <b>740</b> , <b>165</b> 0	6290, 6291, 6293, 6362, 6 6393, 6467, 6468, 6470, 6 6670, 6676, 6760, 6761, 6	561, 6570, 6581,	DV55, 57, 61, 63, 65, 77, 81, 83, 85, 86, 93, 200, 202, 205, 207, 3	66, 67, 71, 73, 74, 75, , 94, 80, 90, 96, 97, 00, 309, 500, 509,	GHV1221, 1232, 1241, 124	10 8715
FERGUSON	No. of the last	VT3000	165p	6975, 8681, 63587, 6858 925831	4, 715B4, 72SB8, 350p	700 V5470, V5480	165p	VCP4100, VCP4130 GHV1290, 1291, 1295, 129 4200, 4300, 4301, 4305, 43 4315, 4320, 4321, 4325, 43	6, VCP4000, 06, 4310, 4311, 26 1200
3V00, 3V01, 3V16, 3V22 3292, 8900, 8901, 8902, 8909, 8912, 8922, 8923,	8903, 8904, <b>880</b> 6.	LT.T. VR3605, 3826, 3905, 3906 3935, 3948, 3948, 3976, 3	5, 3916, 3926, 985, 3986, 3995.	SANYO VHR1100, 1150, 1200, 130	00, 1500, 2100,	PRESSURE ROLLER 40205, V91, V95	209, V609 166p ASSEMBLY - PS403- 350p	GRANADA	- Commence
8929 3V29, 3V30, 3V31, 3V32 8933, 8940, 8941, 8942	165p	3997, 6348 VR3913, 3914, 3943, 3964	180p 1, 3984, 3993,	2300, 2500, 2700 VTC5000, 5150, 5300, 535	185p 50, 5400, 5500,	VCR BELT	KITS	VHSAH1, VHSAH3 VHSVH4, VHSWH1, VHSX VHSYH2	100p H1 60p 50p
3V35, 3V36, 3V38, 3V39 3V44, 3V45, 3V48, 3V49	, 3V42, 3V43, , 3V53, 3V54,	3994 VR3907 VR3908	165p 165p 165p	6000, 6500, 9100, 9300, V 21, 31, 50, VPR5800 VHR3100, 3300, 3310, 34	165p 00, 3700, 3800,	AKAI		VHSBH1, VHSCH1 VHSBP1 VHSAN3	150p 135p
3V55, 3V56, 3V57, 3V58 FV10, FV11, FV12, FV14 8847, 8948	, 3V59, 3V65, , 8943, 8944, 8945, 165p	VR3912, VR3963, VRP383 VR3917, VR3833 VR3927, 3929, 3968 (PRE	165p	VHR0500, 700 VTC3000 VHR4100, 4150, 4200, 43	165p 165p	VP7100, VS9300, VS95 VS9800 VS1, VS2, VS4, VS5	120p 100p	VHSDS2 VHSAV3	125p 125p
3V52 8950, 8951, FV10B, 11R, 21R, 26D, 31R, 32L, 41R	165p 13H, 14T, 20B,	ASSEMBLY) PS403-4020 SVR3799, VR3520, 3701.	5 400p 3719, 3720,	5100, 5200, 5300, 5350, 5 7500, 7530, 7540, 7800, 8	700,7100,7200, 100 8200 8250.	VS10 VSX9, V5105, 112, 115 244, 245, 247, 248, VS2	55p i, 116, 205, 220, 24, 250, 512, 616	VHSBY3 VHSEY1, VHSEY2 VHSCC1	H1 50p 50p 150p 135p 135p 110p 125p 100p 100p 100p 150p 150p 150p 150p 15
52L, VC141L FV44L, FV48T, FV43H	165p	3721, 3730, 3731, 3749, 3 3781 VR3918, 3919, 3958, 3998	165p	8500, VHRD4400, 4410, 4 4710, 4890, 8700, VHRS7 VCR100	000, 4600, 4610, 00 165p 165p	516 VS22, VS23, VS26, VS	300p 35. VS37, VS38,	VHSDP1, VHSFV2 VHFTJ1, VHSTJ2 VHSTJ3	80p 150p 55p
FISHER FVHP420, 520, 530	165p	VR670, VR680, VR681 VR3927, VR3977 VR482, VR580, VR581, VF	185p	SHARP	200 200 200	VS53, VS55, VS66 VS4, VS6 VSA77	80p 120p 140p	VHSWJ1, VHSWJ2 VHSXJ3 VHSFJ2	120p 85p 140n
FVHP615, 618, 620, 622, 716, 720, 721, 722, 725, FVHP905, 906, 908, 910	, 710, 711, 715. 730, 830, 840 165p	VR9720	165p	VC200, 381, 384, 385, 386 800, 2300, 3300, 6000, 62 7750, 8300, 9100, 9300, 9	00, 73 <b>00, 77</b> 00, 500 <b>180</b> p	AIWA		VHSFS1, VHSFS2 VHSFG1, VHSFG4, VHSF6	130p
918, 970, 975, 980, 990, 5075, \$100	5000, 5005, 5050. 165p	J.V.C. HR2200, 3300, 3330, 3360	), 3660, 4100.	VC300, 387, 402, 471, 473 483, 486, 488, 496, 500, 5 583, 584, 585, 8481, VC5F	71, 573, 581, 582,	AV66 AV77 G <b>700</b>	125p 140p 160p	GRUNDIG MV\$400, MV\$440, V\$400	,410, 440, 441,
VBR330, VBS3500, 7000 9000, 9900 FVHD250, 270, 370, 200	165p	7700 HR2650, 7200, 7300, 7350 7650, 7655	165p	VCA1031 VC600, 651, 681, 682, 684	165p 1,685,693,699,	G900	180p	400, 456, 460 VS 180, 200, 220, 226, 262, 2X40800, 0850, 0880, 1800	265, 267,
250, 300, 310, FVSD209		HRO110, 111, 120, 121, 1- 160, 226, 257, 465, 565, 5 HRP50	40, 150, 157, 158,	700, 772, 750, 779, 780, 7 VC782MK2, 783, 785, 786 7810, 7822, VCT72, VC6F	5, 787, 793, 800, 3, VC6V3,	ALBA VCR40000 VCR5000, VCR6000	130p 105p	2200, 2280, MVS200RC VS150 VS310, VS315, VS320, VS	90p 180p
HQ5200, VCR100, 600, 600, 600, 600, 600, 600, 600,	6100 165p 165p	HRD520, 640, 550, 580, 6660, 660, 830, 860, 960, H	00, 620, 637, 641, RS5800 165p	VCA100, 102, 104, 131, 14 211, 234, VCA303, 501, 60	40, 170, <b>202</b> , 203, 102, 5011,	AMSTRAD		VS345, VS380	85p
FUJITSU HS760, VX715, VX720D	166p	HRD170, 180, 210, 230, 3 337, 350, 370, 400, 430, 4 530, 700, 750, 950, HRS5	40, 441, 470, 500,	VCD801, 802, 851, 852, 8 VCT73 VC220	165p 185p	TVR123, VCR4600, VCI VCR5200 VCR7000	120p 80p	HINARI VXL2 VXL7, VXL8, VXL9, VXL10	80p 180p
FUNAI		9000 HRS10	165p 165p	VCA10, 30G, 60, 103, 105 505, 605, 615, 1031, VCDI VCH80, 865, 910, VCS100	806, 810, 815,	VCR6000, 6100, 8600, 1 8700, 8704, 8714, 8800 DD8900, DD8904, TVR	), 8804, <b>9000</b> , <b>9340</b> ,	VXLA, VXL35 VXL5, VXL6 VXL3, VXL20	70p 160p 90p
V1, V2, VCR4000, 4000, 4800, 5200, 5400, 5600, 8000, 6400, 6600, 6800,	5800, 5840, 5843, 6803, 8007, 8103,	LOGIK VR955	180p	610, VCT1314, 5313	165p	AUTHENTIC		HITACHI	
VIP160, 3000, 5000, 600 VIP1000, VIP1400	0 165p 165p	LUXOR		\$A19HD VHL3, VR1000, VR2000, V VR3800	/R2500,	N850	120p	VT11, 14, 17, 19, 33, 34, 35 330 VT5000, VT5500	90p 120p
G.E.C. V4004	165p	9245, 9251 8252, 8253, 8256, 8285 9254	165p 165p 165p	SALORA		RTV100 RTV200, RTV222, RTV		VT7000, VT8000, VT8300, VT680, VT6500, VT6800, VT9700, VT9900	19300, VT9500, 75p
GRANADA VHSAH1, 3, VHSVH4, V	HSWH1, VHSXH1	9255 9270, 9271, 9273, 9274 9272, 928017, 928077, 92	165p 165p	SV6500, SC6600 SV7300, SV8200, SV8300 SC9300	165p	RTV202, RTX200 RTV322, RTV248 RTV306, 307, 309, 310,	160p 100p 311, 312, 328, 414,	VT52, VT57, VT61, VT62, V VT65, VT85, VT86, VT640 VT3000	105p 120p
VHSYH2 VHSAN3, VHSEPT, VHS VHSVN2	165p	929017, 929117, 929317 9281, 9283, 9284, 9292, 9	165p 295, VR370 I,	\$V7400,8400,8420,8500 8600,8620,8700,8710,8 9500,9600,9810	, 8520, 8550,	434, 444, 707 RTV211, RTV214	135p 140p	VT100, 110, 111, 113, 115, 128, 130, 135, 138, 145, 15 225, 250, 255, 258, 260, VT	118, 120, 125, 0, 168, 175, 220, 130 <b>110</b> p
VHSAY3, VHSX42 VHSBH1, VHSCH1, VHS	165p SFS1, VHSFS2,	3721, 3731, 3761, 3781 MATSUI	185p	\$V8000, \$V8100 \$V801, \$V800, \$V900, \$V	165p /901, SV6910,	RTV324, RTV325 RTV315, RTV316, RTV RTV317	50p	I.T.T. VR3605, VR3905, VR3935	
VHSEH2, VHSEH3 VHSBY3, VHSCC1 VHSOS2, VHSXN2	165p 165p 165p	VX850	165p	SV9800, SV9900 SV6700, SV8710, SV8750 SV6800, 6900, 8820, 8850	165p 0, SV9700 165p 0, 8870, 8910,	RTV301, RTV333, RTV RTV424		VR3985 VR3913, VR3914	90p 70p
Assembly PS403-4020	sure Roller 5 250a	MITSUBISH8 HS200, HS300, HS301, H HS304, HS310, HS320, H	\$302, H <b>\$30</b> 3,	8920, 8970	185p	BONDSTEC BT100	110p	VP3826, VR3906, VR3916, VR3946, VR3948, VR3976, VR3995, VR3997, VR6948	VECORE
VHSEY1, VHSEY2, VHS VHSFG2, VHSFG3, VHS VHSFH6	FG4, 185p	HS304, HS310, HS320, H HS700 HS306, HS307, HS318, H HS338, HS347, HS349, H	165p	SAMSUNG SV716, 717, VB510, 520, 619, 520, 626, 627, 629, 9 520, 811, 616, 621, 626, 9	610, 616, 617, 00, SV910, VI510,	BT300, BT310 BT350 BT50	170p 140p 150p	VR3927, VR3977 VR3993, VR3994 VR3963	65p 650 75p 65p 130p 150p 85p
VHSFJ2, VHSFJ4 VHSF83, VBXAS1	165p 165p	HS411, HS412, HS421, H 30, HSE10, 20, 30, 70	S710, HSB10, 20, 165p	520, 611, 616, 621, 626, 9 520, 616, 617, 619, 626, 6 SVX301, 303, 305, 307, 3	00, 910, VX510, 27, 629 163p 19, 322, V8710,	BOSCH-BAUER		VR3912 VR3917 VR3929, VR3968	130p 150p 850
THE PERSON NAMED IN	TENEST	HSE11, HSE12, HSE21, H HSE32, HSE41, HSE61, H	SE22, HSE31,	770, 971, 8220, 8225, V17 18225, VX710, 712, 720, 1	30, 1790, 18220, 730, 750, 770,	VRH50 VRH60 VRP20	100p 140p 180p	VR3907 SVR3799, VR3520, 3701, 3	719, 3720.
SEE OT	THER	NATIONAL PANASON NV100, 180, 300, 332, 33		790, 825, 970, 971, 972, 8 8ANSUI	220 165p	DAEWOOD		3721, 3730, 3731, 3749, 37 3761 VR3908	90p 180p
PAG		688, 777, 788, 3321, AG6 6200, 6400, 6800	010, 6015, 6100, 180p	SVR5030 SVR7010	165p 165p	VCR12, VCR32, VCR52 VCR30DAP VCR30DBD, VCR500BI	150p	VR3918, VR3919, VR3958.	
		NV230, 250, 260, 280, 370 433, 400, 460, 466, 470, 4 770, 780, 810, 830, 850, 8	<b>80, 630, 650, 73</b> 0, 70, 890, <b>2000</b> ,	SIEMEN FM350, FM352, FM355	165p	VCRSODEP	170p	HR3300, HR3330 HR3360, HR4100	HR3660, 130p 70p
FOR M		2010, 3000, 7000, 7200, 7 8200, 8300, 8400, 8600, 8 NVG14, NVG7, 10, 12, 15	800, 8050, 8150,	FM361, FM362, FM363, F FM391, FM392, FM394, F FM464, FM468, FM561	M364 165p	VR8300 VRH8945DK	90p 80p	HR7200, HR7300 HR7350, HR7600, HR7610 HR7655	, HR7660, 75p
GRANI	ATA	6810, NVH70	0, 2100, 2200, 165p	FM484, FM485 FM585, FM602, FM604, F	165p 1622, FM624,	DUAL		HR7700 HRD110, HRD111, HRD12 HRD225	0, HRO121, 90p
BARG		NVG9, NVG120 AG6840, NVH65, 75, NV. 25, 28, NVG300, NVF65, I	NVF70, NVFS1,	FM627 FM600 FM204, 303, 304, 314, 32	165p 185p 5, 328, 374, 375,	VR4430 VR91, VR93, VR97 VR70, VR71, VR74, VR	90p 75p 81, VR90 85p	HRD140, 150, 157, 158, 16 565, 566, 725, 755, HRP50 HRD170, 180, 210, 230, 30	0.320.321.336.
DANG	Allas	NVFS 100, NVG 19, 20, 26 NVD48, NVD80, NVG21,	. 33, 40, 50 165p	376, 384, 386, 388, 404, 4 489	24, <b>428, 429</b> , 488, 165p	VR80 VR96	90p 85p	337, 350, 370, 400, 430, 44 750, 950, HR\$5000, <b>5500</b> ,	0, 441, 530, 700,
THE RESERVE OF THE PERSON NAMED IN		ENGLISHED AND	E WEST	SECTION AND ADDRESS.	SARVING THE	STATES TO	AND DESCRIPTION OF THE PERSON NAMED IN COLUMN	TALE SECTION	CASE CONTRACT

#### VCR BELT KITS / REPLACEMENT VIDEO LAMPS

Model	Price	Model	Price	Model	Price		SERVICE SERVICE	odel Pri	
HRD520, 600, 620, 637, HRD540, 560, 580, 660, HRS5800	641, 650, 830 95p 860, 960, 130p	VR6010, VR9010 VR6020, VR6022, VR60 VR7730	70p 023, VR6028, 75p	Models & Description	Order Code	Price	C	N/OFF MAIN	J
KCENIMOOD KV901 KV903	70p 90p	VR6024 VR6520, VR6540, VR65 VR6710, VR6720, VR67 VR6720, VR6730, VR67 VR6780	75p 660 90p 35, VR8720 130p	UNIVERSAL VIDEO LAMP 9V 80mV (310mm WIRES)	VL01	25p	GRUNDIG PART NO: USED ON:	29703, 29102 C7500, C7500TT, C	
LOEWE 0C11, OC40 0C410, OC420, OC440, OC50, OC55, OC60, OC1 OC75		SAISHO VR2000, VHL3 VR3800	90p 76p	PANASONIC VIDEO LAMPS	VL02	35p	PRICE: £2.25	C8712, C8714, C88 M68-190/99, M70-1 ST66-1602, T55-34	195, P40-345,
LOGIK VR955	180p	SV6500 SV6500 SV6500 SV8100 SV8100	100p 150p 120p 60p	SHARP VIDEO LAMPS	VL02	35p	PART NO: USED ON:	13/1074 CP0200, 0211F, 032	23 0323/1
LUXOR 9245, 9251 9252 9253 9254	130p 140p 140p 100p	SV8500, SV8520, SV95 SV7400, SV8400, SV84 SV6700, SV8710, SV87 SV6800, 6900, 8810, 88 8920, 8970	00 150p 20, SV8560 120p 50, SV9700 120p	HITACHI 5381682 (VT63, VT64) VIDEO LAMPS	VL04	135p	PRICE: £3.00	0341/14, 0345F, 03 0361/1, 9350, CT05 0500T	51/1, 0361,
9255 9256 9270, 9271, 9273, 9274 9272, 9280 9281, 9284, 9285, 9292	130p 130p 115p 140p	SV8600, 8620, 8700, 87 9810 SAMSUNG SV718 717 V1616 V1	130p	AIWA, AKAI, ALBA, AMSTRAD, BLAUPUNKT, FERGUSON,	VL05	150p	PART NO: USED ON: PRICE: £2.00	LFC 005 CVC40	
3731, 3761, 3781 MATSUI VX850	95p 75p	SV716, 717, V1616, V1, VX617, VX619, VX626, V8520, 510, 610, 616, 6 827, 629, V1510, 520, 61 VX510, 520 VB900, VB910, V1900, PX960, 981, 982, SE900	17, 619, 620, 626, 11, 616, 621, 626, 100 V1910 110	FIDELITY, FISHER, FUJITSU, FUNAI, G.E.C., GOLDSTAR, GRANADA, GRUNDIG, HINARI, HITACHI, ITT, JVC (HRD			MATSUI/SAIS USED ON: PRICE: £2.00	MATSUI-2190, SAI PST2130TX	SHO-
MITSURISHI HS200 HS300, 301, 302, 307, 31 349, 411, 412, 421, HSB 20, 30, 70 HS303, HS304, HS306, 1	10, 20, 30, HSE10, 150p	SVX307, 319, 322, VB7 V1770, 790, 8220, 8225 VX750, VX790, 8220, 8 SVX301, 303, 305, SX7 V1730, 710, VX712, VX	70, 8220, 8225, , VK8220, VPX31, 225 135p 301, VB710, 971, 720, 730, 970, 971,	SERIES), MATSUI, MITSUBISHI NEC, ORION, NATIONAL, PHILIPS, SAISHO, SALORA,			PHILIPS USED ON: PRICE: £0.95	K30, K35, K40, KT3	, KT4
HS303, HS304, HS306, H HS400, HS700 HS318, HS319, HS410 M.E.C. N830, N831, N832, N833	150p 130p	972 VX9880 SANYO VTC5000, 5150, 6000, 6		SAMSUNG, SANYO, SHARP, SIEMEN, SONY, TELEFUNKEN, THOMSON, TOSHIBA			SONY PART NO: USED ON:	(POWER SWITCH - SWITCH)	
N895, N897, N892, N895 PVC2300, PVC2400 EXTOOD, 1800, 2000, 300 9014, 9016, 9033, 9034, 1 9066, 9110, 9120, 9610, 1 9610	80p 180p 30, N9012, 9013, 9053, 9064, 9065,	20, 21, 30, 31, 50 VTC5300, VTC5350, VT VPR5800 VTC5500 VTC9100, VTC9300 VTC1100, 1300, 1500, 1	100p 95p 220p 100, 1150, 1200, 90p	AKAJ, GRANADA (VHSTJZ), HITACHI (VT3000), ITT (VR3912, VRP3833), JVC (HR2200, 3300,	VL01	25p	USED ON:	KV1612 MK1, KV16 KV1614, KV2052, K KV2062, KV2068, KV2216, KV2252, K KV2704, KV2705, K KV2752PE3, KX20F	V2056, V2212, V2256, V2706,
NATIONAL PANAS OF NY300, NY332, NY333, NY366 NY777, NY788 NY2000, NY2010, NY300 NY7000, NY7200, NY780 NY8600, NY8610, NY860	NV340, 125p 100p 00 130p 00 95p 20 145p	VHR2100, VHR2300, VI VHR2700 VHR3100, 3300, 3310, 3 VHR3100, 6300, 3310, 3 VHR4100, 4150, 4200, 4 5100, 5200, 5300, 5350, 7500, 7530, 7540, 7800, 8250, 8500, VHRD4400,	150p 1400, 3700, 3800, 110p 1300, 4350, 4770, 5700, 7100, 7200, 7810, 8100, 8200, 4410, 4500, 4600.	3330, 3660), MITSUBISHI (HS200), TELEFUNKEN (VR510, 519, 610), THOMSON (VK300, 305, 306, 3301), FERGUSON			PRICE: £2.75 PART NO: USED ON: PRICE: £3.00	(POWER SWITCH - SWITCH) KV2022, KV2024	The second
NV230, 250, 280, 430, 43 465, 470, 730, 770, 810, 8 1050 NV370, NV380, NV480, I NV830, NV850 NV600, NV688, AG8010, NVG7, 10, 12, 14, 15, 18,	81, 433, 450, 460, 870, 890, AG 1000, 125p NV630, NV780, 100p AG6015 110p	4610, 4710, 4890, 6700 SHARP VC200, 384, 385, 386, 3 9500, 9700 VC7300, VC7700, VC77 VC8000	100p	(3V00, 16, 22, 24, 3292, 8900, 8901, 8902, 8903, 8909, 8912, 8922, 8925)			PART NO: USED ON: PRICE: £8.00 PART NO:	(POWER SWITCH) KV1810 MK1, KV18 KV1820, KV1822, K (POWER SWITCH 2	V2000 MK1 6mm)
NVH70 NORDMENDE V100, V140 V1000M, 1005M, 1205, 1 1305, 1403, 1405, V1500 805K, 2000D, 2405, 250 V3406H, 3105, 4405H, 55 S05 V1001, 1006, 1016, 1025,	P, 1503, 1505K, 0H, 3000H, 000, 8005, 900,	VC8300 VC8300, 387, 471, 473, 4 428, 496, 8481 VC402, 500, 571, 573, 6 585, VC553 VC800, 651, 682, 684, 6 VC5F3, VC6V3 VC772, 779, 781, 782, 7 7810, 7822, VCA100, VC	150p 81, 482, 483, 486, 80p 81, 682, 583, 584, 80p 85, 693, 783, 70 85, 786, 793, 800, 24102, 104, 131,	BLAUPUNKT, ORION (VH1, 2A), NATIONAL (NV200, 2010, 3000, 7000, 8150, 8200, 8400, 8600, 8610, 8620), SHARP (VC2300, 6000, 6200, 6300, 7300, 7700, 8000, 8300)	VL02	40p	USED ON: PRICE: £2.00 PART NO: USED ON: PRICE: £2.00 PART NO:	KV1400, KV1440, K KV2060 (POWER SWITCH) KV2020 2 PIN (FUNCTION S	1/i/i/m +
1055, 1085, 1105, 3005, 5 503 V101, V102, V103, V112, V301, V302 V110, V333 V1500T, V20008, V2000 V250, V460, V9460, V200 V20035643	304, 5005, 502, 80p V141, V142, 90p 110p P, V400H 95p 035542.	VCD806, 810, 815, VCH VC51000, VCT310, 410, VCTS312 SIEMENS FM350, FM352, FM355 FM484, FM485	80, 865, 910, VCT1314, 115p	AKAI (VS10), GRANADA (VHSXJ3), ITT (VR3993, 3994), JVC (HR2650, 7600, 7610, 7650,	VLÖ6	40p	USED ON: PRICE: £0.40	KV1612 MK1, KV16 KV2052, KV2056, K KV2215, KV2216, KV2256, KV2704, K KV2706, KV275PE3	V2212, V2252, V2705,
V300, V303, V380 V500 ORION COMBI15000, 18000, NE 900MVH1012, VH1030, 1	130p 75p 75p 75p	FM391, FM392, FM394, FM461, FM464, FM468, FM361, FM362, FM363, SONY SLC6, SLJ10, SLT6ME	FMS61 150p FM364 120p	7655), TELEFUNKEN (VR530, 535, 539, 550, 630, 650), THOMSON (V309, 316, 357, VK309, 411, TX8000),			PART NO: USED ON: PRICE: £0.50	(4 PIN FUNCTION S VARIOUS ACEMENT IDLER TYPE	
1100, 1120, 1440, 1500, 12308, 2400, 2500, 2600, 2600, 368, 360, 362, 4010, 4018, 4300, 5010, 5015, 530, 540, 730, 735, VP220, 22, 2966, 2880, 821, 925, VX	1660, 1800, 2150, 2700, 2960, 300, 5, 4916, 4020, 95, 536, 630, 635, 5, 245, VR1032,	SLC5, SLC7, SLJ7, SLJ6 SLC9, SL8000, SL8080, SL8000E, SL8080E, SLE SLV256	SLT50 165p 200, SL8600 175p 95p	FERGUSON (3V31, 8941, 8942)  AUTHENTIC (N850), DECCA	VL07	40p	GOLDSTAR HITACHI	M132773 MZ366960J2 VXP0521 6861471	IT01 IT02 IT17 IT03
NEVHL, VCP, VH1204, 23 3080, 4008, 400, 4012, 41 744, 774, 7905, 800, 820, VR2949, 2958, 2957, VXI VC150, 180, VH1000, 200 250, 254, 288, 300, 303, 3 3312, 404, 555, 700, 704, 750, 344, 900, VHP2, VH3	004, 2204, 3050, 12, 512, 600, 666, 900, 974, VP200, 20 90p 0, 201, 205, 212, 1030, 312, 33, 708, 712, 770,	VR400, VR410, VR440, VR450, VR550, VR550, VR529, VR629, VR620, VR530, VR530, VR530, VR530, VR530, VR550, VR590, VR1925, 1930, 19925, 930, 940, 950 A920, VR1970, 1990, 29	/R640 70p /R920 70p /R550, VR630, 73p 40, 1950, 2960, 90p 20, 2925, 2930.	(VR8300), GRANADA (VHSTJ3, WJ1, WJ3), ITT (VR3913, 3914, 3963), JVC (HT7200, 7300, 7350, 7700), TELEFUNKEN (VR450, 520, 529, 540, 549, 620, 640, 920,			JVC/ FERGUSON	6861482 6886971 PU 48967B PU 51380 PU 51402A PU 55373	1704 1705 1706 1707 1708 1709
VH1, VH2A  PHILIPS VR6460, VR6920 VR6540 DV186, 286, 291, 292, 461 761, VR201, 202, VR200 20RW7, 25801, 25802, 3	/1, 20DV2,	2970, 7921, 7926, 7931, 970, 7981, 975, 980 A1200, 930, 932, 935, 98 VR2931, 2935, 2941, 29 3950, 3365, 3975, 4935, 496, 6VR4970, 6000, 79 VR1935 VR2915	60, 980, 990, 71, 3935, 3945, 4940, 4942, 4945,	1920), THOMSON (V4100, VK308, 309, 312, 410), FERGUSON (3V23, 29, 30, 8923, 8924, 8929, 8930, 8931, 8940)			NATIONAL PANASONIC	PU 55374 VXP 0329 VXP 0343 VXP 0444 VXP 0401 VXP 0433	1710 1711 1712 1713 1714 1715
VR30DV2, 35802, 35807, 71585, 71588, VR86582, VR6180, 6195, 6285, 629 6367, 6390, 6391, 6393, 6 5561, 6570, 6581, 6670, 6 VR68584, 86581, 92583 VR6442, VR8542 VR2225, VR2580	3, 63587, 71584, 91582, 92583. 0, 6291, 6293, 467, 6468, 6470, 676, 6760, 85p 70p	THOMSON SV1000, V410, 430, 450, 540, 620, 630, 640, 4240 TX8000, V309, V357, VK TX8500, V342, 343, 351, 364, 358, 4210, 4230, 42 6000, 8564	, SV5540 65p 411 75p .352,353,360,	GRANADA (VHSAY3), SHARP (VC200, 381, 384, 385, 386, 388, 390, 393, 9300, 9500, 9700)	VL08	60p	SANYO SHARP	VXP 0463 VXP 0521 VXP 0581 1430662T15620 NIDL005GEZZ NIDL0006GEZZ	IT 16 IT 17 IT 18 IT 19 IT 20 IT 21
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Contents BELT SET, TUP REI BELT SET, TUP REI BUT Code: SX41  FERGUSON & JVC  342/43  Code: SX45  FERGUSON & STC  FERGUSON & STC  FOR CODE: SX45	EL TABLE BE TABLE FF ER FF/REW TA TE. TA	ELT SET. PINCH ROLLER F/REW IDLER TYRE. T/UP I ABLE TYRE. SUPPLY REE	R. C	Contents Eco BELT SET, PINCH ROLLER. BEL		Section 1991
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			£3.75		er Code: SK48	£3.25
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Order Code: \$K37 £16.00 Order Code: \$K38 £9.00 TENSION BAND Order Code: \$K43 3V58:59/64/65			1	VC781/VC7810/VC7822/VC785/VC786/V VCA100/VCA102/VCA104/VCA202		5000
HRS5000 510/520/25/26/530/35 Contents Contents	/36/540/545/46/48	/28/430/31/35/48/450/498/ 18/570/75/576/580/85/88	6	BELT SET. PINCH ROLLER. BEL	oamy Kit Centents IT SET. PINCH ROLLI IL DRIVE UNIT TYRE	Ŕ
BELT SET. PINCH ROLLER IDELR ARM. TENSION BAND Order Code: \$K44  3V29/3V30  TIMING BELT. PINCH TENSION BAND Order Code: \$K52	H ROLLER. FF/R	REW ARM. CLUTCH BASE	£9.75	BAND Order Code: SK64 £13.50 Ord VC681/VC682/VC684/VC685/VC693/VC6	er Code; SK55	£3.75
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3/35/36/38/39/49			£14.00	FOR MORE DETAILS	DE OVER 5	ດດ
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3/31/33/42 BELT SET. PINCH R HR7600/7610/7650/7655 Economy Kit Contents Order Code: Still	ER TYRES TE	BELT SET PINCH ROLLEF TENSION BAND IDLER TO Order Code: SKO2				
BELT SET. TAJ REEL TABLE TYRE PINCH ROLLER REEL IDERL TV CLUTCH TAJ IDLER. IDLER TYRE TAJ IDERL TYRE Contents		TIBE COME. SRUZ		BACKUP BA REPLACEMENT PHILIPS NI-CA		
Currents	OLLEP. TENSION	N BAND, IDLER TYPE	PF 00	Replaces Ferguson Part No: 00E6-067-001, used on TX10, L21 Replaces Philips Part No's:	1	150P
3V35/36/38/39/49 NV2000/NV2010 HRD110/111/126/121/225 Contents	F	Conomy lift Contents		138-10138, 138-10313, 1.2V - 90r Replaces Philips Part No's:	nAh	100p
BELT SET. TU REEL TABLE  BELT SET. TU REEL TABLE  BELT SET. PINCH R  B	OLLER FF BI	BELT SET. PINCH ROLLER DLER TYRE. PULLEY TYR	H. RF	138-10229. 2.4V – 90mAh REPLACEMENT FERGUSO BATTERIES	N NI-CAD BACKL	180p JP
TYRE. PINCH ROLLER, TAU  CLUTCH, TAUIDLER, REL  CLUTCH, TAUIDLER TYRE, REEL  Order Code: SK13	£6.00 O	Order Code: SX14	£3.50	Replaces Ferguson Part Nos: 00E6-066-001, 2.4V		2000
Order Code: SK35 £10.00 Order Code: SK36 £5.50 Contents	E	Conomy Not Contents BELT SET. PINCH ROLLER		Used on: 3V35, 3V56, 3V58, 3V65 <b>REPLACE</b>		200p
HR7200/7300/7350  FC000WW Kill Contents  TENSION BAND	DLER IC	DLER TYRE CLUTCH TYP	RE	LINE OU'	<b>TPUT</b>	
BELT SET. TAU REEL TABLE BELT SET. TAU REEL IDLER TYRE, SUPPLY REEL TABLE TYRE, SUPPLY REEL TABLE  ARCOCANGO AND A		Order Code: SK12	£3.25	TRANSFOI Description	RMERS	Order
IDLER TRUCKER HEEL THE FINCH ROLLER TYRE CONTENTS BELT SET. PINCH F	OLLER B	Conomy Kit Contents  BELT SET. PINCH ROLLER	R.	ытасні <b>2433</b> 752	1500p	Code LOT01
Tension Brill: YOUR DEAR TO CENTER TO SERVE THE STORY OF	T	DLER TYRE, PLAY IDLER TYRE Order Code: SK16		ORION 3714002 FIDELITY ZX300 FE TX100 90 DEG	1500p 1500p 1500p	LOT02 LOT03 LOT04
HRP50:HRD140/150/158/160 HRD250/257/565/566/755 NVG7/NVG9VNG10/	NVG11/NVG12/N	IVG14NVG15NVG16/		SABA 490007182 FE TX90 WHITE ITT D307/37 EQ	1500p 1650p 1600p	LOT05 LOT06 LOT07
BELT SET, PINCH ROLLER.  BELT SET, PINCH ROLLER  CONTROL	E	G400/NVH6S (PX/AC) Economy Kit Contents	3000	BLAUPUNKT 210 GRUNDIG 2922010 ITT CVC800/1/3	1600p 1600p 1500p	LOT08 LOT09 LOT10
BAND CODE: \$15.00 Order Code: \$K48 \$9.50 BELT. PINCH ROME TENSION BAND	ER IDLER 8	Loading Belt Capstan Belt. Pinch Roller. (D) Tyre	DLER	NORMENDE 5255	1600p 1600p	LOT11 LOT12 LOT13
FISHER Order Code: SX27			£3.00	SABA 81000 200 SALORA T236 EQ SABA 811-50-24	1600p 1650p 1600p	LOT14 LOT15
Contents  BELT SET, PINCH ROLLER.		Conomy (Ct Contents SELT SET, PINCH ROLLER	R.	SABA 770223500 TELEFUNKEN AT1 TELEFUNKEN EQ	1600p 1450p 1400p	LOT16 LOT17 LOT18
TENSION BAND  Grader Code: SK57  E13 09 Order Code: SK58  E5 00  TENSION BAND: FF	N IDLER. P.	PLAY IDLER TYRE, IFFIREN DLER TYRE	W	SALORA FM02188 NORMENDE 5255 ITT CVC 1150/1	1600p 1600p 1500p	LOT19 LOT20 LOT21
FVHP615/618/620/622/710/711/715/716/720/721/722/725/ 730/830/840 NV230/250/260/280/4			\$2.10 I	ITT COMPACT 80 FE TX100 GREEN HINARI CT4/5 5113	1500p 1450p 1500p	LOT22 LOT23 LOT24
Contents Economy Kit Contents AG1200PK/AG1500P BELT SET PINCH ROLLER. BELT SET. PINCH ROLLER. Contents	K E	Economy Kit Contents		SELECO 6320410 BLAUPUNKT 8667 ITT COMPACT B1	1600p 1600p 1450p	LOT25 LOT26 LOT27
IDLER GEAR IDLER UNIT.   IDLER TYPE	AND IE	BELT SET. PINCH ROLLEI Diler Tyre Order Code: SK24	F7 75	ITT CT3326 MUL ITT D066/37 EQ ITT 3546 EQ	1500p 1600p 1500p	LOT28 LOT29 LOT30
HITACHI NV600/NV688	c	Economy Kit Contents		LUXOR 5810110 SABA 849380920 HITACHI 2434141 CP	1600p 1600p 1450p	LOT31 LOT32 LOT33
Contents  BELT SET, PINCH F  BELT SET, PINCH F  BELT SET, PINCH F  PLAY IDLER FFREI	OLLER B WIDLER P	Belt set. Pinch Rollei Play idler tyre ff/rei	R. W	FE TX100 110 D HANTAREX 28021	1700p 1600p	LOT34 LOT35
Order Code: SK08 E5.00 TENSION BAND Order Code: SK25		DLER TYRE Order Code: SK26	£6.00	SHARP C3700 EQ HITACHI 2432981 CP FERGUSON 0003-508-002	1600p 1500p 1650p	LOT36 LOT37 LOT38
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PINCE. L4.00 Eduli PINCH ROLLER, IDI	ER UNIT P	PINCH ROLLER IDLER TO	YRE	PANASONIC TLF14567F Used On: TC2043, TC2243, TX PANASONIC TLF14586F	1850p 300 1850p	LOT39
AMSTRAD MODE KIT Order Code: SX19 Price: £2.75 each W370VX380/460/60		Order Code: SK20 G2100PK/AG2200PK		Used On: TX2231, TX2244 PANASONIC TLF14584F Used On: TC2210, TC2160,	2350p	LOT41
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ı	3635, 3V49, 8943, 8944 3635, 3V36, 3V38	T-UP CLUTCH	PU55373	150p
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	45, 410, 413 5-24, 425, 418, 420, 425, 4	FF-REW ARM 26, 428, 430, 431, 435	6897094	€1.30
	** 55, 56, 510, 518, 5 *** 545, 546, 548, 5	20, 525, 526, 530, 535 70, 575, 576, 580, 585		
	455, 419, 413	35, 635, 640, 645, 646, VTS8 CLUTCH BASE 26, 439, 431, 435	0, 85 6896951	£3.25
	FEE 542 545 546 548 5	20, 525, 526, 530, 635 70, 575, 576, 580, 586		
	¥734625, 626, 630, 6	FF-REW ARM 56, 428, 430, 431, 435 20, 525, 526, 530, 535 35, 636, 640, 645, 546, VTS8 CLITCH BASE 26, 428, 430, 431, 435 20, 525, 526, 530, 635 25, 636, 640, 646, 646, VTS8 TUP DUER (LARGE) REW IDLER	0, 85	£4.50 £6.00
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V7680, 6500, 6800 VT9700, 9900 NITACHI TV	FS-BRAKE	6861505	230
OUTPUT MUDULE HM 62 OUTPUT MODULE HM 62	<b>6</b> 1		25.50
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HB220 2000 4100	T-UP IDLER SML T-UP CLUTCH	PU49280 PU53462A	£5.50 220
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HR7600, 7610, 7660 HR7655, 7700	ROLLER ASSY	PU49042A	350
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VX730, 735, 750, 755 VX770, 800, 810, 880 VX990	LIMITED POST LEVER		£1.3i
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NVG20, NVG21, NGV25 NVG40, NVG46	DEILL EVERNIT	ADDRESS:	400p
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NV370 NVG7, NVG11, NVG12 NVG14, NVG15, NVG18, N	CLUTCH GEAR WORM WHEEL VG30, NVG120, NVG130, NV	VXP0595 VXP0691 /G400, NVH70	£1.50
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NV230, NV250, NV260 NV260, NV300, NV333, NV3	LIMITER ROLLER 640, NV366, NV370, NV430,	NV450, NV460	€1.50
NV870, NV890, NV550, NV NV870, NV890, NV2000, NN NVG14, NVG15, NVG18, NV	/2010, 7200, NV788, NV810, /2010, 7200, 7800, NVG7, N /G30, NVG120, NVG130, NV	/G10, NVG12, /G400, NVH70	
SAISHO VR605, VR800, VR900 VR1100, 1200, 1600, 2500, 3	CLUTCH 1200, 3300	850A20000	420p
VR3500, 3600, 3800 VR1100, 1200, 1600, 2500, 3	LIMITER POST 1200, 3300, 3500, 3600, 3700		£1.30
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SANYO VHR1110, 1150, 1200	DLER	143-0-662T-14730	
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	M20, M21, M30, M31, M50	1400-1411-20001	4.00
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V1C9300	FF ROLLER ASSY	143-0-547T-00200	200p
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VTC5000, 6150, 6000 VTC6500	PULLEY	143-0-6627-01201	£5.20
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VPR5800, VTC5300 VTC5400	LOADING ROLLER	143-0-661T-03800	80p
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VTC3000	IDLER		750p
SHARP			
	IDLER ASSY	NIDL0005GEZZ	110p
	IDLER	NIDL0006GEZZ	110p
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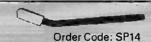
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I	GRUNDIG	Code		PHILIPS (continued)	Code
ı	TP160E	RC 107	900p	RC38	RC 301
	TP200, TP300	RC 380	800p		RC 5301
ł	TP400	RC 401	675p		RC 5352
H	TP590-600	RC 600	850p		RC 5375
1	TP390,TP610	RC 610	850p		RC 5534
н	TP621	RC 621	850p	RC5901	RC 5901
1	TP630, TP650 TP660	RC 650	850p		RC 5903
H	TP661	RC 660 RC 661	850p 850p	SADA	
ı		NC 001	asop	T6772	RC 149
H	HITACHI CLE800-CLE830	RC 140M	700p	TC319-320	RC 328
ı	A617402/655602	RC 192	875p	TC356	RC 356
ı	A512120/230	RC 900	800p		RC 358 RC 360
ı	A514790	RC 901	800p		RC 365
ı	A5088470	RC 902	800p	1000	110 303
н	A518612	RC903	900p	SALORA	00400
ı	SCL002	RC904	850p	SERIES L	RC 190
ı	C2096	RC 905	850p	86173	RC 882
ı	<b>A511940</b>	RC 906	750p		
1	655602H	RC 907	800p	710210, 110222, 110220, 110200	RC 140M
ı	THE STATE OF THE S	NAME OF THE OWNER, OF	Silven	JXGE	RC 878
I	IFB13, 14, 15	RC 143	875p	JXDE	RC 884
1	FS4	RC 148	850p	VHR2300	RC 890
ı	RG305 RG306	RC 305	675p	RC628	RC 865
ı	FS91-10/1	RC 306	825p	SHARP	
ı	VS5 RUK	RC 307 RC 308	850p 825p	G0121CESA, 123CESA, 204, 251	RC 140M
ı	VS4-1	RC 310	850p	SIEMENS	
ı	MULTICONTROL (17C20)	RC 311	800p	FC616	RC 130
ı	KORTING		4000	FC631	RC 132
ı	18279, 18396, 18460, 18521 SE	RC 108	850p	FC742	RC 164
н	40540 VTS	RC 108	900p	SONY	
т	LOEWE			RM604, RM605, RM606	RC 140
П	DC11	RC 146	850p	32 CHANNEL	RC 140M
ı	MATSUI			RM613	RC 141
н	010270601	RC 889	850p	RM632, RM636	RC 160
П	VX770	RC 892	850p	TATUNG	
۱	METZ			FXA	RC 877
н	JAVA COLOR (6890)	RC 166	850p	RC70	RC 883
Ł	COLOR (7156)	RC 183	850p	FX70 FASTTEXT	RC 894
H	JAVA (7180)	RC 184	850p	THE RESIDENCE OF THE PROPERTY.	
Į.	MITSUBISHI .			TELEFUNKEN	DO COO CT
ı	939P/03607, 939P/03609	RC 140M	850p	FB632 F8639	RC 632 ST RC 639 ST
П	NOKIA				NC 033 3 1
۱	SATELLITE	RC 550	850p	THORN/FERGUSON	11 TO 25 TO
L	NORDMENDE	NC 550	goop	3V35-42	RC 342
ı	TC2336	RC 351N	850p	3V31-32	RC 344
L	CMC1, TC3519	RC 356	875p	3V57-58	RC 628
в	OCEANIC		Time	TX10 TEXT TX10 STEREO TEXT	RC 732 RC 738
L	390C9500	RC 339	900p	TX9-90-100	RC 740
1	ORION		966	3V55, FV11	RC 783
L	RC53	RC 892	850p	TX100 FASTTEXT	RC 785
L	PANASONIC		- and	TX100 STEREO FASTTEXT	RC 789
Т	EUR51200	RC 200	800p	PROFESSIONAL	RC 790
ı	TC2200	RC 201	850p	TOSHIBA	
т	VSQ0357/NV730	RC 202	875p	CT937	RC 950
П	TNQ1621	RC 203	900p	CT9117	RC 951
1	PHILCO			201R4B	RC 952
r	CARVEL, CONCORDE,	RC 108	850p	SCHOOL STATE	28085000
ı	MERCURY, TELESTAR	00.450	000	UNIVERSAL PROGRAMMABLE RI	EMOTE CONT
I	TC10	RC 152	900p	Controls up to 4 different devices v	
1	PHILIPS	- Mary Control	220/3	remote controls including TV, audio	
1	RC5002,5154	RC 134	850p	(need original remote control	
I	KT3 NON TEXT	RC 135	825p	Order code: IR100R	Price:
	69117032	RC 178	875p	We stock Remote Controls for or	
1	69117194 PC5001 LININ	RC 180	875p	models. Ring for further details	on 081-900-23
L	RC5991-UNIV	RC 300	580p		CHINA IN

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remote controls including TV, audi	
(need original remote contro	ITC program)
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* RCA ADJUSTMENT TOOL FOR TAPE GUIDE POSTS	* 1.27mm
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Spring Hook Micro Sc VCR Head Extractor	rawdriver
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Price

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850p 850p

700p

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875p

850p 800p

875p 850p

700p 850p 850p 850p

850p

850p 850p 900p

700p 700p 750p 675p

850p 750p

850p

850p 850p

650p 800p 800p 575p 575p

675p 800p

650p

650p

850p 800p 800p

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Value	Order Code	Price	Order Code	Price
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250mA	FUSE02	75P	FUSE18	60P
315mA	FUSE03	75P	FUSE19	60P
400mA	FUSE04	75P	FUSE20	60P
500mA	FUSE05	75P	FUSE21	60P
630mA	FUSE06	75P	FUSE22	60P
800mA	FUSE07	60P	FUSE23	60P
1A	FUSE08	60P	FUSE24	60P
1.25A	FUSE09	60P	FUSE25	60P
1.6A	FUSE10	60P	FUSE26	60P
2A	FUSE11	50P	FUSE27	60P
2.5A	FUSE12	50P	FUSE28	60P
3.15A	FUSE13	55P	FUSE29	50P
4A	FUSE14	55P	FUSE30	50P
5A	FUSE15	60P	FUSE31	50P
6.3A	FUSE16	60P	FUSE32	50P

FUSES				
CURRENT RATING	ORDER CODE	PRICE		
CERAM	IC PLUG TOP	Washington,		
3A	FUSE33	100P		
5A	FUSE34	100P		
13A	FUSE35	100P		
20MM CEF	AMIC TIME LAG			
3.15A	FUSE41	190P		
4A	FUSE42	100P		
5A	FUSE43	100P		
6.3A	FUSE38	100P		
8A	FUSE39	100P		
10A	FUSE40	100P		
32MM CERA	MIC SLOW BLOW			
8A	FUSE44	210P		
10A	FUSE45	210P		
15A	FUSE46	210P		
20A	FUSE47	210P		
38MM CERA	MIC SLOW BLOW			
10A	FUSE48	875P		

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ICPF38 ICPN10 ICPF50 ICPN15 ICPF75 ICPN20 ICPN5 ICPN25 Price: Only 30p each

Price: Unit 3up each
AUDIO CONTROL HEAD
Amstrad Original No: 150751
Used on Amstrad TVR1.2.3, VCR4800, 4800Mil, 4700
Funai V2S, VCR4800, 4800, 5200, 5600, 6600, VIP3000, 5000
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Ultravox
Order Code: AH01 Price: £13.50

Amstrad Original No: 153154 Used on Amstrad 008900, 8904, VCR2000, 6000, 6600, 8602, 8603, VCR8604, 8700, 8704, 8714, 8800, 9005, 9244

9244
Also fits: Antitech, Boadstec, Casio, Crown, Fidelity.
Goidhead, Granada, Hinari, Marguant, Omega, Protex,
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Replacement Video Cassette Housings

MODELS

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Experience shows that 50% of all receiver power supplies 'bounce' unless the correct precautionary measures are taken when being serviced. A kit of all the recommended parts is supplied for the 4 most popular models, which when fitted should overcome this.

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PACE SS9000, 9200, 9010, 9020, 9220	SATPSU2	650p
AMSTRAD SRD510, SRD520	SATPSU3	850p
AMSTRAD SRD500	SATPSU4	650p

#### Replacement Video Heads

MAKE	MODELS	PRICE
HITACHI	VT570, VT575, VT576, VT580, VT585 VT588, VTF70	3100p
LT.T.	VR3761	3100p
JVC & FERGUSSON	HRD950, HRD960, HRD960, FV46	5000p
LUXOR	VR3761	3100p
MITSUBISHI	HSE51	3000p
NATIONAL	NVFS200, NVFS90, NVV8000	4600p
PANASONIC	NVHD100, NVHD101, NVHF100	3100p
	NVSD	1400p
	AG7330, AG7350, AG7355, AG7450	5000p
	NVFS100	5000p
N.E.C.	D5600	3500p
SANYO	TLS1000P, TLS1001P, TLS1100	3100p
	VHR7800, VHR7810, VHR8000SP, VHR8801SP, VHRD4800	3100p
SHARP	VCH80, VCH81, VFH815	28000
	VCA33, VCA36, VCA43, VCA44, VCA46, VCA49	1500p
	VCA55, VCA63	2200p
SONY	SLV656, SLV715, SLV757, SLV777, SLV815, SLV825	4600p
	SLV353UB	3200p
	CCDF340E, CCDF500E, CCDV90E, CCDV95E, CCDSP5E	<b>480</b> 0p

#### Original Video Heads

MODELS	PRICE
NVG20, NVG21, NVG22, NVG25 NVG25, NVG28, NVG200, NVD48 PART NO: VEH 0343	3000p
NVG33, NVG45, NVG46, NVL23 NVL25, NVL28 PART NO: VEH 0417	2900p
NVJ30, NVHJ33, NVL20, NVL21, NVG30, NVG31, NVG40, NVG130 PART NO: VEH 0416	2700p
	NVG20, NVG21, NVG22, NVG25 NVG25, NVG28, NVG200, NVD48 PART NO: VEH 0343 NVG33, NVG45, NVG46, NVL23 NVL25, NVL28 PART NO: VEH 0417 NVJ30, NVHJ33, NVL20, NVL21, NVG30, NVG31, NVG40, NVG130

#### **Audio Control Head**

AMSTRAD ORIGINAL NO: 150751
Used on: AMSTRAD TVR1, 2, 3, VCR4600, 4500MKII, 4700,
FUNAI VS2, VCR4600, 4800, 5200, 5600, 6600, VIP3000, 5000
Also fits: FIDELITY, FUNAI, HINARI, PROUNE, SCHNEIDER,
TOWADA, UNIVERSUM
ORDER CODE: AH01 PRICE: 1350p

OHDER CODE: AHOT PRICE: 1350p
AMSTRAD ORIGINAL NO: 153134
Used on: AMSTRAD DD8900, 8904, VCR2000, 6000. 6100, 8600, 8602,
8603, VCR8504, 8700, 8704, 871, 8800, 9005, 8244
Aso fits: ANITECH. 80NDSTEC. CASIO, CROWN, FIDELITY,
GOLDHAND, GRANADA, HINARI, MARQUANT, OMEGE, PROFEX,
SCHNEDIER, SEG, SENTIRA, SHINTOM TASHIKO, TATUNG,
TOWADA, UNIVERSUM ORDER CODE: AH02 PRICE: 1450p

#### Replacement Audio Control Video Sound **Head for National Panasonic**

LET NUMBER	MODELS	PRICE
BR 0091	NVG7 etc	875p
BR 0050	NV300, NV340 etc	875p
BR 9061	NV777 etc	875p
5R 0103A	NV250, NV450 etc.	625p
SP 0125		625p
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GRANADA	VHSDP1
	VHSYJ2
GOLDSTAR	GHV1290P, 1291P, 1295 VCP4200, 4300, 4301, 43
- 1900	GHV51, 1221, 1232, 1240
FERGUSON& IVC	3V38 3V39 8943 8944

100	VHO132	CHOI	Sounh
GOLDSTAR	GHV1290P, 1291P, 1295P, 9400. 73401, GSE1295P, GSE1891P, 20001Q, 20051Q, VCP4200, 4300, 4301, 4305, VCP4306, 4311, 4315, 4316,4320, 4321, 4325	CH25	2000p
-	GHV51, 1221, 1232, 1240, 1241, 1242, 1244, 1246, 1248, GHV8000, 8200	CH26	2900p
FERGUSON & J.V.C.	3V38, 3V39, 8943, 8944, 8951, 3V36, 3V36, 3V49, HRD 110, 111, 120, 121, 225	CH01	2600p
	3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V57, 8945, 8947, 8948, HRD140, 141, 150, 157, 158, 160, 250, HRD257, 455, 566, 566, 725, 755	CH02	2600p
	8948, 8950, FV10B, 12L, 13H, 14T, 20B, 21R, 22L, 26, 395, HRD230, 430, 530	CH03	2600p
	3V58, 3V59, 3V64, 3V65, FV11R, 8950, 8951, HRD170, HRD180, HRD370	CH04	2800p
	FV31R	CH19	4300p
	HRD515, 520, 527, 540, 550, 580, 600, 610, 620, 660, 670, HRD830, 840, 850, 860, 4050, 6600, FV37H	CH20	2400p
	HRD540, 580, 830, 860, 910, 960, HRD970, HRDX29, FERGUS ON FV57H	CH27	2400p
I,T.T.	VR3605, VR3905	CH01	2600p
	VR3918, 3926, 3946, 3948, 3976, 3986, 3995, 3997, 6948	CH02	2500p
	VR3916, 3926, 3946, 3948, 3976, 3986, 3995, 3997, 6948	CH02	2600p
NATIONAL PANASONIC	NV730	CH06	4300p
N.E.C.	N830EG, N831EG, N832, N833EG	CH01	2600p
	N895	CH02	2600p
PHILIPS	CASSETTE LIFT ASSEMBLY (69120366) DV186, 190, 286, 471, 562, 761, VR6180, 6182, 6185, 6285, VR6290, 6291, 6293, 6362, 6367, 6393, 6467, 6468, 6470, VR6561, 6670, 6760, 6761, 6870, 6970	CH05	1100p
STATE OF STATE OF	VR6443	CH22	2900p
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VCS211, 244, 5055, 605, VCB230, VCD806G, 810G, VCT212, 310, 410G, 610

V342, 343, 352, 353, 360, 364, 368, 4210, 4230, 4260, 4400, V5500, 6000, 8540

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FREEZE IT	170ML	SP04	220p
FREEZE IT	400ML	SP16	350p
FOAM CLEANER	400ML	SP05	170p
ANTI STATIC	150ML	SP06	170p
AEROKLEANE	135ML	SP07	200p
AERO DUSTER	150ML	SP08	220p
AERO DUSTER	400ML	SP17	425p
PLASTIC SEAL	200ML	SP09	200p
GLASS CLEANER	250ML	SP10	160p
COLDKLENE	250ML	SP13	200p
EXCEL POLISH 80	250ML	SP18	150p
ADHESIVE 120	400ML	SP19	190p
LABEL REMOVER 130	200ML	SP20	240p
REFURB 140	400ML	SP21	240p
TUBE SILICON GREASE	50 GRAMMES	SP11	200p
TUBE SILICON SEALANT WHITE	75ML	SP22	280p
TUBE SILICON SEALANT CLEAR	75ML	SP23	280p
TUBE HEAT SINK COMPOUND	25 GRAMMES	SP12	150p
DRIVE CLEANER	200ML	SP24	150p
SCREEN CLEANER	200ML	SP25	150p
COMPLITER CARE KIT		SP26	2100o

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V55, V57

V65. V66

VCA100, VCH851, VCH852

V320, 321, 323, 326, 4200, 4300

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9V MOTOR	170p
12V CW MOTOR	170p
12V CCW MOTOR	170p
13.2 CCW MOTOR	290p

PREE

2300p

CH05

CH24

CH22

CH23

CH24

CH02

CH02

CH01

CH02

2500<sub>0</sub>

2500p

2500p

2600p

2600p

2500p

#### Cassette Tape Heads

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# TELEVISION



#### Whose Baby?

It doesn't seem often nowadays that an individual receives acknowledgement, let alone a substantial award, for research in the TV field. So the news that Larry Hombeck has been awarded the Eduard Rhein Foundation's Technology Award for inventing the Texas Instruments' digital micromirror device (DMD) is welcome. The award is made for basic research into, or development in, the fields of radio, television and information technology and has a cash value of DM167,000 (about £75,000).

For those who haven't been following digital light processing, which was mentioned in George Cole's report from Berlin last month and has received several mentions in teletopics, the DMD is a highly sophisticated chip which carries on its back an array of tiny micromirrors. There are at present two versions, one with 848 x 600 mirrors (each mirror produces one displayed pixel) and the other with 1,280 x 1,024 mirrors. These mirrors are each mounted on an electronically-controlled tilt mechanism within the chip. What they do is to modulate an incident light The chip is complex electronically as well as mechanically, since it has to convert the incoming interlaced TV fields to produce the digital signals that control the micromirror array. Movement and other forms of image compensation are incorporated to remove picture distortion, also extrapolation between scan lines.

The names of Cambell Swinton. Baird, Zworvkin and those in the EMI team that developed the 405-line system in the early Thirties are well enough known, as are those of many others who contributed to television in the early days. Many from the early days of radio and electronics are remembered from circuits that still bear their name - the Eccles-Jordan counting circuit, the Hartley, Colpitts and Miller oscillators, the Wheatstone bridge and the Schmitt trigger for example. Then there's Professor Yagi of the aerial. But who led the team that developed the shadowmask tube (the idea initially came from the Hazeltine Corporation, being taken up by RCA when it required a display device for its colour system)? Who devised teletext? Which names do you associate with satellite and digital TV technology? In truth, very few.

We all know that Bardeen and Brattain first discovered the transistor effect, while Shockley devised the junction transistor. Thereafter there are few names that come to mind in the semiconductor field. Clarence Zener, Schottky and Darlington – after that I, personally, draw a blank!

Could the relative lack of well-known names from more recent times be to do with the fact that research today, being infinitely more complex, depends on larger teams of scientists and engineers? Yet the EMI TV system development was very much a team effort, and the members of that team became well known. But teams today are probably much larger, while ideas tend to get thrown about and developed by different firms let alone teams. Research in the semiconductor memory field has become so expensive and complex that major electronics manufacturers worldwide have to collaborate.

The award to Larry Hornbeck at least brings recognition to one current man in TV research. This is welcome but unusual: one doesn't expect to get to know many of the names behind such current advances as digital TV, tape and disc systems and the various forms of flat-screen display. Probably recognition for technical achievement has always been a rather hit or miss affair, with hundreds of unacknowledged contributors to our technology.

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#### **COVER PHOTO**

This month's cover photograph shows part of the Pace MSS100, a recently introduced entry-level satellite receiver-decoder with a revolutionary profile. Our thanks to Pace for the loan of the receiver.

## Letters

#### AN UNHELPFUL APPROACH

Problems with manufacturers who are reluctant to offer technical advice to any but their top account holders have been aired in these pages from time to time. Clarion has gone a step farther.

We needed a cassette motor for a relatively new model. On contacting Clarion we were told that as we didn't have an account we would be transferred to the Customer Services department. This turned out to be rather difficult. When we did eventually get through we were told that spares couldn't be supplied direct. We would have to get in touch with the local repair shop, which is some thirty miles away.

A call to this company didn't really help. They told us that they couldn't supply spares to third parties, and had previously got into trouble for doing so. They were sympathetic and tried to suggest alternatives, unfortunately to no avail.

Clarion suggested that we open an account if we needed spares on a regular monthly basis. This seemed to be a waste of time, as we rarely need any specialist Clarion parts — and an account would have taken time to set up.

We had a similar experience recently when we needed an instruction manual for a Toshiba fax machine. Various phone contacts around the country were given to us, but all came up with the same type of reply – "sorry, we don't supply parts or information to third parties." Just one phone call did the trick a few days later when we required an instruction manual for a Samsung fax machine. We were given the price immediately and the manual arrived by return of post.

It seems that while some companies go out of their way to be helpful, others just put obstacles in your way. You can guess whose products we will be recommending to our customers in future.

Radio and Electronics Engineer, Cambridgeshire. (Name and address supplied.)

#### **ELECTRONIC SET-UP PROBLEM**

This is a plea to manufacturers to give thought to us poor chaps on the ground who have to grapple with innovations that, however well intended, often simply make our jobs more difficult. For example I was recently called to a Panasonic TX25W3 TV set (Euro 1 chassis) whose colour subcarrier oscillator required adjustment – the customer's complaint was that the picture went into coloured bars when the set was warm.

Now with this chassis all adjustments are made electronically, using the remote control unit to gain access to the set's service mode. Sounds marvellous – no need to remove the back cover! But I was not in possession of the necessary information, and guessed that the likelihood of my hitting on the correct sequence by chance was about the same as winning the Lottery. So the set was hauled into the workshop and the technical people at Panasonic were contacted. I was told that to enter the service mode you turn the bass to maximum, the treble to minimum and then press the button marked reset while at the same time pressing the volume down button on the TV receiver. Obvious really, when you think about it!

Once the set is in the service mode the various adjustments can be selected and made using the remote control unit's Fastext buttons. I selected 'colour VCO' and found that the setting was +37, way off the recommended -002. Carrying out this adjustment cured the problem and the set was then returned.

Fortunately Panasonic provide technical information to non-dealers, so I escaped without having to buy a service manual. With many other manufacturers the manual would have had to be obtained, turning a simple adjustment into an involved and relatively expensive job.

Manufacturers should realise that many of us engineers have to deal with a wide range of different models, most of which now have unique control set-ups. We can't be familiar with them all! So come on you manufacturers, use a bit of common sense. It shouldn't be necessary to have to obtain a service manual to carry out simple adjustments. Information on gaining access to these hidden functions could easily be printed on a label and stuck to the inside of the cabinet.

Colin Hartley, West Yorkshire.

#### **NEWSGROUP**

If anyone is interested in me forming a newsgroup for the TV trade, like the ham radio one, please e-mail me on "stephen@hardrock.zynet.co.uk". I envisage tips, queries, items for sale and general topics as the main subject matter for the group, but other things would probably be acceptable. Please let me know.

S. Woodbridge-Smith, Argyle TV and Video, Plymouth.

#### PRODUCT QUALITY

The quality of the electronic equipment being sold to the public seems to be declining remorselessly. There are VCRs with plastic mechanics that fail if you try to insert a cassette the wrong way round, TV cabinets that crack at the drop of a hat, and products that crack when you try to repair them because they have no service position. All, it seems, in the name of cost cutting. Here are some examples:

- (1) Try removing the back mechanism PCB from a midmount Matsui VCR. It's easy to break the PCB as you remove it, or crack the main PCB.
- (2) Ferguson and Toshiba VCRs have a small plastic gear that drives the carriage. It can break if the customer tries to put in a cassette the wrong way round. They also have the drum motor stator (coils) mounted on the main PCB with the rotor being part of the mechanism. So you can't separate and test them.
- (3) In the Panasonic K mechanism arm P5 (part of a long, thin strip of metal) bends. On the G deck it was a cast gear arm.
- (4) There are JVC control cam gears, plate assemblies and load gears that sheer, or the plastic twists.

There are countless more examples, too numerous to mention. Why are we obsessed with making things smaller, service unfriendly and very cheap? I bet that if VCRs cost £500 for the most basic models the public would still buy them.

Today's products should be idiot proof. You can't watch

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small children all the time, and it's easy to insert a cassette the wrong way round. Doing this shouldn't result in the machine going into the self-destruct mode! Equipment needs to be moved, and it needs to be serviced.

Whatever happened to the plastic covers one used to find on the primary side of switch-mode power supplies? With some VCRs the live mains supply is on the same PCB as the low-voltage electronics. One small mistake and you can end up with a nasty shock. You find this unsafe practice in Amstrad, Sony, Ferguson and Toshiba VCRs — I'm sure there are many more. Have these products been passed for safety?

Name and address supplied.

#### AKAI VS-F200

John Edwards' fault note on this model (September, page 793) was correct as far as it went. There can however be a problem with damaged eject gear teeth with this VCR and earlier machines that use the same mechanical design. The cause is poor meshing between the eject gear and the eject slider, because the black plastic lug that retains the slider provides insufficient support should excessive stress be placed on the mechanism. A technical note (AV 10014) on this problem was issued at the time, outlining a remedy (fit new type arm shutter, add new spacer, replace eject gear if teeth are damaged, apply grease to specified points). Later mechanisms of this design were upgraded, with a double-width lug that gives good support.

The purpose of the arm damper and spring combination is so that when a cassette is inserted it drops down into position smoothly, and subsequently ejects smoothly. If the combination is not fitted, the cassette will drop into position

and flip back up too quickly - a toaster effect.

When a cassette is inserted, a lug that's part of the cassette load block runs along the moulded groove in the chassis. It pushes the arm damper down, under spring tension, as the cassette moves into position. Otherwise there is a big drop for the cassette as it turns the 90° bend to go down. The heavier the cassette, the more apparent the effect. This is why it's called an arm damper—it cushions the drop, and works the same in reverse (eject).

Alan Murphy, Technical Liaison Officer, Akai (UK) Limited,

Hounslow, Middlesex.

#### HINARI VXL8/9, AMSTRAD VCR6000 ETC

John Pitt-Francis's advice on these machines (November, page 44) is not entirely correct. He is right to say that the cause of no rewind and fast forward is unreliable trigger lever action, but not in recommending edge cutting, increased spring tension and light greasing as a cure.

We see a fair number of these decks in various low-budget VCRs, and used to advocate the filing and greasing method. When the units began to bounce however we looked more closely at the root cause of the fault. The reason the trigger lever (item 260) is left proud is that the brake plate (item 261) which carries it doesn't travel far enough to the right. The cause is wear on the rubber block, which the brake plate pushes against, on the chassis. All that's required for a lasting cure is to replace this rubber pad (item 41, Amstrad part number 153091), which is available from Amstrad or CPC.

Rob Younger, Darton Electronics Services, Barnsley, Yorkshire.

## Teletopics

#### Projection TV Systems

Texas Instruments recently gave a demonstration, with a number of its customers, of projection TV systems using its digital light processing (DLP) technology. The Brussels demonstration signified the official launch of DLP systems in Europe. The of DLP technology is TI's micromirror device (DMD) chip, which uses an array of digitally-controlled micromirrors to produce a picture by modulating the light from one or more light sources. An optical system, including a colour filter wheel, projects the modulated light on to a screen. TI has announced that it will not be selling the DMD chip separately: OEM customers must buy the whole light modulation and optical system, which TI can tailor to meet particular requirements.

For example a Nokia back-projection system using two DMDs, one for red and one for green and blue, produced a 50in. (diagonal) display. The reason for the two DMDs is that the light source used in this application emits more blue and green than red light, enabling these colours to be

time-multiplexed by a single chip. nView demonstrated a single DMD projector aimed at the office presentation market, while Rank Brimar demonstrated a high-power (more than 1kW) projector that uses three DMDs, designed to produce displays on screens of about 5m (diagonal). The light source makes a big difference to cost, ranging from \$1,000 to several thousand dollars.

The quality of the pictures has been widely acclaimed. But problems remain, in particular the fact that the DMD chip yield is not high. Failure mechanisms are also still being studied, something that takes time with new technology.

Samsung has developed a 30in., widescreen 3D projection TV system. It uses two projectors and head-tracking technology that moves the image as the viewer's eyes move. The system is due to be launched late next year. Samsung has also developed a 22in. TFT LCD screen that cost some £15m to develop over four years. The screen is less than 25mm thick and has an energy consumption of less than 15W.

JVC is about to launch in Japan two new LCD projectors for PC and HDTV applications.

#### Satellite TV

The fifth Astra satellite, 1E, has been successfully launched into orbit at 19·2°E. It's the first of a planned series of satellites that are dedicated to digital TV transmissions. In all there will be 56 transponders, each able to provide around ten TV channels. A number of leading European broadcasting organisations, including CLT and Canal Plus, are already planning to offer services.

According to Astra's parent company SES, over five million households in the UK can now receive Astra services, three and a half million via individual dishes and distribution systems and one and a half via cable systems.

Developments in LNB technology have enabled Sky to offer a new, smaller dish. The 48cm diameter makes it 37 per cent smaller than the 60cm size previously regarded as being the minimum acceptable. The dish is intended for use in the area to the south and east of a line from Southampton to Hull.

#### Pocket-sized Video

NEC engineers have developed a pocket-sized video playback device, called Silicon View, to play back MPEG-1 video and audio stored on a credit-card sized memory board. The prototype, which has been produced primarily to prove the system, has a 40Mbyte

memory card that provides a playing time of just four The device. minutes. which has no moving parts, is unlikely become available until much larger storage capacity memory chips have been developed. It weighs 295g, the dimensions being 14.6 x 7.6 x 3.7cm with a 5 x 3.9cmscreen size.

#### TV and the Internet

Intel, the world's largest manufacturer of microprocessors, has developed technology to enable domestic PCs to receive television programmes and related information simulataneously from the Internet. The company sees its Intercast technology as an alternative to digital transmissions and broadband cable networks as a way of supplying news, entertainment and information services to domestic PCs. PCs equipped with the technology would receive TV signals with related information as embedded signals. This could include point-and-click links giving access to pages of information on the Internet.

Philips has developed a television-based method of using the Internet. Its Internet connection system is designed around the use of a CDi player. The Philips Internet connection kit consists of a modem that plugs into a CDi player, a telephone cable, a telephone adaptor and the CD-Online disc. According to Philips this approach should appeal to the mass market. The price of the CDi player and kit, at around £500, is far less than the cost of gaining access to the Internet via a PC.

#### Servicing News

Hitachi is appointing service agents and closing its Middlesex-based service operation. Techsure in Greenford is being closed down, though Hitachi will keep a specialist camcorder

repair team at Hayes. It will also deal with "non-routine service matters". The authorised agents will be service specialists, not retailers. There is no change to the spares ordering system.



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## VCR Clinic

#### Panasonic NVG21

The symptoms were badly distorted sound and diagonal lines across the picture. Anyone optimistic enough to try to play a tape would see that the drum and capstan speeds were incorrect. In a machine of this age the initial checks should be carried out in the switch-mode power supply. We found that C1019 (1,000µF, 25V) had died of old age.

B.S.

#### Panasonic NVG10

An intermittent mechanical fit was the complaint with this machine – the mechanism would shuffle around, the machine then powering down. Selecting rewind or fast forward would sometimes produce a quick shuffle, then the command would be ignored. A machine of this age is usually in dire need of maintenance kit VUD4103KIT, but the part needed to cure the symptoms just mentioned, the mode switch, is not included. Its part number is VSS0135.

B.S.

#### Panasonic NVJ40

The machines in this range and subsequent ones incorporate an internal fault diagnosis system. Pressing eject, fast forward and rewind puts the machine in the fault diagnosis mode (with shuttle search machines press eject and hold shuttle forward). The VCR will then recall from its memory the last registered fault –unless it has been unplugged from the mains supply since the last fault occurred.

The fault with this machine was intermittent stopping. Unfortunately it occurred once every two weeks. But the machine said E2, which according to the manual means reel stop problems. So we turfed out the two ON2170 reel sensors and cleaned the reflector surfaces. Our sincere thanks to the diagnostic system – the machine hasn't darkened our doorway since!

B.S.

#### Akai VS765

This machine wouldn't respond to any function requests. There was also no clock display. A start was made in the power supply, to see whether there was anything obvious amiss, but the voltages at plug WP201 were all correct. Attention was next turned to the microcontroller chip IC403 and the front control panel. We found that the 5V supply to the chip and the panel were o.k., but the 5V reset voltage to the clock microcontroller chip was very slow in coming up while there was no reset voltage at all at the microcontroller chip on the main board.

The reset pulse is derived from the BU5V supply, which was very low. It comes from TR205 on the main panel. This transistor should receive a 23V input, but the voltage had fallen to only 5-6V. The cause was the  $15\Omega$  safety resistor R221, which had gone high in value. A replacement produced normal operation. M.L.

#### Akura VX90

The customer said that this machine would shut down when play or record was selected. Fast forward and rewind were o.k. Once the top cover had been removed I saw that there was no drum rotation. Although I didn't have the circuit

Reports from Brian Storm, Mike Leach, Terry Lamoon, David Belmont, Paul J. Charlton, Robert Marshall, Stephen Leatherbarrow, Ray Porter and Michael Maurice

diagram, I decided to strip out the main PCB and investigate. Unfortunately first-line checks proved to be inconclusive. As no resistors or safety components had failed, I felt that a manual would be required.

While I was trying to relocate the top board however my hand brushed against the r.f. booster/modulator. It was very warm. I then noticed that the r.f. channel output adjustment was chewed and possibly damaged. When the modulator was disconnected from the PCB the drum rotated and playback was achieved. A new modulator put matters right. The job might have been easier had there been a few more safety components.

M.L.

#### Samsung VIK320

Watch out for this one: if the machine starts to do weird things by itself, e.g. trying to load with no cassette inserted, or the cassette flap 'flapping' with no tape in, check for dryjoints at the lighthouse.

M.L.

#### Matsui VP9401

This machine wouldn't load. As there was no drive to the loading motor I pulled the machine apart to gain access to the loading drive chip. This was very hot and its casing was damaged. The machine worked when a replacement chip had been fitted, but the chip was still overheating. A new loading motor put that right. The machine then worked fine.

T.L.

#### Matsui VX1100 etc

Intermittent mechanism faults are now common with this range of machines, e.g. failure to eject, not playing, etc. If you get this problem you can clear it by cleaning the mode switch. For a permanent cure however replace the switch with the improved type.

T.L.

#### Matsui VP9401, VP9501

For problems with sound recording or playback, or any other intermittent deck problems, check the jump connection board at the rear of the mechanism. You will probably find dry-joints. Resolder all connections and give the machine a good test.

#### Sony SLVE40

This machine wouldn't eject tapes. The mechanics didn't jam: the mechanism would go to the point where it was ready to eject, then just sit there. The culprit was the mode switch, a replacement restoring normal operation. The mechanism bears an uncanny resemblance to the deck used in the Amstrad double-deckers, budget Aiwa machines, etc. D.B.

#### Hitachi VT65

Intermittent failure to record the picture was the complaint with this machine. When a sample tape provided by the customer was tried we found that no f.m. had been recorded. When the fault eventually put in an appearance in the workshop we found that little f.m. came from the modulator chip.

A replacement thick-film unit cured the trouble.

D.B.

#### **Panasonic NVF65**

This machine was dead with just a squeal from the power supply. When the main PCB was disconnected the power supply worked perfectly. So it was time to start disconnecting the loads to find out which one was imposing the excessive load. The 45V line turned out to be the culprit. Now there's a rather unusual shunt stabiliser across this rail, based around transistor Q6021 which was being turned on hard. A fault in its base drive circuit was therfore suspected. But checks here proved fruitless. The cause of the problem was the fuse on the main PCB. It was dry-jointed. Resoldering it cured the problem.

#### Sanyo VHR7700

This machine was dead, with only the clock display showing. There was no switched 5V supply because Q5402 was open-circuit.

D.B.

#### **Amstrad UF20**

There was buzz on the E-E sound and tuner signal recordings: recordings via the scart socket were fine. In this and later Amstrad models the tuner, i.f. section and r.f. converter are housed in one can, part no. 254873. A replacement cured the fault.

D.B.

#### Ferguson FV31R

This machine would jam intermittently then turn itself off. It uses optocouplers as mode switches. A sub-panel mounted on the power supply/servo PCB feeds the pull-up resistors associated with these optocouplers. The cause of the fault was a dry-joint on this panel.

D.B.

#### Matsui VX800/Saisho VR1000

This machine's mechanics failed to complete the loading cycle in either play or record. On inspection we found that the cam gear was bone dry. A replacement together with some grease restored normal operation.

D.B.

#### Panasonic NVFS90

This machine's playback picture was certainly below par. We suspected the heads but the drum is very expensive. So some checks were carried out. We found that the source of the trouble was on the delay PCB, which sits on its own at the bottom of the machine, being connected to the main PCB via various cables. A clean signal arrived at this board, but a very poor signal left it. On further investigation we found that capacitors C3501 and C3506 had dried out. Replacing them restored the excellent pictures that this superb SVHS machine produces.

D.B.

#### **JVC HRD660**

The pulley ring on the capstan motor in these machines tends to split, the result being either cyclic interference to playback accompanied by a ticking noise or complete failure if the pulley and belt actually come off. The pulley is

a toothed gear. JVC can supply a replacement, part number PTU96031-678C, to eliminate the need to replace the capstan motor.

P.J.C.

#### **Amstrad DD8900 Twin Deck**

The problem with this machine was no fluorescent display. R29 ( $15\Omega$ , fusible) in the power supply was open-circuit. Replace D29 (BA157) as well, or the repair will probably bounce. It's wise to mount these two components off the board to increase the air circulation around them. P.J.C.

#### Mitsubishi HSM34

This machine had a cassette stuck inside it. We found that the eject sequence couldn't be carried out because the main reel belt was off its pulley at the capstan motor. The pulley ring was off the capstan too – a split had appeared in the pulley. This would normally call for replacement of the capstan motor. We've had success however by simply fixing the split pulley back on its shaft. The small split doesn't impair performance.

P.J.C.

#### Akai VSF30EK

Fluorescent display failure is common with these machines. A kit is available from Akai, part number BX744015J. It consists of replacements for C446/7 and D416/7 together with details of a small modification to extend tube life.

P.J.C.

#### Mitsubishi HSM54 and Variants

This machine seemed to load the cassette correctly until either play or record was selected. It would then cut off, after approximately three seconds. The cause of the fault was the cam pinch lever (L016) which had become misshapen where it contacts the pinch cam, preventing completion of the loading sequence. I've also known this part to break completely, the symptom then being either failure to accept a cassette or tape damage on load/eject.

P.J.C.

#### Hitachi VTM830

This machine didn't record sound and there was no E-E sound whilst recording. When the record button was pressed there was a noise as if the sound was being strangled: sad, really! The sound feed to the modulator and the scart socket is from pin 30 of the LA7297 record/playback processor chip IC401, which also switches on the 9V supply to the bias oscillator. The bias oscillator transistor Q401 had died.

R.M.

#### Goodmans TX1101 etc

The deck used in this machine is the same as that in the Amstrad VCR6000 and many other, often obscure, models. There are many similarities in the electrical/electronic systems as well. The following fault, which has become common, applies to them all.

The usual symptom is switching from the LP to the SP mode without being asked. Ripple on the 'mcoµ +5V' supply is the usual cause – it's at the rightmost power supply plug pin. The component that's responsible is either the bridge rectifier or C509 (220µF, 25V). We replace them

both, also the pinch roller, then set up the control head. There have been no comebacks after doing this.

It's also common to find that the audio/control head tilt adjustment was incorrect from new (as it was with the Amstrad machines), to the extent that there is insufficient tension at the top edge of the tape. This produces rippling at the top edge and thus poor tape/head contact.

C509 can deteriorate further. As a result the 5V supply is so poor that the microcontroller chip fails to reset. The deck continues to carry out its initial shuffle however.

S.L.

#### Samsung VI711

Intermittent play was the customer's complaint. I assumed to start with that the cause was of the usual idler or belt kit variety. Not so. Another symptom I noticed was patterning on the E-E pictures. So I checked for hum on the supply rails. This was in fact the cause of the trouble: C102 (3,300µF, 35V) had fallen to a very low value. S.L.

#### Sharp VC390H

After carrying out a deck service I did a full function check and was suprised to find that there was a no record fault. Playback was o.k., but the machine would neither record pictures and sound nor erase previously recorded material. The Rec12V line seemed to be an obvious thing to check. Bingo – the voltage was missing. It comes from the 2SA950 transistor Q807 on the bottom 'servo' board. As we didn't have a 2SA950 a BC640 was tried instead. It provided a complete cure.

#### Matsui VX735A/Saisho VR3300

The customer complained that the aerial socket was too hot to touch! When we tested the machine we found that the r.f. modulator's metal case was indeed extremely hot. A check on its supplies showed that one read 18V while the other was correct at 12V. These voltages were measured at CP501. Further checks in the power supply revealed that Q502 (2SD1207) was short-circuit all ways round.

#### Orion D4500

No playback was the customer's complaint. In fact the machine's r.f. output lacked video modulation because of an intermittent dry-joint on the wire link next to R4203, which is near the LA7282 chip and the r.f. modulator can.

The innards of this machine bear a close resemblance to the Matsui VX1000/2000. R.P.

#### Fisher FVH5100

Failure to play was the original symptom, with auto-ejection of the cassette. A new idler assembly cured that. But there was occasional colour dropout when playing a known good tape, leaving a white-spotted monochrome picture. Scope checks showed that one head's f.m. signal was missing at the output from the BA7253S three-head amplifier and switching chip. By the time the head-switching signal at pin 1 could be measured, the fault had cleared and didn't return for a month – in the customer's home, of course. Replacing the upper drum assembly cured the fault.

The original head assembly appeared to be in perfect

condition. There must have been an intermittent break in a head winding or head ferrite, possibly caused by the tape brought along by the customer – it had been spliced using Sellotape.

R.P.

#### Matsui VX800A/Saisho VR1200

This machine had been in several times because of the same fault: intermittent switching off. I changed the mode switch, but this made no difference. Then, quite by chance, I discovered that the spring action of the play and stop switches had been lost. As a result they were not making when required. New switches cleared the trouble, but two weeks later the machine was back. This time the cam had seized. After replacing this item we'd finally seen the back of the machine.

M.M.

#### Ferguson FV62L

Capstan wobble was the trouble with this machine – the picture broke up in both rewind and forward search. The culprit was IT25. After replacing it the machine behaved normally.

M.M.

#### Matsui VX1100

There was no LP playback colour with this machine, though recording was normal. The cause was eventually traced to C4316. One of its legs was dry-jointed.

M.M.

#### Telefunken VR4940

This machine is similar to the Ferguson FV32. The one we had would load up, start to play, then stop. I suspected the reel sensors, but replacing them made no difference. Replacing the mode switch put matters right.

M.M.

#### Matsui VX2700

Intermittently reverting to standby, after long periods of varying duration, was the complaint with this machine. Resoldering a number of dry-joints around the microcontroller chip IC1101 cured the trouble.

M.M.

#### Philips VR727

This machine's threading motor had seized and its drive chip had burnt out. Unfortunately the chip is not listed separately in the manual: you have to replace the capstan drive board. Replacing this and the motor restored normal operation.

M.M.

#### Ferguson FV62L

The customer described the symptom as "a vibration on verticals when a tape is being played". The fault was intermittent as well. A call to Ferguson Technical produced the suggestion that IT25 was responsible. Replacing it cleared the trouble.

M.M.

#### Hitachi VT430

This machine wouldn't eject tapes. The cause was simply a slack reel drive belt – in the eject mode the belt drives the carriage. A new belt put matters right.

M.M.

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## Satellite Workshop

A lot of our business nowadays seems to start with a telephone call. The results can be quite mixed.

#### **Bright Star**

One of our local shops had sold an Amstrad satellite receiver system to a customer from Baslow, which is a rather posh sort of place. A few weeks later he returned to the shop to ask about buying another dish and LNB. He was naturally sold these items, and away he went. The next bit is where I became involved. He had rung the shop with a question and they had put him on to me!

I quizzed him for a while to get his story. He told me that he has a holiday cottage in France and that he had bought the original system for use there. It had been such a success that he'd decided to buy another dish for UK use, taking the receiver itself back and forth with him on his visits.

Now that I knew the background, I asked what the problem was. He wanted to know how to set up the dish. Being the sort of person I am, I enquired how he'd aligned his French dish.

Apparently he was able to "see the satellite" at his cottage in France. He had only to point the dish at it therefore.

Intrigued, I asked him what the satellite looked like. He replied that it was "a bright light in the sky"... Unfortunately he couldn't see it when in England.

At this point I mentioned its distance from earth and added that it doesn't have headlights.

Obviously a job for a local installer, but how lucky can you be – just pick a star at random and point the dish at it!

#### **Funny Pictures**

I had a call this morning from a lady in distress. She couldn't receive satellite pictures at all, neither would her video. Her TV set had been "playing up" or, to be more precise, "giving funny pictures". She'd tried swapping over with her portable but, as she couldn't figure out how to tune the channels, she'd swapped back.

When I arrived I found that the coaxial lead from the aerial was connected directly to the back of the TV set, and two r.f. leads connected the VCR to the satellite receiver. A quick lead swap restored the satellite TV pictures. The TV set itself was an ITT Model CT1611/2. When tapped, it would produce maximum volume and lose field hold. I assume that the cause was a dry-joint which I'll no doubt find in the workshop later. For the moment I've left the portable connected.

#### Technisat Kundendienst wir Bedanken uns bei Ihnen!

On Wednesday evening three weeks ago I received a callout while I was listening to Eric Wiltsher's Satellite Workshop (Astra radio, frequency 7.56MHz on the JSTV transponder, at 8.10 p.m. for those interested). I was a little annoyed, because I couldn't very well listen in the car!

The problem was a 'dead' Technisat 4000ST receiver, which I brought back to the workshop for investigation. It

didn't take long to find that the mains transformer's primary winding was open-circuit. As there's no longer a Technisat subsidiary in the UK, I dusted off my English-German dictionary and phoned the factory at Daun. The girl who answered said that the transformer for that model was obsolete but, if I faxed an enquiry, she thought that a replacement might be available. At least I think that's what she said!

So I faxed the information in my best schoolboy German and waited for a reply that didn't arrive. A week later however my toes were crushed by a battered jiffy bag that came through the letter box. It was a transformer, free of charge, with the compliments of Technisat! Impressed by this service, I faxed back a letter of thanks (if you're puzzled by the heading above, it should translate as Technisat Customer Service we thank you!). A note inside the jiffy bag explained that J.D. Electronics in Sudbury, Suffolk, is now the Technisat UK agent. I rang Joe at J.D. (01787 880 328): he confirmed that the transformer is a stock item, and mentioned that the firm also supplies Echostar spares. Useful to know.

#### No Connexions

A gentleman who phoned last week was happy to let me take away his Connexions CX95A receiver for repair: I made the mistake of assuming that he would be happy to pay for it! After ordering and fitting a new decoder board I telephoned to give him the good news — only £75 plus VAT. He became quite stroppy, and insisted that it shouldn't have gone wrong "after only two years".

Without an extended warranty there was little I could do about this: it was well outside the twelve-month warranty, and I'd been lucky to get a brand new Thomson decoder board so cheaply. Call me stupid but, to try to reduce the cost, I decided to see if I could fix the original decoder.

The fault symptom was display of the 'card invalid' message each time a valid card was inserted. A check on the 5V supply to the card reader showed that the voltage appeared briefly as the card was inserted, then dropped to zero. This suggested to me that the supply itself was o.k., the fault being in the card reader. It took an hour however to track down the culprit, a leaky 5.6V zener diode next to the card holder.

I compromised and suggested a £45 repair charge – expensive for a zener diode, but it helps with my petrol costs and the fact that I now have a new, unwanted Thomson decoder board in stock (it fits most Echostar and Palcom models...).

When I returned the receiver the customer asked me to install it back in the cabinet, on top of his VCR! I compromised by squeezing them side-by-side on the shelf. This arrangement still looked tidy, and provided far better ventilation. He paid me without a murmur, and seemed grateful.

#### **Decorators**

Loss of the satellite TV picture following a visit from the decorators was the complaint. When I called to inspect the installation I found that the Amstrad SRD400 receiver had popped its 630mA fuse. This suggested a possible short-circuit in the LNB or the cable. A replacement fuse melted instantly, so the diagnosis seemed to be correct.

The terrestrial pictures were also very poor however, bringing a suspicion to my mind. I traced the aerial and LNB cables through the wall and went outside. They'd been swapped over! The decorators had removed the sockets so that the cables could be pulled into the wall, allowing the new wallpaper to lie flat. They'd made a superb job of refitting the sockets — on the wrong cables!



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# The Digital Video

#### George Cole

Digital video recording systems have been used for many years in professional broadcasting studios, where there is a need for multiple dubbing and editing with little or no loss of picture quality. The consumer market is now to be offered a digital video format – the Digital Video Cassette

Electronics companies have been working on consumer digital video formats since the mid-Eighties. In 1990 Sony, Philips, Thomson and Matsushita (Panasonic) entered into discussions on a single, standard format, with the aim of avoiding the format wars that caused so much trouble in the consumer VCR market. In 1993 these four companies, plus six others, formed the High Definition Digital VCR conference. By April 1994 the total number of firms involved, from the electronics, computer, film and video industries, had grown to fifty two. They include Apple, IBM, Kodak, Texas Instruments, Samsung, BASF and TDK.

At a time when disc-based formats look as if they might replace tape the idea of launching a new tape system, albeit one that offers digital recording, may seem strange. But tape offers a higher recording capacity than disc, and is cheaper.

#### The DVC Format

There are four main standards within the DVC format. These are:

- (1) SD (Standard Definition), designed for PAL and NTSC TV systems and camcorders.
- (2) HD (High Definition), for higher picture quality.
- (3) ATV, for use with the US Advanced TV System, which will offer high-definition digital TV.
- (4) DVB, for the European Digital Video Broadcasting standard, which uses MPEG-2 video.

While the SD and HD standards were agreed in April 1994, the ATV and DVB standards are still under development. A system known as DVC PRO is designed for the semi-professional and professional markets. It's supported by several companies including Matsushita. The equipment due to be released in the consumer electronics markets during the next year will use the SD standard.

There are two types of DVC cassette. The full-sized version ( $125 \times 78 \times 14$ -6mm) is designed for VCR use. It stores up to four and a half hours of video. The mini cassette ( $66 \times 48 \times 12$ -2mm) is intended for camcorder use, storing up to an hour of video. DVC decks can use either type of cassette without the need for an adaptor. The tape width is 6.35mm.

Basic features of the SD system are as follows: two-head helical scanning; luminance horizontal resolution about 5(0) lines, with a sampling frequency of 13-5MHz and 8-bit quantisation; colour signals recorded in digital component (separate R-Y and B-Y) form, with a sampling frequency of 6-75MHz, 8-bit quantisation and a chroma bandwidth of

about 3MHz; video transfer rate 25Mbits/sec (after compression); compression system DCT (Discrete Cosine Transform), giving a ratio of about 5:1; audio recorded in PCM form, in either a 12- or a 16-bit mode. Note that the chroma bandwidth and sampling frequency quoted above apply with the PAL version, the specification being different with the NTSC version.

The drum is the same in both camcorders and VCRs. Its diameter is 21.7mm and it rotates at 9.000 r.p.m., giving a writing speed of 9.9m/sec. For the sake of comparison, the Video 8 drum has a diameter of 40mm, rotating at 1,500 r.p.m. to give a writing speed of 3.12m/sec, while for VHS the figures are 62mm and 4.86m/sec.

#### Recording System

Fig. 1 shows in basic outline the recording system. The analogue luminance signal is fed to an analogue-to-digital converter which samples it at 13.5MHz, converting the samples to 8-bit digital form. The analogue colour signal is first separated into its R - Y and B - Y components. These are then sampled at 6.75MHz and are also converted to 8-bit form. Recording the colour signal in component form means that the DVC colour bandwidth is much wider than with other domestic video formats: because more signal information is recorded, colour blur is minimised and a degree of compatibility is provided for HD operation.

The digitisation process produces a vast amount of data, far more than could be recorded on the tape. Data compres-

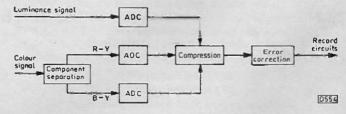


Fig. 1: Block diagram of the basic recording system.

sion is therefore required. Two systems are involved, discrete cosine transform (DCT) and variable-length coding. The compression process works in the following way.

First only the visible portion of the picture is coded – with conventional TV systems there's a certain amount of screen over-scanning. This reduces the data from 162Mbits/sec to 127Mbits/sec (NTSC figures this time). Each frame is then analysed, only the changes between successive frames being coded. This reduces the data rate to 25Mbits/sec, achieving a compression ratio of around 5:1. This is a lower ratio than with MPEG-2, which compresses the image data by a factor of around 20:1. It means that DVC images contain more

## Cassette Format

detail, and are more suitable for still-picture display, editing and frame-advance viewing.

Error correction is applied before recording.

Despite the digital compression, the DVC picture quality is good, SD standard pictures having a horizontal resolution of around 500 lines. This is better than with existing high-band analogue video formats such as S-VHS and Hi-8.

#### Track Pattern

One frame of PAL signal (converted to digital form then compressed) occupies twelve successive helical tracks. The track pitch is ten microns. Fig. 2 shows the basic composition of a track. The video data is recorded towards the centre, preceded by the audio section.

There are two possible DVC audio modes: 16-bit PCM with alternative sampling rates (32kHz, 44-1kHz or 48kHz, i.e. CD quality sound can be recorded); or 12-bit PCM with a sampling frequency of 32kHz and non-linear quantisation. Since the audio and video data are recorded separately, features such as audio- and video-only insert editing are possible.

Other data is recorded, including auxiliary information such as the recording date and time, the picture mode (e.g. wide) and the signal source (e.g. channel number). This is carried in the sub-code section. There's also room for optional carncorder information. This data can be displayed on the TV screen if required.

The ITI section of the track stores three pilot tracking signals.

DVC also stores, in the sub-code section, time-code information which is useful for accurate editing, index marking information (cue signal) which helps to find the start of a scene, and PP-ID data which is used for still picture recording and playback.

#### Tape and Cassette

As previously mentioned, there are two types of DVC cassette. The mini cassette looks like a smaller version of the DAT cassette, complete with protective lid and hub lock to prevent tape slack. A small, sliding tab at the bottom of the cassette can be used to prevent accidental recording. It holds up to an hour of video.

The standard (full-sized) cassette is a little larger than the 8mm type and stores up to four and a half hours of video.

There's a simple DVC coding system: for example, DV270 indicates a standard 270-minute cassette while DV M60 indicates a miniature cassette with a sixty-minute recording time. The playing times are the same with both PAL and NTSC signals.

DV cassettes can incorporate an optional 4Kbit chip to store data such as the type of tape and a table of contents. The basic data structure is standard, but manufacturers can decide what information they want to store in the chip. If the cassette doesn't contain a memory chip the data can be stored in the machine itself.

The 6.35mm tape (quarter of an inch for those who prefer Imperial measurements!) has a double evaporated-metal layer with high coercivity (500mT/5,000Gauss). This enables a

wider bandwidth to be recorded. There's a hard carbon coating to improve durability. See Fig. 3.

#### Compatibility and Connectivity

There is no compatibility between DVC tapes and analogue formats. DVC camcorders and VCRs can be connected to both analogue and digital VCRs however, and to standard TV sets for playback.

A single cable is used for transferring the digital data. It carries both audio and video information and is bi-directional.

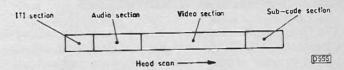


Fig. 2: Way in which the data is arranged along a track. The ITI section contains tracking signals etc. This is followed by the audio and video sections then, finally, the sub-code sector.

Prerecorded DVC tapes will have an anti-copying system – not least because any copies would look as good as the original!

#### **Prospects**

Panasonic, Sony and other companies are planning to launch DVC camcorders in Europe this autumn. They will, not surprisingly, be expensive. The cheapest will probably carry a price tag of over £2,000, though prices should fall as production builds up.

The DVC format is likely to establish itself in the camcorder market first, where enthusiasts may be prepared to pay extra for a machine that gives excellent picture quality and good copies. DVC will face a harder task if it seeks to replace VHS in the VCR market. Most VCR users don't seem to be all that bothered about picture quality – as the poor sales of S-VHS decks shows.

A point to watch is that JVC plans to launch D-VHS, a digital version of VHS that can play and record on standard VHS tapes. According to JVC, D-VHS is not designed to compete with DVC, instead being intended as a giant domestic data storage system.

Whether DVC or D-VHS can replace the VHS box that sits under hundreds of millions of TV sets around the world remains to be seen.

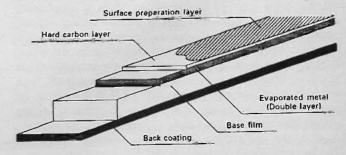


Fig. 3: Digital video tape composition.



# Servicing the Philips G110 Chassis

Richard Newman

The Philips G110 chassis was used in models introduced during the years 1989-91. It was one of the first of several chassis to make extensive use of surface-mounted components. The result was a very compact, high-specification chassis with no component crowding. Nicam and Fastext are standard features. S video connection was an option with some sets, and there was also a 41in. projection version.

Mainly because of the number of surface-mounted components used in the power supply, these sets have not exactly been favourites in the servicing trade. In this article we'll describe how to tackle repairs and also take a look at the optics used in the projection version.

#### The Power Supply

The power supply circuit is shown in Fig. 1. It's of the familiar Philips self-oscillating (SOPS) type, but the component count is fairly high. There are basically three sections. First the BUT18AF chopper transistor T7625, which is connected as a blocking oscillator. Secondly a switch-off circuit based on transistors T7615 and T7616. This is used to ensure that the chopper transistor is switched off at the correct point during its on/off cycle. And thirdly a regulation control circuit, based around transistors T7637, T7652 and T7654 on the secondary side of the chopper transformer L5625. This controls the switch-off circuit via the optocoupler T7614.

As most power supply problems seem to relate to start-up and standby, we'll take a look at how it all works.

During normal operation the base of the chopper transistor T7625 is controlled via diode D6621 by the voltage across winding 3-4 on the transformer. When T7625 switches on, a voltage of around 280V is connected across the transformer's primary winding 5-6/7 and a linearly rising current flows through this winding. There is no current output from h.t. winding 17-16 on the secondary side of circuit during this period because the voltage at pin 16 is negative. Magnetic flux therefore builds up in the transformer. When the transformer becomes saturated, the voltage across winding 3-4 will fall and T7625 will switch off. As a result, the voltage across winding 5-6/7 will reverse its polarity and C2625 will charge. The maximum voltage developed across this capacitor is around 680V. At a certain point in the cycle the voltage across winding 17-16 will reverse and D6630 will charge the h.t. reservoir capacitor C2630, producing the 148V supply for the line output stage.

When the current flowing in winding 17-16 falls to zero, C2625 will form a resonant circuit with the winding 5-6/7. The polarity of the voltage across winding 3-4 will then reverse, providing the chopper transistor T7625 with base current drive. The cycle is then repeated.

To start the power supply at switch on, a 100Hz pulse is obtained from the mains supply via R3624/26. This is fed via R3618 and R3619 to the base of T7625 which is thus switched on.

#### The Turn-off Circuit

When the chopper transistor T7625 is conductive, the voltage across winding 3-4 is rectified by D6622. This produces a negative voltage, clamped by zener diode D6617, across C2617. When the regulation control circuit on the secondary side of the circuit produces a pulse, this is linked via the optocoupler T7614 to the base of T7615. Transistors T7615 and T7616 then switch on, linking the base of T7625 to the negative voltage across C2617. T7625 switches off very quickly, and C2617 is partly discharged. When T7615 and T7616 switch off, T7625 could start to conduct again. This is prevented for a short time by the blocking transistor T7612. In addition D6618 prevents T7625 starting spuriously. Diodes D6613 and D6614 with C2614 prevent spurious pulses triggering the turn-off circuit.

#### The Blocking Circuit

T7612 and its associated components prevent T7625 switching on before all the energy stored in the transformer has been dissipated. When T7625 is non-conductive, a positive voltage is present across winding 2-1. As a result T7612 is conductive, and any current that might drive the base of T7625 is shunted away. When the energy stored in the transformer has been removed, the voltage across winding 2-1 falls to zero. C2611 and R3611 provide an extra delay for T7612's turn off. Once T7612 has switched off, base current can be fed to T7625 to switch it on. This extra delay means that T7625 is switched on at precisely the correct time.

#### Voltage Regulation

The regulation control circuit consists of voltage comparator transistor T7637 and the pulse-width modulator T7652, T7654 and their associated components. The pulses

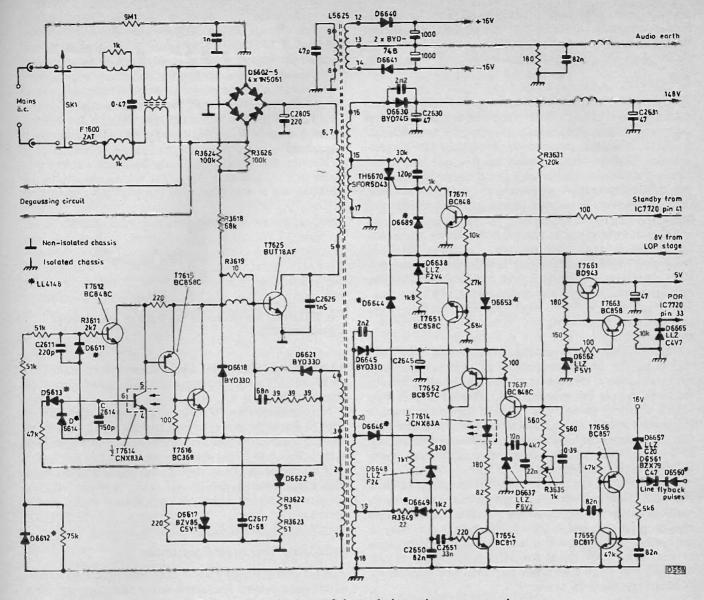


Fig. 1: Circuit diagram of the switch-mode power supply.

produced by the modulator are passed to the switch-off circuit on the primary side of the transformer by the optocoupler T7614.

When T7625 is off, C2650 is charged negatively via R3649 and D6649 from winding 18-19. T7654 is held cut off by this negative voltage, so no current flows through the optocoupler. When T7625 switches on, a positive voltage appears at pin 20 of the transformer. D6646 now conducts, and C2650 receives a positive charge. T7654 starts to conduct, current flowing through the optocoupler. This operates the chopper switch-off circuit.

Comparator transistor T7637 compares a sample of the h.t. voltage at its base with the constant reference voltage at its emitter provided by zener diode D6637. It sets the voltage at the base of T7652, which in turn controls the d.c. conditions at the base of T7654. In this way the timing of the switch-off pulse produced by the circuit is varied, adjusting the on/off period of T7625 and thus regulating the h.t. R3635 enables the h.t. to be adjusted.

#### Overvoltage Protection

In the event of the h.t. voltage rising above the correct figure, the current flowing in the line output stage will increase. The pulses developed in the EW diode modulator circuit are sensed via zener diode D6561 and D6560. Should the pulse amplitude exceed about 48V, D6561 will conduct, switching on the thyristor-connected transistors T7655/7656. The current through the optocoupler is thus increased, switching off the chopper transistor T7625.

T7655/7656 also receive information from the beam limiter circuit, the audio output stage and the 16V line (via D6657). In a good working receiver the input to T7655/7656 should be zero or slightly negative, ensuring that the transistors remain cut off.

#### The 5V Supply and Stand-by Operation

The series regulator circuit T7661, T7663 and zener diode D6662 provide the 5V supply. In normal operation this circuit receives an 8V input obtained from the line output stage.

For standby, pin 41 of the microcontroller chip IC7720 goes low and T7671 switches off. This enables thyristor TH6670 to switch on. It acts as a rectifier. The voltage at its cathode rises to about 10.5V, forward biasing D6653 which now provides the supply for the optocoupler. T7651 also switches on, increasing the current through the optocoupler via T7654. This turns off the chopper transistor for much longer periods, with the result that all the output voltages

(except for the 5V supply) are reduced. The 5V supply remains constant, enabling the microcontroller chip to operate.

#### Servicing

When power supply repairs are required, Philips provide a kit (part no. 4822 310 20489) that contains around thirty components. There is good reason for this. It's very difficult to check individual components when they are surface mounted. Experience has proved that it is far cheaper too carry out a block component change rather than try to locate the faulty component. As you cannot reuse surface-mounted components, there is no point in trying to remove them for test.

When one of these sets comes in with a blown mains fuse and a short-circuit chopper transistor, a common mistake is to check T7615/7616 quickly in situ then, if they are not short-circuit, replace the BUT18AF transistor (T7625). The set may work, but the chances are that it won't for long. More likely there will be a bright flash from the fuse as the new transistor fails, taking with it numerous other components.

There is only one way to go about repair. Order the correct kit and fit the components it contains. Once you have done a few it takes about an hour and a half to rebuild the power supply properly and test it. Initially it will take longer. This may sound like a daunting task, but in practice it is much easier than you might think. Each kit comes with full instructions, and I always mark off the components as I fit them. This way you won't waste time finding out where you were if you get distracted.

The first thing to do is to clear the bench area. Then unclip the chassis and remove as many plugs as necessary to enable you to lay the panel on the bench as flatly as possible, print side up. A good bright light is necessary. I use eye magnifiers rather than a hand-held magnifying lens as this leaves both hands free. Use a hot (30W or so) soldering iron fitted with a fine bit, some fine desoldering braid and non-magnetic tweezers.

#### Component Replacement

I find that the easiest way of removing individual chip diodes and transistors is first to desolder the tags, using the fine braid, then gently grip the old component with the tweezers and apply just enough heat to free it from the board. Extreme care is required. Otherwise the PCB print pads will be damaged.

When fitting the replacement component, position it as accurately as possible on the pads, hold it in place with the tweezers and use fine solder on each pad to secure the device. The solder connections should be made as quickly as possible. With practice, you'll achieve very professional results. Some may frown upon this method, but I've found that it works well and have never had any problems.

#### Testing

When every part in the kit has been fitted, spend a little time going over your work. Diode polarity (A and K) is marked on the PCB, but because of the close proximity of some of them it's possible to misread the markings. Also note that D6622 has been replaced by a conventional type diode and that R3622 and R3623 (both  $51\Omega$ ) have been replaced with a single, conventional  $100\Omega$  resistor.

When you are certain that everything is o.k., reconnect the plugs you removed, with the exception of plug 15G which provides the connection to the line output stage. Connect a scope set to 100V/div and 2msec/div to the collector of T7625 and a 60W bulb across the 148V line. Connect the set to the mains supply via a variac. If any of the following tests fail, see the next section.

Switch on and increase the mains input voltage slowly to about 90V. The power supply should start up at around 60V. This is proved by a waveform appearing on the scope's screen and the bulb glowing as the mains input is increased towards 90V.

Measure the voltage across the bulb and increase the mains input to just over 100V. The h.t. should stabilise at 148V. Slowly increase the mains input to 220V, monitoring

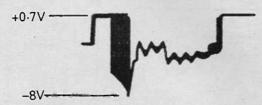


Fig. 2: Correct waveform at the base of the chopper transistor T7625.

the h.t. voltage all the time. Check the waveform at the base of T7625. It's most important that this should appear as shown in Fig. 2.

Next measure the 8V rail voltage (at the collector of T7661). Force the power supply into the standby mode by shorting together the base and emitter of T7671. The voltage at the collector of T7661 should rise to around 11V.

If the above checks are all o.k., the power supply can be considered repaired. Switch off and disconnect all test equipment. Reconnect plug 15G and test the set for normal operation.

#### Problems You may Encounter

If the power supply fails to start with plug 15G disconnected and a dummy load connected, reduce the mains input to around 70V. Check that the voltage at the collector of T7625 is about 100V d.c. If so, short together pins 1 and 2 of the optocoupler. If the power supply now starts, the cause of the problem may lie in the protection circuit. Check the voltage at the base transistor T7655. The reading should be 0V or slightly negative. If the voltage is greater than 0.5V, the protection circuit is operating. The only likely culprit with plug 15G disconnected is zener diode D6657. I've come across failure of this 20V chip zener diode on several occasions – it monitors the 16V supply.

If the supply fails to start after shorting pins 1 and 2 of the optocoupler, check around the standby thyristor. If all is well here, disconnect pins 12-14 of the chopper transformer. If the power supply now works, there's a fault in the audio output stage. If the power supply remains lifeless, check the start-up circuit. Don't forget to remove the short across pins 1 and 2 of the optocoupler before testing.

If the power supply fails to stabilise, check the circuitry around the optocoupler. Reduce the mains input to around 70V, then short together pins 4 and 5 of the optocoupler. The power supply should switch off. If not, recheck the components in the switch-off and switch-on delay circuits.

#### Final Touches

Once the power supply is working I like to clean the board with proper PCB cleaner to remove any untidy-looking flux. I then finish off with a coating of clear protec-

tive lacquer. It's not essential to do this, but the repaired board tends to look more professional, with an almost as-

new appearance.

Success in repairing these power supplies is in direct proportion to the amount of care taken during the rebuild. There is no point in trying to rush, or in deciding not to replace certain components because they measure o.k. It will take you a couple of hours to do the job properly, especially if a third party has been there before. If the set comes in as a normal breakdown with no previous third-party attention, success is almost certain first time.

#### **Other Circuits**

The signals circuitry is fairly standard. There's a U944 tuner followed by filtering then a TDA2549 i.f. chip. A TDA2545 is used for the sound i.f. section. After an emitterfollower, the video signal is passed to a TDA8452 chroma/luminance filter chip which also incorporates the luminance delay. This chip provides three outputs. The chroma signal at pin 5 is fed to the TDA8390 PAL decoder chip; delayed CVBS at pin 4 is fed to the teletext decoder panel and the sync chip; the luminance signal at pin 3 is fed to the TDA4565 CTI chip. The two chroma outputs from the TDA8390 PAL decoder chip are fed to a TDA8451 chroma delay chip whose outputs are passed to the CTI chip. The colour-difference signal and luminance outputs from the CTI chip pass to the TDA8390 matrixing chip whose outputs finally go the the TEA5101 RGB output chip on the tube's base panel.

The sync/timebase generator chip is a TDA2579. The sound i.f. chip's output goes to the Nicam decoder - this panel also contains the f.m. sound demodulator and the tone control chip. Stereo audio outputs are provided by a

TDA1521 chip.

The line output stage is conventional, using a BU508AF

output transistor.

The microcontroller is a TMP47C634N with the program code 2415. As in some previous chassis, this type of chip can suffer from the effects of static. Replacement chips come with a metal shield that overcomes the problem. Tuning and personal preference settings are stored in a PCD8582 EEPROM chip.

#### **Projection Sets**

The projection model does not in essence differ much from the standard chassis. The signals stages, the main power supply and the line and field output stages are mostly identical. The power supply can be repaired using the same kit as with the standard version. The main differences are in the line output stage, where an e.h.t. splitter is used to feed 25kV

#### CORRECTIONS

There was a typographical error in the article on Designing for Reliability (September). In the penultimate paragraph, under the heading 'Multilayer Ceramic Capacitors' on page 778, "for the fault to occur the 5V supply had to be providing at least 8mA" should have read 80mA, not 8mA.

TV Fault Finding: Ferguson D51ND (ICC9 chassis), page 889, October. "Line output transformer was short-circuit" should have read "Line output transistor was short-circuit".

to the three tubes. There is also an elaborate protection circuit and a convergence board.

The three tubes, one for each primary colour, are mounted in the base unit, facing upwards. They have powerful lenses in front of them, containing a liquid coolant. The images from the tubes are reflected via a front-silvered mirror at the back of the cabinet on to a special screen at the front. A properly adjusted projection set produces a very good quality picture.

The size of these sets means that dealers don't like to get involved with them. Owners tend to live in large, out-of-town houses however and are often prepared to pay more for repairs, so it's worth taking them on. There are also the pubs and clubs that have them in the bar showing Sky Sports all day long. The cost of repairs tends to be less of a problem in these circumstances. Once you've done a couple you may find yourself earning some welcome extra income as other owners get to hear of you.

It's essential to have the service information, Philips part number 4822 727 16947, for the projection version.

#### **Transport**

If you are called to one of these units and decide that it has to be a workshop job, the problem of transportation can be solved very easily. The top half, containing the screen and mirror, can be removed complete. It's held to the base unit by six screws (usually torx), one at each side towards the front and four along the back. Once they have been removed you can tilt the screen backwards and lift it. This is a two-man job: the screen is not very heavy but is rather awkward, being too wide to get your arms around it.

The golden rule with the base unit is never to tip it on its side. You'll see why later. Casters are fitted, so it can be rolled across carpet or smooth flooring. Once you have it in the van, make sure that it cannot roll about. The screen should be covered with a blanket and made secure. Extreme care is required with the screen, which can easily be scratched or marked: the trade price is about £250!

#### General Servicing Notes

The rear cover of the base unit can be removed, while the front speaker grille must be removed to gain access to the tube assemblies and the convergence board. This is done by removing the two screws at the front, just below the grille. After removing the two securing screws the control panel can then be swung down.

The most common problem seems to be associated with the RGB drives. The symptom is that the set shuts down just as the raster appears, rather bright and predominantly of one colour. You can usually get the set to work by removing the relevant tube base. Usually the cause of the trouble is the TEA5101A RGB drive chip on the green tube's base. If on the other hand all the tubes turn on hard (a white raster) before the shutdown, check the 200V supply on the red tube's base (R3392). The feed to this comes from pin 1 of the line output transformer.

Another very common problem that can usually be tackled in the field is a very wide picture with severe convergence errors. The cause is nothing more than dried out electrolytics in the EW correction circuit. Replace C2549 (10µF) and C2533 (1µF).

#### The Optics

For some reason the blue tube seems to fail - I've had to replace three to date. They are expensive, at around £200 trade. Provided care is taken, a tube can be replaced without

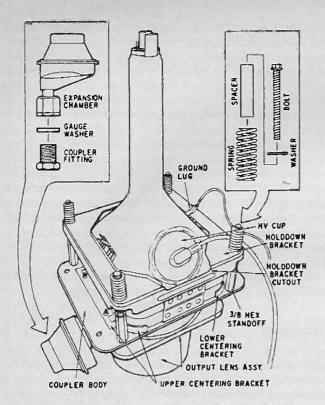


Fig. 3: Projection tube assembly.

loss of the coolant fluid. Fig. 3 shows the assembly and Fig. 4 the individual components. The tube must be removed from the base unit first. Full instructions are given in the service manual.

The e.h.t. cable is silicone cemented to the tube. Remove the cable at the e.h.t. splitter end then, using a sharp knife, cut away the cement from the e.h.t. connection cap. If you are replacing only the cable, all traces of the old cement must be removed from the tube. Apply new silicone cement (Philips part number 4822 390 40087) to the rubber cap. Fit the cap, making sure that the cable is in the correct position. Allow the cement to harden, preferably for 48 hours, before powering the set.

#### The Cooling Fluid

Because of the high brightness level at which they are run, the three tubes generate a lot of heat. Cooling fluid is used to reduce the heat in the lenses. It's very much like antifreeze, consisting of glycerine and ethylene glycol with some additives to inhibit corrosion. It's therefore poisonous, so extreme care must be taken.

A kit for replacing the fluid is available under part number 4822 390 80152 – this is sufficient for one tube assembly. New gaskets are included, and full instructions. Fluid loss usually occurs only if there has been a leak or, because of natural evaporation, after extensive use. If the fluid level is low, the symptoms will appear as gross purity, focus and convergence errors at the bottom of the picture. Why the bottom? Remember that a lens inverts the image.

The lenses can be cleaned with a solution of two drops of washing-up liquid to a cup of water. Use a soft cotton cloth.

Tipping the base unit on its side will also result in a low fluid level – the fluid runs out of the lens assembly into the expansion chamber. If this has happened, leave the set to stand for a while, allowing the fluid to drain back. Tapping the chamber will help to disperse any air bubbles.

All traces of coolant must be cleaned off the drip tray

when a leak has occurred. Check the main and the convergence panel thoroughly for damage. I had one set in which coolant had dripped over the convergence panel plugs. Because of the highly conductive nature of the fluid, this resulted in a burn up.

#### The Screen and Mirror

The screen and mirror are very delicate. It's best not to touch them unless this is absolutely essential. As the dust seals are extremely good, it's unlikely that the mirror will be dirty. The screen should be cleaned with a camel-hair brush, in a downwards direction following the fine grooves. If the mirror is soiled a very dilute solution of washing-up liquid, as used for the tube lenses, can be used with a mineral wool.

#### Final Adjustments and Checks

Setting up is necessary after any major repairs to the optics. This is not too bad, as only one tube will usually have required attention. It's reasonable to conclude that the convergence and focus of the remaining two tubes are pretty well o.k.

Mechanical and electrical focusing have to be carried out, using a crosshatch pattern. The static and dynamic convergence must then be adjusted. I find that the controls on the convergence board all do what they are supposed to do, so there should be no major difficulties. It's sometimes necessary to go over the adjustments more than once. Full instructions are contained in the manual.

Check that there are no leaks, and finally make sure that all leads are clipped up correctly. Extreme care is required over the positioning of the e.h.t. cables.

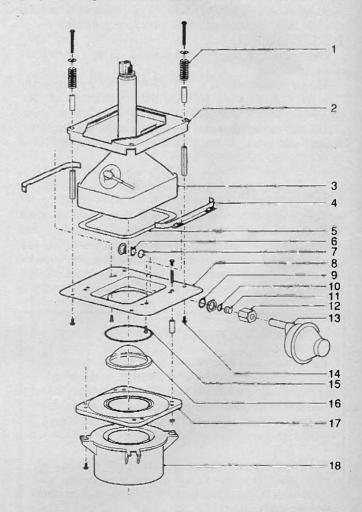


Fig. 4: Exploded view of a tube assembly.



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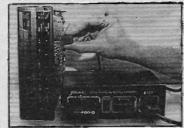
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## VCR Signal Processing

Part 2 Joe Cieszynski

In Part 1 last month we explained why, before the analogue luminance signal is recorded on the tape, its bandwidth has to be reduced from 0-5.5MHz to 0-3MHz after which it is used to frequency modulate a 3.8MHz carrier.

During playback the f.m. signal is demodulated to recover the analogue luminance information. In addition to the luminance signal's reduced bandwidth (in comparison with a broadcast transmission), its signal-to-noise ratio is poor (because of the low -0.3 – modulation index) and it sufferes from dropouts caused by inconsistent tape coating density and mechanical jitter. The luminance record and

signal. This filter also serves to restrict the luminance signal bandwidth to 0-3MHz.

The following a.g.c. and clamp circuits are standard arrangements. They are included to ensure that the luminance signal and its d.c. level remain constant. This, as we shall see later, is essential when recording. Pre-emphasis is then applied to the h.f. components of the signal to improve the signal-to-noise ratio which, because of the low modulation index figure, is very poor. Pre-emphasis also serves to sharpen the rise time of the h.f. luminance signal components – the effect of low-pass filtering is to slow the rise

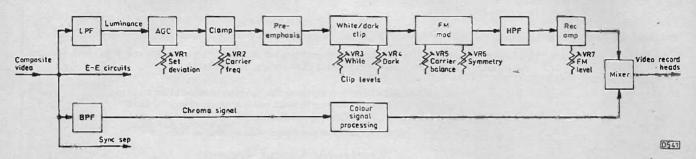


Fig. 1: Block diagram of a typical VHS luminance record channel.

playback processing is designed to compensate for these factors and, where possible, enhance the picture quality.

We'll next take an overall look of the luminance record/playback processes, following up with a more detailed investigation of the various operations involved.

#### Luminance Record Block Diagram

Fig. 1 shows in block diagram form a typical VCR luminance record system. The input consists of a 1V peak-to-peak composite video signal, from either the tuner/i.f. section of the machine or an external video source. This signal is fed to the luminance, the chroma, the E-E and sync separator circuits. The term 'E-E' refers to the electronic-to-electronic mode, which provides the TV receiver with a signal during the record or stop modes. The E-E output is 1V peak-to-peak, with negative-going sync pulses. The output from the sync separator is used to provide a signal (at 25Hz) for the control track, to lock the drum servo and to operate phase-shifting circuits in the chroma signal section of the machine.

It's essential that none of the chroma frequencies reach the f.m. modulator. So the luminance section starts with a 0-3MHz low-pass filter that removes the 4.43MHz chroma time. The white- and dark-clips prevent over-modulation of the carrier because of excessive pre-emphasis overshoot.

The output from the f.m. modulator contains a number of unwanted sideband components, in particular in the 0-1.2MHz region where the chroma signal is recorded. A high-pass filter is included to remove such components. The modulator may be followed by a limiter to remove a.m. (a product of the modulation process) from the f.m. signal. Any a.m. would interfere with the chroma signal later on.

The video f.m. passes through an amplifier before being fed to the record heads. An f.m. record current level control is often included here to set the f.m. voltage level at the heads at typically something between 1.5-3V peak-to-peak. The setting required depends on the head characteristics: consult the service manual before making any adjustments.

With audio recording the signal must be superimposed on an a.c. bias signal to prevent crossover distortion caused by the BH characteristic of the magnetic tape. In a VCR the f.m. demodulator acts on the peaks of the f.m. video signal, so any low-level crossover distortion is ignored. There is thus no need to bias the luminance f.m. signal. The much smaller a.m. chroma signal does require bias however: this is provided by the luminance f.m. signal – the chroma signal sits on the edges of the f.m. luminance signal. This occurs in

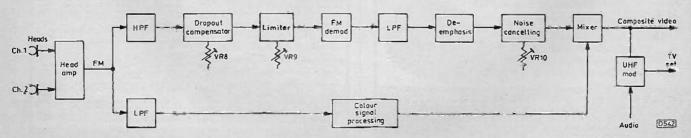


Fig. 2: Block diagram of a typical VHS luminance playback channel.

the mixer stage, where the f.m. luminance and 627kHz down-converted chroma signals are combined for feeding to the heads.

#### Luminance Playback Block Diagram

Fig. 2 shows in block diagram form a typical VCR luminance playback channel. The signals from the heads pass first to the head amplifier, where equalisation is also applied. The 25Hz drum flip-flop signal provides switching between the two heads (ch. 1 and ch. 2) as they rotate and scan successive tracks. A low-pass filter then separates the feed to the chroma circuits while the luminance channel has a high-pass filter to remove the chroma signal and the hi-fi sound carriers if these are present.

Deficiencies in the tape or the heads can cause small, random f.m. signal loss which would show up as random white specks on the playback picture if the dropout compensator was not present. This detects such signal dropouts and, to mask them, inserts stored f.m. from the previous line.

The limiter removes any a.m., which would otherwise produce an effect that's often referred to as black-to-white inversion. This would show up as horizontal black streaks to the right of light areas of the picture content, e.g. captions, clothing etc. There are several causes of black-to-white inversion, the most common being head wear. The other causes will be mentioned when we look at the luminance signal processing in more detail.

The output from the f.m. demodulator contains large components at the carrier frequency. These are removed by the following low-pass filter. De-emphasis then reverses the action of the pre-emphasis circuit in the record signal channel, improving the signal-to-noise ratio: when an oscilloscope is used to view the effect on the waveform you can see that the overshoot spikes are removed.

Noise-cancelling circuits vary quite a bit from one type of VCR to another, but all machines have some form of noise cancellation to clean up the picture. Some of these circuits can be very complex, and effective. Others may consist of nothing more than a simple soft/sharp control that alters the definition of all picture detail, including the noise!

The following mixer combines the luminance signal with the up-converted 4-43MHz chroma signal to get back to composite video – this is not the case with S-VHS, where the Y and C signals are kept separate to prevent Y/C beat patterning. The composite video is at 1V peak-to-peak, and is available at the machine's BNC or scart outputs. It's also fed, along with the audio signal, to the r.f. modulator which produces a u.h.f. output somewhere in the range of channels 33-39 for feeding to a TV set's aerial socket.

In addition to the items shown in Fig. 2, the machine may incorporate a luminance delay line for improved Y/C correlation. Some form of tuning bar generator will provide an input to the r.f. modulator: while early machines produced a simple black and white bar display, many modern machines produce a colour display with on-screen graphics such as the manufacturer's name.

#### The E-E Mode

In broadcast equipment the E-E signal is that which, in the stop mode, has passed through the record and playback processing sections of the machine. It gives the operator an immediate indication, on the monitor, of any misadjustments or faults in the equipment (other than the heads). Such an elaborate check is not necessary with a domestic machine, where the E-E signal is usually taken off somewhere soon after the output from the i.f. strip, or looped

from another direct video source input, and passed to the TV receiver either via the r.f. modulator or a scart socket. It serves purely as a monitoring signal.

Many machines have adjustments for the E-E vision and sound levels. The sound level is perhaps not so critical, but if the vision level is set too high the monitoring TV set may produce intercarrier sound buzz. If the vision level is set too low the result will be insufficient contrast. These adjust-

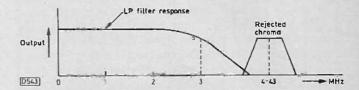


Fig. 3: Lur\(\text{Ninance}\) record channel low-pass filter response with a standard VHS machine.

ments do not usually affect the recording levels.

#### Summary

That completes our overview of the luminance record/playback arrangements. We will now take a closer look at each section, following the order outlined in the two block diagrams, Figs. 1 and 2.

#### Record Low-pass Filter

The response of the low-pass filter in the luminance record channel of a standard VHS machine is shown in Fig. 3. It fulfils two purposes, first rejection of the chroma signal centred on 4-43MHz and secondly limitation of the luminance signal to 0-3MHz (with a standard VHS machine).

#### AGC

A.G.C. is included in the early stages to ensure that a constant luminance signal amplitude is maintained. You may wonder why the luminance signal level should vary when any fluctuations should have been dealt with by the a.g.c. circuits in the tuner and the i.f. strip. Remember however that the recording source may be via the scart or other direct input socket, where a constant signal level cannot be guaranteed.

The a.g.c. circuit is a convenient point at which to control the deviation of the f.m. modulator, and many machines take advantage of this. VR1 in Fig. 1 represents the set-deviation control. Remember that in the basic VHS system the deviation limits are 3.8MHz (sync tip) to 4.8MHz (peak white): the deviation control adjusts the amplitude of the luminance signal to the level at which peak white deviates the modulator's output to 4.8MHz. Thus VR1 functions in the same way as the contrast control in a TV set. We'll return to this in a monent, when we consider the set carrier frequency control in the clamp circuit.

Because the majority of machines use the field blanking period as a record a.g.c. reference level, manufacturers of prerecorded tapes often add a simple anti-copying signal in this part of the waveform. It takes the form of a burst of constantly-varying amplitude. In theory this has no effect when the original cassette is being played back. When an attempt is made to copy the tape however, using a domestic machine, the record a.g.c. circuit will be confused by the apparently shifting signal level during the field blanking period, the result being a constantly changing contrast level during playback.

It's worth mentioning that there have been complaints about vertical jitter when hired tapes are played back. On occasions the cause has been traced to the anti-copying signal interfering with the TV set's field sync circuit. It is not the tape but the integrating circuit in the receiver that's

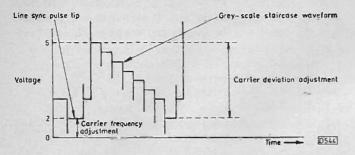


Fig. 4: Effects of the carrier deviation and frequency controls on the luminance signal. The voltages shown are typical. The carrier frequency control moves the signal's d.c. level while the deviation control adjusts the peak-to-peak voltage.

to blame for this. Some manufacturers have issued modifications for specific chassis to overcome the problem.

#### The Clamp

It is important that the sync tip remains at a constant d.c. level as it passes through the recording channel. If a luminance signal with a 'floating' d.c. level is fed to the f.m. modulator there can be a number of problems. Apart from the obvious contrast level variation, patterning effects can occur as a result of the modulator being driven outside its deviation limits. This will generate sidebands in the chroma region, or folded sidebands should the signal bandwidth extend below OHz. Signal clipping can also occur, depending on the design of the modulator.

The clamp circuit sets the sync tip at a predetermined d.c. level. In some machines this level is adjustable, enabling the f.m. carrier frequency to be set.

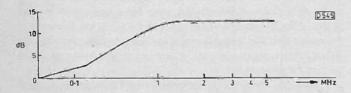


Fig. 5: Standard VHS pre-emphasis response (from BS6482). There is little change in gain up to 100kHz. Between 100kHz and 1MHz the gain rises dramatically. It flattens off above 1MHz.

VR2 in Fig. 1 represents the set carrier frequency control, whose effect is shown in Fig. 4. The clamp fixes the sync tip's d.c. level. This can be adjusted by VR2 to the point at which, when this voltage is fed to the f.m. modulator, the output will be at 3-8MHz. Fig. 4 also illustrates the effect of the set-deviation control in the a.g.c. circuit. You can now see that once the sync tip is fixed at 3-8MHz the peak luminance signal amplitude (peak white) will govern the amount of carrier deviation.

#### Pre-emphasis

With any f.m. system the signal-to-noise ratio falls as the modulating signal frequency rises. It is thus standard practice to use pre-emphasis and subsequent de-emphasis of the

higher modulating frequencies in f.m. systems. It was therefore natural for this technique to be adopted in VCRs.

There are several types of pre-emphasis. The two used in VCRs are linear frequency pre-emphasis and non-linear frequency pre-emphasis. The former is part of the original VHS specification. We'll look at it first.

With a video signal, high-frequency noise will be most noticeable in areas of the picture with fine detail, or at sharp vertical black/white transitions or edges. Linear preemphasis, by boosting the h.f. signal components, improves the h.f. signal-to-noise ratio, enhancing fine detail and sharp edges in the picture.

To apply pre-emphasis, the luminance signal is fed to an amplifier which has a frequency response of the form shown in Fig. 5. The luminance signal staircase waveform (grey-scale bar signal, see Fig. 4) consists of vertical (h.f.) components and horizontal (d.c./l.f.) components. The effect of amplifying the h.f. components more than the l.f. components is to create large overshoots on the staircase waveform. When viewed on an oscilloscope these appear as shown in Fig. 6.

As well as improving the signal-to-noise ratio, preemphasis enhances the sharpness of the picture. Removal of the 3-5-5MHz section of the standard luminance signal by filtering it out means that during playback the rise time of the signal's higher frequencies is increased. The result is slight smearing of sharp edges in the picture. As Fig. 7 shows, the addition of an overshoot increases the rise time with a picture transition (edge). This gives the impression that the h.f. components of the signal have been restored, which is not true of course: although the edge is sharper than it would otherwise be, its phase has shifted slightly. When this phase shift is examined on the TV set's screen, a dark outline effect is seen around picture content edges.

The amount of pre-emphasis applied governs the degree of edge correction achieved. If the overshoot depicted in Fig. 7(c) is doubled, the rise time will be faster and the edge sharper. Formats other than standard VHS take advantage of this by using much greater amounts of pre-emphasis. For example while the peak white overshoot (after clipping, which we'll consider in a moment) with standard VHS is 80 per cent of the peak-to-peak luminance signal voltage, with the 8mm format the figure is increased to 200 per cent, achieving a much faster rise time.

Non-linear pre-emphasis was adopted with some later VHS machines to provide further picture quality improve-

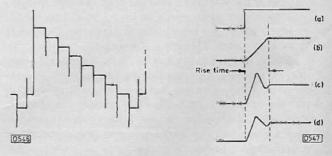


Fig. 6: (left) Effect of linear pre-emphasis on one line of a luminance staircase signal waveform.

Fig. 7: (right) Rise time with a step (h.f.) signal. (a) Luminance step signal rise time when the bandwidth is 0-5·5MHz. (b) When the bandwidth is reduced to 0-3MHz the rise time is increased (shown exaggerated here). (c) Use of pre-emphasis produces an overshoot and reduces the rise time, but note that the edge is subjected to a phase shift. (d) After de-emphasis during playback the overshoot is removed, leaving an enhanced but phase-shifted signal.

ment. In some models it may be used in addition to linear pre-emphasis.

Subjective tests show that h.f. noise is more noticeable in darker areas of the picture. With non-linear pre-emphasis only the h.f. signal components that sit at low brightness (and thus low d.c.) levels are affected. Non-linear pre-

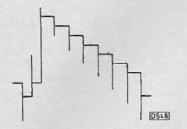


Fig. 8: Effect of adding non-linear pre-emphasis to a luminance staircase waveform.

emphasis doesn't affect h.f. signal components at higher brightness levels. This additional boost (and later cut – deemphasis) in the level of low-brightness signals considerably improves the playback picture. The effect of non-linear pre-emphasis on a staircase luminance signal waveform is shown in Fig. 8.

### White and Dark Clips

As we have seen from Fig. 7, introducing a large overshoot on the h.f. signal components reduces their rise time, giving an improvement in horizontal definition. Excessive overshoots could result in over modulation of the f.m.

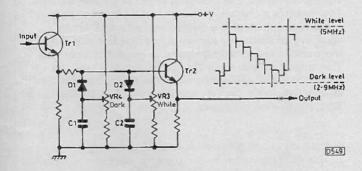


Fig. 9: Basic white- and dark-clip circuits.

carrier however. To prevent this, the level of the overshoots has to be kept within an acceptable level which is specified for a given system. The circuits that reduce the overshoots are known as the white- and dark-clip circuits.

The clip circuits are contained within the luminance processing chip. Their principle of operation is shown in Fig. 9 however. The conduction points of diodes D1 and D2 are set by VR4 and VR3 (the reference numbers match those in Fig. 1). When the line sync tip is present at Tr1's emitter, the voltage will be low and D1 will conduct. The low reactance of C1 will then attenuate the h.f. components of the signal. At peak white the voltage at the emitter of Tr1 will be high and D2 will conduct. This time C2 attenuates the h.f. signal components. The voltage thresholds at which D1 and D2 conduct are set by VR4 and VR3. Thus by adjusting these controls we can set the level of the overshoots at the clip circuit output.

All early VHS machines had white and dark clip adjustments. As production techniques have improved however the need for this amount of adjustment has decreased. More

# Next Month in TELEVISION

### **TOSHIBA'S V3 VCR RANGE**

The designers of the current Toshiba range of VCRs set out to make them easier to use, with features that are really wanted by consumers and improved performance. The mechanism has a faster winding speed and a third fewer parts than the previous range. Next month Philip Blundell takes a look at the technology used in these machines.

### LNB TEST SIGNAL SOURCE

It's inconvenient having to instal an LNB on an outside dish in order to test it. Instead, a workshop source of signals is much handier. You can obtain signals by modifying a spare LNB to act as an up-converter instead of a down-converter. Hugh Cocks describes such a conversion.

### THE JAPAN ELECTRONICS SHOW

George Cole has been over to Japan to see the latest offerings at the Electronics Show there. They included three types of flat-screen technology; widescreen TVs; digital camcorders; the digital video disc; HDTV receivers, VCRs and video disc systems; the MiniDisc photo system; Wide Clear Vision (Japan's NTSC version of PALplus); and sets designed to link with PCs.

### THE TATUNG 120 CHASSIS

John Coombes provides a servicing update on this popular TV chassis.

### **CHINESE JUNK**

More adventures in CD land, from Les Austin. The main problems this time relate to players of Chinese manufacture.

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recent models dispense with either one or both adjustments, though the need for clip circuits remains.

Adjustment of the clip controls is critical. Insufficient clipping leaves large overshoots that usually produce black-to-white inversion. Conversely if too much clipping is applied the sync tips and peak whites can be affected, the result being poor field sync and loss of peak white – some machines will not permit such an amount of clipping. A typical adjustment method is shown in Fig. 10. Refer to the service manual however for the correct settings.

It will be seen from Fig. 10 that there is significant overshoot after setting up the clip controls. We have seen that for VHS the f.m. modulator deviation limits are 3.8-4.8MHz. So what effect do these overshoots have on the modulator and the frequency spectrum it produces? In practice there are, for two reasons, no problems. First, because of tolerances and problems with drifting, the modulator has a permitted deviation error of  $\pm 100 \mathrm{kHz}$  at each of its limits. These limits accommodate the overshoots. Secondly the overshoots represent a brief, low-energy modulating signal that wouldn't produce sidebands or harmonic components of significant value.

### The FM Modulator

One might expect the f.m. modulator to use a sinewave oscillator circuit. Such an arrangement requires accurate tuned circuits that cannot be incorporated within an i.c. however. Furthermore a sinewave oscillator doesn't perform well as a frequency modulator at the low frequencies used in VCRs. For these reasons the f.m. modulator usually consists of an astable multivibrator which, of course, produces a squarewave output. This output must be filtered to obtain the fundamental sinusoidal signal.

Fig. 11 shows a simple astable multivibrator modulator circuit: in practice the circuit is contained within a signal processing chip.

One point of major concern to designers is that the astable multivibrator modulator should produce an output with a 1:1 mark-space ratio. Different transistor characteristics and component tolerances can however result in a squarewave output at the correct modulating frequency but with an unequal mark-space ratio. Then, after filtering, the sinewave will suffer from serious harmonic distortion. As these harmonics cannot be filtered out during playback demodulation, they will give rise to patterning in areas of fine detail—an effect that's commonly known as carrier leak. When viewed on an oscilloscope, f.m. with carrier leak appears to have a 'woolly' outline. For this reason VR5 and VR6 are provided to ensure correct output symmetry.

The set carrier leak control VR5 ensures that the luminance signal voltage applied to point A, and thus the voltages at the bases of the two transistors, results in equal conduction of the transistors at all levels from the sync tip to peak white, the result being a 1:1 ratio from 3-8MHz to 4-8MHz. VR6 (set symmetry) may be included to ensure that the oscillator's output is symmetrical before modulation is applied, i.e. at 3-8MHz.

Some chips include a limiter after the modulator and filter. This is used to remove any a.m. on the f.m. signal caused by LC reactance changes. If the a.m. is not removed, sideband components may enter the playback chroma circuits, the result being colour patterning.

### The FM Record Amplifier and Mixer

The modulator's output goes to a final amplifier before being applied to the record heads. This amplifier's response Output

Now of A

Peak white

Modulating waveform

A

VRS
Symmetry

DSS1

DSS1

Fig. 10: (left) Method of determining the clip levels. Using a standard grey-scale bar signal as the input, with the machine set to the record (or sometimes E-E) mode, measure the amplitude of the luminance signal from the line sync tip to peak white. This is shown as value A above. The white clip level is then set so that the amount of overshoot above peak white is 80 per cent of value A. The dark clip is set so that the undershoot below the line sync tip is 40 per cent of value A.

Note that the original standard VHS white clip specification was 60 per cent: it was subsequently increased to 80 per cent.

Fig. 11: (right) An astable multivibrator frequency modulator circuit. Although the frequency is determined by the time-constants of the RC coupling networks in the base circuits of the two transistors, it is also governed by the voltage at point A. When this voltage is varied, the charging times of C1 and C2 alter. The result is a change in the frequency but not the mark-space ratio of the output waveform. Thus by applying an analogue luminance signal to point A a frequency-modulated squarewave output is obtained. The output is filtered by the tuned circuit T1/C3, which produces a sinusoidal f.m. output. The high-pass filter shown following the f.m. modulator in Fig. 1 consists of T1/C3 in the circuit above.

is designed to compensate for record head losses.

The 627kHz colour under signal is then mixed with the luminance f.m. signal. The final result is an f.m. carrier with the a.m. chroma superimposed. This 'composite' signal is fed to both heads simultaneously. Note however that simultaneous application of the f.m. to the heads in a VHS camcorder that has a miniature drum (41mm instead of the standard 62mm diameter) is not possible. This is because the miniature drum has four heads that act as two A and two B heads. So the heads have to be switched during record as well as playback, otherwise they would over-record on each other's tracks.

When scoped at the output of the record head amplifier, the amplitude of the f.m. signal is typically 2-3V peak-to-peak. This can be adjusted by using the f.m. record current control VR7. If the f.m. record level is set too low, the play-back pictures will be grainy. If the level is set too high, there is the possibility of black-to-white inversion. In practice the record level rarely requires adjustment as the circuits are all contained within a specific chip and are thus unlikely to drift in tolerance.

### **Next Month**

In Part 3 we'll look at the luminance playback circuitry.

# What a Life!

### Donald Bullock

It's amazing how the news has got about in this small corner of Spain that my life affliction has been in the TV/video trade. It comes up all too often in fatuous conversations in bars, while people keep showing up at the door with sets I can't work and don't understand.

I was relaxing with Greeneyes in Paco's bar the other night, watching his TV set doing its best with hardly any field sync, when this huge roughneck came and sat at our table. We soon learnt that after losing all his money running a bar he'd decided to take a postal careers course. "I'm now a physiotherapist" he said. "You mends tellies doncha?"

Using the skills of a lifetime, I changed the subject. But it

was no good.

"Which is the best set?" he said, "and do you reckon they'll ever get the colours right? I only watches the sport meself." After that I got a potted history of his set, those of his friends and neighbours, and of all the rogue dealers from whom they'd suffered. Then he noticed the missing sync on Paco's set. "Hey Paco" he bawled, "this man's a telly mechanic."

Fortunately Paco doesn't understand any English. I'd entered Paco<sup>2</sup>s with a spring in my step. I left it thoroughly choked

### **VCR Troubles**

Harry was at the gate, sitting on an up-ended video, when I got back from the village the other day. "It ain't much" he said, setting me up to work for nothing. The machine was a Sony SLV270 which, when I tested it, was lifeless except for a faint whining noise. I quickly developed the same trouble. Then I recalled that I'd had the fault before, and made for the power pack. C1326 (16μF, 25V) was open-circuit. A replacement put everything right.

As I was boxing it up a lady called in with her Samsung SI7220 VCR, which is identical to the Goodmans VCR2550. "I can't get a tape into it" she said, "not even

with my foot."

On test the clock lit up but there was no on LED illumination and no loading motor operation. I soon found out why she couldn't get a tape into it: there was one jammed in there already. When I dismantled the machine and took it out I found that it was shredded and broken. My experience has always been that the motor in this model is a bit sluggish, but this one was worse than usual. There was less than a volt across it. As the windings checked out all right I made for the STK5333 regulator chip IC101 on the power panel. It was the cause of the trouble. I don't know whether it comes in different qualities, but the prices quoted vary enormously.

### Edgar's CD Player

Shortly after that Greeneyes clopped round with Handsome Edgar, whom I don't like. "Edgar's got a Sony CD player" she announced. "We've all got our troubles" I replied nastily, "what's up with it?"

"Doesn't plaih" said Edgar, smiling like a dish of treacle. Then he disappeared up the garden path with Greeneyes.

It was an M35, minus the amplifier and speakers. It

accepted a disc, read the TOC, then played the disc without skipping or jumping. In fact it behaved perfectly. I peered through the window, trusting that Edgar was doing likewise.

Then I noticed that the disc was vintage Sinatra. So I connected an amplifier and some speakers. There was no sound. On opening the player I found an identical dry-joint on both output sockets – where they connect to the board. Resoldering them brought excellent results.

### A Grundig T55-340/90A Telly

"Jumps about and flickers when cold" was Maisie's complaint about her Grundig set, which was fitted with the CUC3490 chassis. I opened it up and looked around for dryjoints – I've worked on Grundigs before. Sure enough the chopper transistor was dry-jointed. Once again a bit of resoldering put matters right.

### More VCRs

Old Mrs Sorrel struggled in with her Pye DV291. She was widowed a month after settling here and now devotes her life to raising funds for her favourite charity. The DV291 is the same as the Philips VR6290, but whatever clothes it comes in the machine frightens me to death. This one had died during a recent lightning storm. I was worried about being able to fix it, but fortunately the damage was confined to the primary side of the power supply. The BUT11AF chopper transistor had suffered, and safety resistor SR3 had failed. When both had been replaced the machine came autocratically to life.

I've had mode switch trouble with several Amstrad VCRs of late. Often the machine is a VCR9500 (Goodmans TX3650). The symptoms are misfunctioning. When a cassette is inserted you may find that the machine selects rewind and the heads spin. Sometimes the only symptom is failure to eject the tape. I now have a routine procedure for dealing with this situation.

I remove the fascia and the bottom cover by taking out the two screws near the front. Then I remove the clamp and screw at the centre, rear of the deck. This leaves the deck retained by two block connectors at the rear. After disconnecting these the deck can be lifted out. The mode switch is beneath the deck, to the right at the rear. I remove and examine it. If it's simply dirty, I clean and lubricate it. If there's wear I replace it.

A word of warning. It's easy to damage one or both of the two sensors at either side of the PCB. Another point. Fluorescent lights in the workshop will activate the sensors when the machine's cover is removed. No amount of striving will 'cure' this. To test the machine, turn the lights out or refit the cover.

After doing a couple of these recently I picked up a Sharp VCA63HM which was also suffering from mode switch trouble. It was about two years old. While it had updated panels, the deck was the one I'm used to, with the same troublesome mode switch and motor assembly. The symptoms were failure to eject, then lacing and unlacing when the stop button was pressed. Repairing or replacing the switch usually takes only ten minutes, so it's not too bad.

After putting this one back together I decided that it was time for a break. So we made off for the local open market in the next village. Several stalls were selling a wide variety of electronic equipment, much of it quite sophisticated. A stall that appeared to be devoted to Panasonic items was doing particularly good trade. Only there was something odd about the Panasonic trade mark. It was spelt Panasonic!

# Satellite Notes

**Hugh Cocks** 

### **Tuning for Sky Movies Gold**

Several of our customers were in a state of panic when Sky Movies Gold changed from Astra transponder 26 (11.597GHz) to 60 (10.877GHz). If the installation of a converter is impractical the following course does work, though it involves receiver retuning and Superchannel on the lowest 1D frequency can't be reached.

Most 10GHz LNB oscillators have sufficient adjustment range to enable transponder 60 to appear at an i.f. of 950MHz. CNN then appears 75-80MHz higher than before, at 1,700MHz (previously 1,622MHz). The Amstrad SAT510 will just get this in, as its i.f. bandwidth is only 950-1,700MHz (not -1,750MHz as with some other receivers).

With the Continental Microwave (CMW) LNB the oscillator adjustment is the large Allen screw near the F socket. Unscrewing it by about three turns is sufficient (this is in fact the maximum low setting). The oscillator frequency will be reduced by about 80MHz. If you have access to a signal source such as a satellite i.f. up-converter, you'll find that the LNB's output moves by about four and a half Astra channels. Thus if Sky News was originally at 1,377MHz (receiver displaying 11377 in the tuning mode) it should, with the new oscillator setting, be midway between Sky 1 and Sat 1.

If the oscillator range is not quite enough, check that the receiver's LNB offset is at its lowest setting. Adjust transponder 60 to come in at 950MHz.

Unfortunately this method means that all channels have to be retuned upwards by around 80MHz. It's the major disadvantage of this course of action, but may be an advantage to the customer, rather than having to press TV/SAT on the receiver's remote control unit to obtain Sky Gold.

If the customer subsequently decides to get a new receiver the non-standard LNB i.f. doesn't really matter, certainly not with Pace MSS series receivers, as a non-standard oscillator frequency can be entered – in this case the figure will be approximately 9.92GHz. This will produce correct frequency readouts with the new receiver.

Some early receivers tune below 900MHz – I encountered an Alba receiver recently that tuned down as far as Zee TV with an old Marconi blue cap LNB. The customer was very keen to have Superchannel on Astra. The receiver's tuner also went quite high, well beyond the top Astra 1B frequencies (CNN etc.). When I'd removed the Marconi LNB's rivets and its outer cover, the local oscillator screw was easily found. Unscrewing it by about four turns produced a good Superchannel at the bottom end of the tuner's range – CNN at the top end was also fine.

### **Cambridge IRDs**

This receiver-decoder came in as the JVC Model AD1000. The customer's complaint was of poor, jumping pictures that had got worse over the course of a few days. Connection was at r.f., as the TV set being used had no scart connector.

When we checked the receiver in the workshop we found that the pictures obtained via the scart socket were very good, though the results with the r.f. output were indeed dreadful. A look around with the scope was called for.

The video input to the modulator was fine. But it was being modified by a small, blue  $1\mu F,\,50V$  electrolytic that's mounted just above the BB modulator video input pin. It's not difficult to find this capacitor, as there are no other electrolytics in the area. Fitting a replacement cured the problem.

We don't get many Cambridge receivers in for repair, though many a happy hour has been spent tuning them in for people who bought systems from local installers who have since disappeared. It has always seemed strange that when in the 'favourite' menu you can't just go round and round the favourites. Above F20 the receiver goes into the 'normal' channel mode via the up/down buttons.

### Pace PRD800

The customer wanted to use this receiver with both a MAC D2 and a Dutch RTL Luxcrypt decoder. Unfortunately the RTL decoder requires an unclamped PAL input. Using the output from the video or TV scart socket produced a very poor picture, with streaking and general liney effects. Somehow, we had to find an unclamped output.

In the end we connected a 1µF capacitor across the clamp diode D70. This worked well. By disabling/reducing the efficiency of the video clamp in the receiver, good pictures were obtained via the RTL decoder which provided clamping for all the PAL signals.

The on-screen graphics became a little jittery, but the customer wasn't at all concerned about this. Quite possibly reducing the value of the added capacitor would have decreased the jitter and still given good results with Luxcript signals. An alternative would have been to add a switch to the receiver to enable/disable the clamp circuit as required. Even better would have been to break the link between the unclamped video and the clamp circuit within the receiver and connect the Luxcrypt decoder, giving an unclamped output, between these points. Since time is always at a premium, we were unable to look into this possibility.

### The Uniden UST7007

Quite a number of these receivers remain in use here in the Algarve, along with the matching UST771 positioner box. They were made in the late Eighties/early Nineties and are well built, though they are prone to dry-joints on the power board.

It's quite common to find that the memory in both the receiver and the positioner unit is lost after disconnecting the power for more than a few minutes. Both units have a 3V lithium disc battery that's linked to the PCB. After a few years the batteries fail. Replacement is straightforward.

With original installations you usually find a magnetic polariser and an interface unit. The latter is used because the receiver produces an output to drive the mechanical type of polariser. A standard 13/17V V/H LNB can be used however. The magnetic polariser tends to go open-circuit, and we are reluctant to replace it. One reason for this is that skew is difficult to adjust at the extreme ends of the Astra band when an interface unit is used, particularly where the feed to the polariser is via a thin cable – the voltage drop limits the polariser current.

When an LNB with voltage-controlled polarisation selection is used, slide the switch at the back, near the F socket, from 18V to 'Cont'. Selection is then achieved by pressing DBS or ECS on the front panel. DBS gives the higher voltage. Tuning seems to be a little coarser in the

DBS mode: it's often best to get the frequency right in the ECS mode, then change to DBS for the channel with horizontal polarisation.

Reception of the German ZDF channel is difficult in the DBS mode, being right at the bottom of the Astra 1C band. If this channel is a customer requirement, turn the LNB through 90° and invert the DBS/ECS settings (UK Living, the next channel up, is o.k. with either setting). The other solution is to tune in ZDF in the DBS mode – lots of white sparklies will be present. Then remove the tuner from the chassis. You'll see the i.f. bandpass filter in three solid-looking cans (no SAWFs here!). There's a red, air-spaced coil adjacent to them. Spread its turns and ZDF will become clear as the tuning frequency is reduced a little.

We've encountered one or two cases of poor contact between the tuner's F socket and the PCB when the nut that holds the socket has been over-tightened after replacing the tuner

### A Decoder Problem

A Dutchman with a Grundig GRD150 gave us a call. He'd previously used a very early, manually tuned Astra receiver and was looking forward to the luxury of changing from RTL4 to RTL5 by remote control. This is where the problem arose. He wanted his RTL4/5 decoder connected, but this receiver has no decoder socket – though there appears to be provision on the PCB, presumably for other receivers in the range.

From experience we know that RTL decoders like an unclamped, de-emphasised video signal. They don't like being presented with clamped video, usually producing

streaks/lines, particularly on the many subtitled programmes.

We come across a variety of decoders here in the Algarve, mostly pirate types that are openly on sale in the Netherlands. RTL have kept to the same coding system for years, and seem to intend to continue doing so.

We wired up a decoder and routed the signal via the scart socket on the customer's VCR (the VCR being on AV to watch/record coded channels). Clamped video was taken from the Grundig receiver's TV scart socket – we had to begin somewhere, though we had no great confidence about the outcome. And the Dutch channels are never coded when you want them to be! – the transmissions are coded only when programmes originating from outside the Netherlands are being shown, otherwise they are in the clear.

The results were surprisingly good, with no streaking on subtitles. But the decoder would drop out from time to time, especially with bright scenes. Adjusting the decoder's internal presets didn't help. As the customer wasn't interested in VideoCrypt reception, we decided to remove the VideoCrypt decoder PCB and look for unclamped video from the main PCB – though this meant taking the Grundig GRD150 and the decoder back to the workshop.

When I switched on with the VideoCrypt decoder PCB removed the RTL decoder worked well, with no sign of dropouts. The only problem was that the on-screen graphics had disappeared – the customer decided that he could live with this. So everything was reassembled and no further investigation was carried out. I can only assume that unclamped video appears at the scart connectors when the VideoCrypt decoder is removed. We rarely see these receivers here, so maybe someone else could investigate further.

# Test Case 396

Except for some occasional co-channel interference during the summer months, old Mrs Simes had enjoyed good TV reception for twenty five years at her village High Street cottage. Now, suddenly, her pictures were being torn to shreds every few minutes by some form of interference. Regardless of which channel she was watching, the picture would be obliterated by wavy patterns and black bars, while raucous rasping and grunting noises would take the place of the programme sound. It was no coincidence that this had all started when Beeline Taxis (motto: Where You Come First) had taken the premises next door and erected a mighty guyed pole with a v.h.f. whip aerial at the top. Mrs S confronted Mr Beeline, who agreed to finance a solution if one was possible.

Now Mr Beeline is no fool. He consulted his radio-telephone licence, which told him that his transmit frequency was about 176MHz. He discovered that terrestrial TV broadcasts are transmitted in the 470-860MHz band. So he couldn't see why there should be a problem. Admittedly his aerial was close to Mrs Simes's TV one, which was also mounted on a pole because of the poor local TV signal strength. Living in one of the few poor reception areas left around here, she had to use a masthead amplifier – a rare beast these days. No doubt the weak TV signals made her installation more susceptible to the 25W signals that Mr B used to guide his taxi fleet. Anyway, the upshot was that Mr B consulted the pages of his copy of the *Evening Echo*, and settled on Sick-em-Up Aerials to sort out the problem.

When Stick-em-Up was called in, its Tex Rogers gave his opinion. Drawing his breath through his front teeth and shaking his head, he pronounced (probably for the fourth time that day) "this is going to cost you, squire". Tex talked knowingly about special filters, braid-breakers and so on. They would have to be specially ordered — maybe specially made. Having obtained details of Beeline's v.h.f. transmit frequency, he drove off in his battered van, still shaking his head and drawing in air through his teeth. Our taxi mogul, seeing no other solution, duly sanctioned the work.

Stick-em-Up Aerials returned to Mrs Simes's cottage a couple of weeks later, this time with a rectangular metal box which had coaxial connections at each end, a couple of trimming holes and "-52dB, 176MHz" scrawled on it. This was the wonder filter that had been ordered from a specialist firm.

Tex inserted it in the feed between the aerial socket mounted on Mrs Simes's skirting board and her TV set, then phoned Mr Beeline next door. Mr B keyed his RT microphone, and the TV picture went to pieces — just as before. Consternation! Tex twiddled the trimmers, instantly destroying the precision factory alignment of the notch filter. Still the picture was obliterated whenever Mr B was on air. Tex vented his opinion of Fleetway Filters Ltd. as he removed their gadget and substituted an ordinary CB filter in the coaxial feed. The TV picture and sound still went haywire whenever the v.h.f. radio-telephone came on.

The harassed aerial man tried braid-breakers, ferrite rings, earthing the coaxial feeder's braid and every other possible remedy he could think of. All to no avail. A couple of hours later he retired defeated, with no chance that he could see of getting paid for his trouble. There was a solution though, if only he had had a full understanding of what was happening in this r.f. wipe-out situation. Do you know what the root cause of the problem was, and why the filter had virtually no effect? If not, turn to page 136 for the solution.

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HA13119 HA13403 HA1377

HM6232

HM6251

KA2263

**KAR361** 

KBLO8 KIA6210AH KSR1001

KSR1004

KSR2001 KSR2004

1200CY

IA1503

LM261 LA4270 LA4282

LM422

LAAAAA

LA4445 LA4460 LA4461

I AAA75

LA4476 LA4508

LA4700

1463585

LA6510 LA7520

LA7800

LA7820 LA7830 LA7835

147837

LC7132 LED3G LED3R

LM1203

LMI 303N

LM317T LM324N LM339N

1M340T5

LM358 LM358N LM380N LM386N

1M3914N

LM393N LM741 M104B1

M293B1 M491 M494B1 M51387P

M51393AP

M5218L M5231L M54519P M54543L

M54544L M54548L

M54648L

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MB3730 MB3732 MC13002 MC1310P

MC1377F

MC1391P MC14426P MC3357P MDA2062

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MPSASA

NES45B NES55N NES56

NES92N

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STK5332 STK5333 STK5338 STK5342

STK5372H STK5372H STK5421 STK5466 STK5471

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TA7222P TA7227P

TA77338

TA7240P

TA7250

TA7750BF

TA7270P

TA7273P

TA727AP

TA7280P TA7281P

TA7288P

TA7299P TA7317P

TA7609P

TA7680AP TA7698AP

TA7769F

TA7784P TA8201

TA8205

TA8205AH TA8207

TAR210H

TA8215H

TA8220H

TA8221H TA8221L TA8410K TA8691N

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TBA920 TBA950 TCA440 TCA8000

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	1N4002 1N4003	0.07	2SC2120 2SC2166	0.23 1.29	2SD669A 2SD716	1.46	BC300 BC301	0.48 0.28	BF757	0.12 0.43	BYD33J
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	IN4007	1.06	2SC2236	0.36	2SD820	5.06	BC307C	8.15	BF760 BF762	0.26	BYV95C
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	1N5401 1N5402	8.14 8.12	2SC2335 2SC2458	1.12 0.14	2SD870 2SD871 2SD880	3.81 5.08	BC309C BC327	0.14 0.18	BF959	0.18	BYX55600 BYX71600
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	2N2222	0.22	2SC2625	2.54	2SD973	0.38 7.69	BC338 BC368	0.06 0.11	BFR90 BFR90A	8.68	BZX6112 BZX61120
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	2N2907	0.20	2SC2724	8.19	2SK192A	0.36	BC372	0.43	BFR91A BFR96	0.55 0.55	BZX6120
	2N3053 2N3055	6.38 8.50	2SC2979 2SC3117	2.74 0.60	2SK794 3SK88	8.41 2.57	BC461 BC517	0.31 0.14	BFY51	0.39	BZX6127 BZX6133
	2N3440	8.35	2SC3153	2.48	74LS247	0.62	BC548A	0.07	BR100	0.21	BZX615Y6
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	2N3906	0.80	2SC3242	0.19	7815	0.82	BC548B	0.06	BRY56	0.43	BEX/912
	2N4123	0.30	2SC3310 2SC3311	2.12 0.29	78L05 78M05	0.35 0.35	BC548C	0.06 0.11	BSR50	0.75	BZX7915 BZX7930
	2N5296 2SA1013	0.69 0.35	2SC3330	0.26	7905	0.35	BC550	0.15	BSS38 BT139600	1.77	BZX7936
	2SA1015	0.11	2SC3355 2SC3358	0.96	7915	0.82	BC549B BC550 BC550C BC556A	0.09	BT151/500R	1.44	BZX794V7 BZX795V6
	2SA1015GR 2SA1016	0.11	2SC3420	0.69 0.55	AA119 AA143	0.36	BC557	0.05	BT151800 BU104	1.15	BZX796V2
	2SA1020	0.44	2SC3420 2SC3423 2SC3502	0.60	AC127	0.52	BC557 BC557A	0.15	BU205	1.07	BZX79C3V9
	2SA1029 2SA1048	8.26 6.19	2SC3502 2SC3656	0.45 0.18	AC151 AC153K	0.52	BC5578 BC5588	0.06 0.08	BU208A	1.44	BZX79C5V1 BZX83C6V2
	2SA1286	0.60	2SC3679	4.45	AC187K	0.53	8C560C	0.06	BU208AT BU208D	1.25	B7Y8810
	2SA1370 2SA1489	0.43 2.40	2SC3788 2SC3795	0.77 1.97	AC188 AC188K	0.48 0.82	8C635 BC636	8.19 0.14	BU326A	1.36	BZY8811 BZY8812
	2SA1706	9.52	2SC3795B	2.63	AD149	0.52	8C637	0.11	BU406 BU406D	1.02	BZY8813
	2SA562 2SA564	9.17	2SC3807 2SC3883	0.84 5.92	AF124 AF125	1.75 0.82	BC639 BC640	0.09 0.06	BU407	0.53	BZY8824 8ZY8827
	2SA608	8.33 0.24	2SC3892A	4.79	AF126	2.23	BC879	0.40	BU4070	0.98	BZY882V7
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# Day of the Show:

# More Confessions of a TLO

Mark Paul

"Ach! I know he's a pain in the proverbial, but he's also a very big accoont." This was the National Accounts Sales Manager, addressing me in his broad Glasgow accent. "So when he arrives, you tak him oot fur lunch, and I'll take him oot for dinner. OK?"

It was an order of course, not a question. He then glided away across the thick pile carpet that covered the floor of the large room, heading for another very dear, ever-so-long-standing friend of a dealer who had just arrived. That well-rehersed welcoming smile was again dominating his face.

It was 10 a.m. on the first day of the annual Trade Show, and the atmosphere in the spacious hotel suite was dry and already heavily scented with a mixture of Old Spice, Chanel, cigars, cigarettes and Polos. A reflective mood came over me as 1 stood with my fourth cup of coffee, viewing the early show excitement. It seemed to me that on an ego scale of 1-10 the company sales personnel all scored 11. Such a concentration of poseurs in one place and at one time seemed strangely unnatural.

### Angeligue and Roj

"I say, are you the TLO?" A rather high-pitched, sibilant voice broke into my reflections. I turned to see Angelique Matthew-Henry, who worked in the ultimate department at the ultimate centre of the known universe – Marketing. She wouldn't, of course, recognise someone like me, even though we had in the past dealt, over the phone, with certain customer problems.

"Good" she continued. "Come with me. We're giving a pre-show presentation of the new model line-up to the press and need someone technical to make sure that everything works and answer any questions. You know the sort of thing. All right? Good. Let's go."

Before I could reply, she was off. I gulped the remains of my coffee, put the cup down and hastily followed to

the special pre-view area. Roger St John Stevas-Brown, head of marketing, was presiding here.

"Roj! This is our TLO" Anjy said looking up into the face of the Marketing Manager. He turned slowly to look at me, his smile showing an amount of ivory seldom seen outside a game reserve.

"How splendid" he replied to Anjy. "You're so clever being able to get one so quick."

"Listen" he said to me in a low voice as he grasped my arm and took me aside. "Anjy has probably already told you what we need. The Trade Press is coming to see the new range and give us some good copy. At least I hope so."

"Now you know what these journalists and editors are like. There's the long-haired, smart-ass freelance journalist who always asks the highly technical questions. Simply an ego tripper. Then there's the pipe-smoking, beenthere-seen-this-done-that editor with leather patches on his tired Harris Tweed jacket. Here's really here for the beer. And then there are the women. They are the worst, focusing on trivial detail and full of buzz words and phrases. They tend to get themselves all tangled up technically - this is where I need you." Then he went on to tell me a long story about a couple of female journalists and their faux pas at the last show. Finally he paused, with a glazed look in his eyes.

I have a theory that the milieu of these events creates this sort of effect. A kind of mental eclipse is brought on by nervous energy drain and the effects of caffeine poisioning and breathing recycled air. Anyone who has experienced these shows will know what I mean. It makes the whole event seem somehow surrealistic.

I felt I had to break the spell. But it was a measure of the crazy situation that I came out with the words a mature TLO should never utter — especially to someone in marketing!

"So what do you want me to do?"

He turned, looked at me, smiled and said gently "just play it by ear". The ultimate cop out! With that he left me to my own devices. I decided to check that all was well with the presentation models.

### The Presentation

The turn-out was good. Everyone who was anybody in the consumer electronics press was there. It was now almost mid-day, and for the last half hour the visitors had been lubricated with several glasses of good vintage Chablis. This produced excited chatter, and it seemed that the guests were now well set up for the model presentation.

This was to be done in a small auditorium. I worked my way forwards and sat at the end of the front row. While I was scanning the press release, someone came and sat in the next seat. It was that well-known, sometimes troublesome technical writer Barry Badger. Before he had time to notice, I'd unclipped my lapel name tag and stuffed it into my pocket. Then I tried to give the impression of being deeply immersed in the handout.

A loud crash of drums introduced some rock and roll music. Modulated, multi-coloured lighting wizzed around the room, highlighting the various models on display. Five go-go dancers appeared from nowhere and started to girate violently in time with the beat. All this was meant to emphasise the with-it theme of the new range, which had been created at great expense by that well-known designer Pinstripe Stork – the handout described the theme as "colour and movement". Oh well.

Just as suddenly the lights dimmed to dark, the music stopped, the dancers disappeared and a small rostrum, to the side of the front row not far from where I was sitting, was highlighted. Behind it stood Roj.

The audio-visuals on the large backprojection unit behind Roj were as good as his slick presentation. He worked his way through the sales and marketing strategy for the coming year, while describing the model line-up.

After the formal part of the presenta-

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tion was over senior company staff from sales and marketing, plus yours truly, clambered on to a small stage in front of the back-projection screen. The meeting was opened for questions from the floor. Most of them were, as one would expect, aimed at my colleagues. Many of those present had either succumbed to the wine or were engaged in 'power napping'.

As it turned out I had only one question to answer. Predictably, it came from Barry Badger. He wanted more information on the design innovations in the new, super-fast teletext module with its Constant Repeatable Access Programme – CRAP for short.

"With the move away from SDRAM architecture towards FPMDRAM, and EPROM being dropped in favour of a combination of FLASH and EEPROM, giving increased densities and faster access speeds, does this mean that the

SRAMs will be replaced with SSRAMs, and if so will the pipe-lined approach be replaced by the non-pipeline flow-through version?"

I sensed a hush fall over the meeting. All eyes were on me. I told myself that the question was easy enough to deal with. After all the company had recently sent me on a self-assertion course. So I took a deep breath, sighed audibly whilst looking at the ceiling, and then slowly returned my gaze to the questioner.

"Yes" I answered positively.

Barry Badger blinked. He pushed back his glasses and began to scribble furiously in his notebook. Another scoop in the making.

The moment of tension had passed. Roj rose to close the meeting. He thanked everyone for attending, and told them where lunch was being served.

I slipped away quietly to the main

display area, where my lunch appointment was waiting. He was talking to the National Accounts Manager, who called me over.

"Here he is Jimmy" he said, referring to me and talking to the dealer. "He'll tak you oot for a bite tay eet an I'll see you later. OK?"

I smiled and we headed for the place where they served the standard chicken dish. For want of anything else to start up the conversation, I asked my guest "do you know anything about SDRAMs, FPMDRAMs, SRAMs or SSRAMs?"

He blinked and looked at me blankly. Then, fingering the neon screwdriver clipped to his top pocket, he replied "are they a kind oh mains dropper then?"

I had to smile to myself when I realised that this was still only the first day of the show.

# Inside the Ferguson TX90E Chassis

Part 3 Mark Paul

In this concluding instalment we'll take a brief look at the remaining circuitry used in the chassis – the timebases, the RGB output stages, the audio amplifier and the microcontroller chip.

### The Line Timebase

The line timebase is conventional. The line sync and oscillator circuits are in the TDA8218 chip IL01, which produces a line drive output at pin 17. This is passed via a driver stage to the base of the S2055AF line output transistor TL01. The line output stage is very simple, there being no need for EW correction.

Fig. 12 shows the line generator section of IL01, which also contains the field oscillator and output stages. Composite video is fed to the internal sync separator at pin

negative-going output at pin 12 to pull the line oscillator into lock.

The free-running oscillator frequency is set by PL02, RL02 and CL03, in conjunction with the internal resistor chain connected to pin 1. RL05 and CL05 integrate the current output from the phase detector, producing a d.c. error correction voltage which, via RL04, adjusts the charge/discharge timing of the oscillator tuning capacitor CL03, thus locking the line oscillator frequency to the line sync pulses. CL04 stabilises the phase-locked loop, ensuring a fast response time. RL05 and CL05 set the basic loop time-constant.

The sawtooth output produced by the oscillator, at the collector of internal transistor Tr, is fed to a comparator whose other input is a 4.8V reference voltage. Its output is a constant pulse-width squarewave signal which drives the

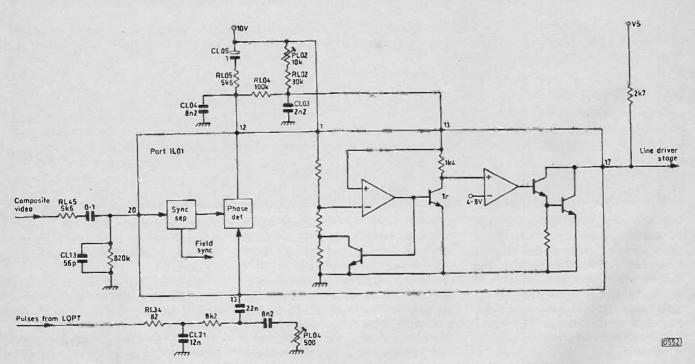


Fig. 12: The line sync/generator arrangement.

20. RL45 and CL13 form a low-pass filter at the input to suppress h.f. harmonics or noise that could cause picture jitter.

The separated line sync pulses are fed to a phase detector whose other input is derived from pulses tapped from the heater winding on the line output transformer. These are integrated by RL34 and CL21 to form a sawtooth waveform which is applied to pin 13. PL04 provides horizontal shift adjustment, by varying the phase of the sawtooth feedback waveform. The phase detector compares the timing of the line sync pulses and the sawtooth, producing a positive- or

chip's open-collector output transistors (open collector means that the load resistor is external to the i.c.). The line-frequency squarewave signal thus generated at pin 17 of the chip is capacitively coupled, with d.c. restoration, to the following driver stage.

### The Field Timebase

The TDA8218 chip drives the field scan coils directly from pin 10. The field timebase circuit follows conventional practice, with the usual flyback voltage generator arrange-

ment. The oscillator is similar to that used in the line timebase section of the chip, though the separated field sync pulses are applied to the internal resistor chain directly instead of via a detector in a phase-locked loop.

There is a.c. and d.c. feedback from the scan coil circuit to pin 7 of IL01. The height control PL03 varies the slope of the feedback waveform at pin 7, thus adjusting the slope of the scan coil current drive waveform at pin 10.

A 25Hz signal from the teletext module is applied to the junction of the field scan coils and the scan coupling capacitor CL07 (1,000 $\mu$ F). This alters the scanning to non-interlaced in the teletext mode to prevent jitter.

### Super Sandcastle Pulses

IL01 also provides super sandcastle pulses at pin 19, with three levels as follows:

- (1) Field blanking level, typically 2.5V.
- (2) Line blanking level, typically 4.5V.
- (3) Burst gating level, typically 9V.

The field blanking generator is a monostable multivibrator with an external RC timing network connected to pin 8. The start of the blanking pulse is triggered by the falling edge of the field sawtooth waveform. The line blanking section of the super sandcastle pulse is produced by a comparator whose inputs are line flyback pulses and an internal reference voltage. The position of the burst gate section of the super sandcastle pulse is fixed by an external RC network connected to pin 14, with reference to the middle of the line flyback period. Close-tolerance components are used in these external RC networks.

### **RGB Output Stages**

There are only very minor differences between the RGB output stages, so only one will be described. Fig. 13 shows the red output stage circuit.

The red output signal at pin 25 of the video processing chip IV01 is fed to base of the voltage amplifier transistor TT52, whose load resistor is RT52 ( $10k\Omega$ , 2W). This high value is used to achieve high gain with low dissipation. The following pnp transistor TT51 serves two purposes. It acts as an emitter-follower: when TT52 is brought into conduction by a positive signal at its base, its collector voltage falls and TT51 conducts, providing a path for the tube's cathode current. The path, from chassis, is via pin 33 of IV01, RV17, RV18, PT50, TT51 and the flashover protection resistor RT54.

TT51 also provides current sensing for the automatic grey-scale correction circuit described last month. The voltage developed across PT50 and RT50 is directly related to the cathode current. This voltage is fed to pin 34 of IV01, operating in the manner previously described. Diodes DT55 and DT95 are included to prevent TT51's collector voltage rising above about 21V. Otherwise TT51 could saturate, with loss of beam current limiting. PT50 and the corresponding potentiometer in the blue output stage enable tinting at peak white to be removed – a fixed resistor is used in the green output stage.

In addition to supplying a stable 3.8V bias voltage for the RGB output transistors TT81 provides switch-off spot suppression. At switch off the 13V supply, which is obtained from the line output stage, collapses quickly. CT81 is very rapidly discharged, reducing TT81's base voltage to

zero. As a result it switches to full conduction, removing the emitter bias voltage from the RGB output transistors. These also switch to full conduction, discharging the e.h.t.via the tube's cathodes.

### **Audio Circuit**

The audio output stage is conventional, using a TDA2006 chip. The only point to note is that the input is via either

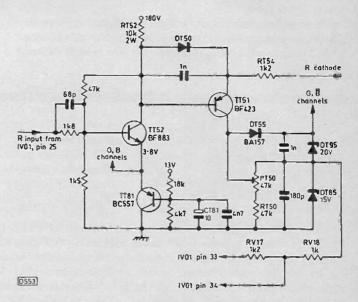


Fig. 13: The red output stage circuit.

transistor TS02 or TS03. In the TV mode TS03 is switched on while TS02 is switched off. This situation is reversed in the radio mode.

### The Microcontroller Chip

The ST6399B1/KU microcontroller chip IR01 operates with an 8MHz clock, crystal QR01 being connected between pins 31 and 32.

The on-screen display (OSD) functions are built into it. OSD blanking is used to produce the black fringe background around the OSD characters. Timing of the OSD functions is controlled by the super sandcastle pulses. A separate OSD oscillator is connected to pins 28 and 29, running at approximately 5.5MHz. Adjustment of LR03, which is connected between these pins, varies the width of the characters.

There are different bus arrangements for video and teletext/tuner control. In both cases the data output is at pin 40. The video clock and enable lines connected to pins 38 and 39 are used for brightness, colour and contrast control via IV01. This Thomson bus is unidirectional. Pins 40 (data) and 41 (clock) carry commands to the tuner and teletext modules. This I2C bus is bidirectional, enabling the tuner or teletext module to carry out a 'handshake' with the microcontroller chip. These lines are normally high, going low to transmit commands.

The 62.5kHz output at pin 5 is used by the colour decoder chip IC01 for PAL/SECAM switching.

Pin 7 detects the presence of an AV signal at the scart socket while pin 17 switches the receiver to the AV mode.

The resistor connected 6 determines the TV standard, with pin 34 providing an output to the i.f. module to select the video and sound systems.

An associated muting signal generator circuit senses the presence of a video signal. Its output is also fed to pin 36 of

IR01 as a station detect input in the auto-search mode.

The keyboard has four key scan output and four key scan input lines. When no key is pressed the output lines are low. When a key is pressed the low from the output appears on one of the input lines. Once this is detected, the output lines begin to scan sequentially to enable the microcontroller chip to decide which key is being pressed.

Resistors connected to pins 18 and 19 tell the chip whether a simple clock or a radio/clock module is incorporated. These pins are also used for alarm input and f.m. power on/off control.

The remote control input is at pin 35. There's a 5V peakto-peak square waveform with pulse-position modulation when a command is being received. The line is high with no signal input. The standby/on output at pin 20 goes high for standby. Pin 4 produces a pulse-width modulated output for volume control.

The reset circuit, centred on transistors TR76/7, generates a reset pulse for pin 33 of the microcontroller chip when a.c. is first applied to the receiver or after a power supply interruption. The reset line is held low initially, rising to 5V after about 20msec.

The power interrupt (power failure detect) input at pin 37 provides the microcontroller chip with a warning that the a.c. input is about to be lost. It's low when a.c. is applied, going high as soon as the mains input is disconnected. The 5V supply to the microcontroller chip is designed to maintain itself for at least 150msec, so that the chip can store the receiver's current status in the EEPROM.

# Help Wanted

The Help Wanted column is intended to assist readers who require a part, circuit etc. that's not generally available. Requests are published at the discretion of the editor. Send them to the editorial department – do not write to or phone the advertisement department about this feature.

For disposal: Television magazines January 1971-December 1979; ERT service sheets/manuals from early Sixties-late Seventies as a lot; a 20in. CM51 Barco RGB monitor with spare tube, both unused; a Thorn TX100 chassis with panels. Contact Brian, Maidstone. 01622 730 504.

For disposal: Practical Television /Television magazines from 1970 (Vol. 20) to date. Also Radio and Television Servicing books 1977/78, 1978/79 and 1979/80. Stuart Higgins, 1 Strathmore Drive, Charvil, Reading RG10 9QT. 01734 340 736.

Wanted: MAB8051C21D1 microcontroller chip, used on board P607 in the Philips Model VR6467 and clones. D. Jannece, 54 Wyatts Green Lane, Brentwood, Essex. 01277 822 380.

Wanted: Circuit diagram (photocopy would do) for the Video Circuits tube tester Model V33 and any relevant information on it. B.R. McLeod, 8 Cunningham Road, Horndean, Portsmouth PO8 9LT.

Wanted: Mechanical layout of the CR-W77 cassette section of a Fisher Hi-Fi separates assembly (other units are MT55 and FM55). Also a circuit diagram for the Boots-Thomson T3614P1 colour portable. Photocopies

would do. P. Travers, 6 Woodfield Road, Bebington, Wirral, Cheshire L63 3DX.

Wanted: Service manual/circuit diagram (photocopy would do) for the following: Panasonic NV2000 (Granada VHSNV1/VHSVN1); Granada VHSYH2 (GEC V4001/2 or Hitachi VT9300/9500). Also any information or circuit diagrams for the Commodore 1541 Mk II disk drive. W. Keenan, 86 Tyne Gardens, Ryton, Tyne and Wear NE40 3DR. 0191 413 6192.

Wanted: Betamax VCR in good working order, with camera socket. Paul Thompson, 58 Ella Road, West Bridgford, Nottingham NG2 5GW. 0115 981 3587.

Wanted: Service manual/circuit for the Questar Laser 1900 mono TV/a.m./f.m. radio/tape deck/digital alarm clock. Also source of SN96517BN and TDA1070 chips for Hoover washing machine motor modules. R.H. Hespley, 3 Cotsdale Road, Penn Common, Wolverhampton WV4 5LF.

Wanted: Circuit diagram and instructions for the Philips PM5504 pattern generator. Also scrap Philips music centre with good Philips FT260 micro and a movement for a TMK500 multimeter. Jim Littler, 363 Atherton Road, Hindley Green, Wigan, Lancs WN2 3XD. 01942 258 794.

Wanted: Laser assembly/main board ribbon connector for the Pioneer PD6010 CD player. Faulty unit with ribbon intact would do! David Upton, 85 Clyne Court, Sketty, Swansea SA2 8JA. 01792 207 697.

Wanted: Any service information for the Ayr Model T1 Viewdata/teletext adaptor. J.M. Parry, 4 Courtland Drive, Aston Park, Queensferry, Deeside, Clwyd CH5 1UQ. 01244 819 728.

Wanted: Service manual/circuit diagram for the Barco 3200 series

CTV and any information on spares etc. Any circuits/manuals for older TV sets, audio equipment, VCRs, test equipment would be welcome for a new entrant to the business. Ken Darville, Avia, Station Road, Yeoford, Exeter EX17 5HU. 01383 84 017.

Wanted: S2800 or equivalent thyristor for the Ferguson Model 3787 (NordMende chassis), circuit reference number DU04. Have for disposal over 200 *Practical Television* magazines. Offers please! Stan Jesney, 56 Barnacle Lane, Bulkington, Nuneaton CV12 9RQ. 01203 315 788.

Wanted: LOPT for the Ferguson Model 51J7, also an automatic programming button unit assembly for the Sony Model KV2217UB. J.R. Walker, 45 Woodside, Barnard Castle, Co. Durham DL12 8DZ. 01833 690 557.

Wanted: French (SECAM) TV set required for test purposes – cabinet, tube condition not important. L.P. Watkinson, Telesonic Services, Regent House, Week St. Mary, Holsworthy, Devon EX22 6UJ. 01288 341 254.

Wanted: Remote control handset for the Fidelity AV2000 AV system, or a supplier's address. Also a circuit diagram (photocopy would do) for the Tandy Portavision-2 monochrome portable. G. Cannon, 16 St Cuthbert's Road, Holy Cross, Wallsend, Tyne and Wear NE28 7JF. 0191 262 0172. Wanted: Circuit diagram plus any

other information including a parts stockist for the Emelcold Super General 20in. TV/VCR Model DVT-9254D – it was bought in Cyprus. P.J. Rowe, 7 Trevol Place, Torpoint, Cornwall PL11 2NZ. 01752 815 392.

For sale: Television 1980-90

For sale: Television 1980-90 complete. £90 plus carriage, or collect for cash. F.S. Yarham, 18 Ivel View, Sandy, Beds SG19 1AU. 01767 680 154.

# Camcorner

Reports from Brian Storm, Gerald Smith Simon Bodgett and David C. Woodnott

### Panasonic NVM40

Tape playback was marred by a noise bar across the picture, as if the tape path was misadjusted. So this was the first thing we checked, only to find that it was all right. We next found that the PG adjustments had no effect on the head switching point. The cause of this was eventually traced to C6219 (0·027 $\mu$ F), which is connected across the PG adjustment control VR6201. It had gone open-circuit. A replacement capacitor closed the gap in the f.m. waveform.

### Panasonic NVMS50

This oldish S-VHS machine would intermittently power down by itself, usually after working for hours on the soak test bench. The only thing we could do was to carry out a blanket replacement of the TL1453CNS power supply control chip (IC1001) and the 2SB956 transistors Q1001/2/6/7. After doing this we gave the machine a long soak test and declared it fit for return to service.

B.S.

### **JVC AA-V3EK**

This is the power supply for the GRAX5. It wouldn't charge, the power LED display being dull and pulsing. On investigation I found that D2 on the primary side of the supply was open-circuit.

G.S.

### **JVC GRS70**

This one wouldn't record colour. It's a not uncommon fault, caused by the failure of capacitors in the a.p.c. loop on the hybrid chip. You have to replace the chip.

S.B.

### **JVC GR303**

"Playback picture interference, see tape" it said. Yippee! With this one we got a sample tape. We had to clean the clogged flying erase head.

S.B.

### Sony CCDF340E

The E-E pictures were o.k. but there were no mechanical functions. Failure of the drum to rotate was the basic cause. Investigation brought us to an open-circuit lead-through between the sides of board SS86, specifically between Q053 (drum drive inverter) and Q052 (PWM amplifier).

When we'd restored the drum motor drive another problem showed up: playback was marred by coloured lines that flickered across the screen. The cause of this was C456 (22µF, 16V) which was open-circuit. It decouples pin 1 of IC363 (jog chroma processing) on board VA41. This fault has been reported previously but is now becoming quite common.

D.C.W.

### Mitsubishi CX1B

When we received this VHS-C camcorder a cassette was stuck in the mechanism and a "no tape" message showed in the viewfinder! No functions worked. Once you've removed the forty or so screws, access to the mechanism is quite good. We then removed the tape by using the Sony mode box to power the loading motor.

The cause of the trouble was damaged parts around the

back-tension lever. Compared with some decks, this part of the mechanism is actually quite complex. The parts that had to be replaced were: spring push 2: set arm S; and lever tension off.

An excellent training tape from Akai covers all you need to know about aligning the mechanism, which is used in the Akai Model PVC20.

D.C.W.

### Sony CCDV800E

A knocking noise was being recorded on the tape. The cause was a faulty capstan motor bearing. Unfortunately the bearings are not available separately, so a new motor is required. We've had the same problem with other camcorders that use the same mechanism (U and U'), e.g. Canon, Sanyo etc. models. D.C.W.

### Sanyo VMD9P

Noise bars on the playback picture is quite a common problem with this model. The effect is of no a.f.t. control. The fault sometimes affects the recorded picture as well, but more often it affects only playback. There seems to have been a batch problem with IC361: a replacement invariably cures the symptom.

D.C.W.

### **JVC GRAX2**

The E-E picture was o.k. but there were no mechanical functions. A quick check showed that CP1 (N38) was open-circuit. When this had been replaced the problem appeared to have been cured, with all functions restored, but on test the symptom returned when we pressed the record button. With this model there is a high current demand when the drum motor starts up and is then slowed as the tape wrap occurs. Even when the machine is working normally some 2A (total current) can be measured if the drum is slowed slightly in the record mode. The cause of the trouble turned out to be Q13 (2SB1302-SB) which was leaky. It acts as a switch-mode regulator for the drum 5V MDA supply.

### Sanyo VMD3P

Three more capacitors to add to the list of those that should be replaced in this model. First C2009 (33µF) which is connected to pin 9 of the audio chip IC2001. It's in the audio level control circuit, and when faulty the result is continuous maximum audio sensitivity in the record mode. The other two capacitors are C1098 and C1124, which can leak producing a symptom that's identical to failure of one head in playback. The electrolyte leakage causes loss of the drum FF pulses to the head amplifier chip, hence the 'one head only working' symptom.

D.C.W.

### Canon E200E

The problem was lack of playback audio — the E-E and recorded sound were both o.k. Only a rough, rasping sound could be heard during playback. The culprit turned out to be the LA7454W a.f.m. demodulator etc. chip IC802, which is on the A-V out sub PCB. After fitting a replacement the relevant controls (deviation etc.) have to be set up as laid down in the manual.

D.C.W.

# Repairs to MTI LNBs

**Hugh Cocks** 

The MTI (Microelectronics Technology Inc.) LNB is readily identifiable, being a large, round cylindrical unit with a flat part near the F socket. There are two common versions, the black UP3 and another that comes in various colours and has a silver or gold label stuck to the case. The body of this latter type, though looking similar to the UP3, is slightly larger.

Standard 13/17V voltage switching is used for polarisation selection. Because of the large diameter body however these LNBs are not compatible with a Marconi type feed bracket. Both versions use a 10GHz local oscillator, though models were available for the telecom/DBS bands. There's a later 9.75GHz type with a slightly shorter body, but we have no experience of this version.

We sold quite a lot of these LNBs, as part of satellite TV systems, up to a couple of years ago. Their performance is very good, especially the gold-label type, though there is one annoying feature: when the summer temperatures arrive here in the Algarve the LNB very often just stops working! A colleague in the UK tells me that this is much less common there

I got fed up with sending these LNBs back and, at the time, other makes didn't seem to work so well here, partly because of the weaker signals -- especially from Astra 1A. So I decided to open up and see whether anything could be done.

### Dismantling the LNB

Gaining access to the innards is fairly easy. Unscrew the front ring that holds the Teflon cover in place (the warranty sticker will break in the process!). This reveals a substantial scalar ring type feed, which in all probability was the reason for its performance edge over its contemporaries. Undo the nut on the F socket at the back, and push the socket into the case. The assembly then comes out. Make sure that you remove the front O ring on the feed at this point – otherwise it can fall off and disappear. The second, larger O ring just behind the first normally stays put.

The low-noise amplifier (LNA) and mixer are under a cover at one side. The i.f. amplifier and voltage regulator PCB is mounted at 90° to the LNA/mixer. The local oscillator assembly, which is easy to identify by its small cover with a large screw that sets the frequency, is on the opposite side.

### The Problem Area

The local oscillator is the problem area. For some reason the oscillator stops oscillating, though the gallium arsenide FET (GaAsFET) continues to draw power as usual. An indication that the oscillator is about to stop is sometimes provided by the fact that there is a small 'jump' of about half an Astra channel – usually just about resettable using the receiver's offset menu. Replace the transistor and all is well.

A couple of years ago MTI were very helpful and sent me some complimentary oscillator transistors. The type of GaAsFET used doesn't appear to be very critical. The original type had just a blue mark on it – the replacements supplied by MTI had the identification J on the case. It may be an idea to buy a Sendz Components ex-rental LNB and plunder it for spares. Maplin listed a GaAsFET (type

2SK571, order code UH65V) in the 1993 catalogue but there is no such listing in the 1995 catalogue.

Some experience with handling GaAsFETs, and familiarity with the innards of LNBs, is an advantage. A signal source is helpful. A subsequent article will describe a microwave i.f. upconverter which will provide a good reference signal.

### Oscillator Circuit

The oscillator circuit is quite simple – see Fig. 1. The transistor's drain is linked to a 5V supply via some thin PCB track that acts as an r.f. choke. Its gate is earthed via a length of stripline and a  $51\Omega$  chip resistor, its source being connected to earth via some more stripline and an  $18\Omega$  resistor. The d.c. voltage at the transistor's source is therefore positive with respect to its earthed gate.

A dielectric resonator mounted on a small, ceramic stand-off pillar sits on the Teflon PCB between the drain and gate

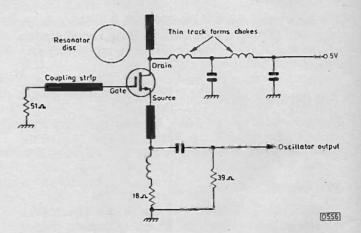


Fig. 1: The local oscillator circuit in the MTI LNB.

striplines. The result is a stable, very high Q tuned circuit – to function properly the cover needs to be fitted. The oscillator's frequency is determined by the distance between the large screw in the cover and the resonator. If you want, you can think of this simply as a 10GHz crystal connected between the transistor's gate and drain!

### GaAsFET Replacement

Removing a no-go transistor from the PCB is the easy part. Fitting the replacement is not so easy: GaAsFETs don't like static! Take the normal precautions when handling the replacement device. When soldering it, ensure that the bit is linked to the LNB's body and that everything is earthed.

Use as little heat as possible if you remove a transistor from an old LNB to transfer it to the MTI one. Remember which way round the connections go – the gate and drain are 180° apart with the two, thicker source leads (only one of them is used here) in between. See Fig. 2. If you use a new device you will find that the gate lead is cut off at an angle or identified by a dot.

Once the transistor has been installed, apply power but be

prepared to switch off quickly. There should be 5V at the drain and a small positive voltage at the source. The gate voltage should be zero – the meter may produce a small reading if the device is oscillating correctly. If the gate voltage varies around

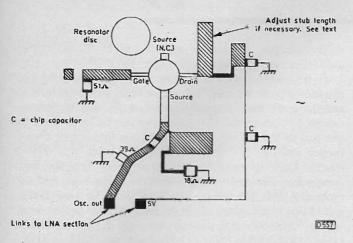


Fig. 2: Physical layout of the oscillator circuit. Note that chip capacitor and resistor earth connections are via through-plated points on the PCB. The chip capacitor values are not known.

zero when a finger is brought near the transistor, at least this shows that the circuit is oscillating.

If the voltage at the gate and/or source is 5V, disconnect the power to save the chip resistors. The GaAsFET has unfortunately died. Check your static precautions and have another go. If the FET has been obtained from an old LNB don't be too surprised if it dies in the transfer process. A new transistor shouldn't die however. If it does and your earthing arrangements are o.k., check that the transistor is the right way round: death is rapid if the gate and drain connections are reversed.

Test with signals and adjust the large screw for 10GHz (compare the pictures with those produced by a known good 10GHz LNB). Power up the MTI LNB a few times. If the oscillator is sometimes reluctant to start up (no picture), adjust the length of the drain stub slightly. Cut it back by 1-2mm and see if this helps — use a sharp, fine knife to cut through the track. If the results are now worse, the length of the drain stub needs to be made a little longer instead. Solder a very small piece of tinplate or similar material to the end of the stub. The results obtained should then be o.k.

### Astra 1D Modification

If all has gone according to plan and you are feeling pleased with yourself, it might be worth considering modification for Astra 1D reception by changing the oscillator's frequency to 9.75GHz. The MTI LNB performs well at the 1D frequencies.

As things stand, the adjustment screw won't have enough range to tune down. With the screw fully out of the case, you will be lucky to have reduced the frequency by 60MHz or so. Proceed as follows. Remove the resonator and ceramic pillar from the PCB. There's actually a cut-out in the PCB, the pillar being glued to the metal undemeath. A little force is required, but make sure you don't break anything! Remove the pillar from the resonator. This calls for some care, as the resonator can fall on the floor and be lost. Fine cutters and a small vice may be the best way to carry out the removal – the resonator and pillar are glued together very well.

Another pillar is required from an old LNB. Cut it down to approximately the same size as the original one. This is quite fiddly, but can be managed with a little care. When this has been done, stick the replacement pillar on its own into the

oscillator cavity. Wait for the glue to dry (the type of adhesive used doesn't seem to be critical).

The original resonator now needs to be stuck on to the new pillar. Before you do this, if possible balance the resonator on the pillar, put the cover back on and see if anything appears on the screen (using the signal source – doing this at the dish is well nigh impossible!). All being well, you'll see something in the way of a new channel. All we're doing at this point is to check that the oscillator is working. Now glue the resonator on to the pillar and wait for the glue to dry. There may be no oscillation at all until the glue is completely dry, so patience is necessary.

Once the glue has dried, adjust the oscillator's adjustment screw for Galavision where Sky News was with the oscillator at 10GHz. Reassemble and test at the dish. Astra 1D reception should be good, with CNN appearing near 1,900MHz. The stability of the retuned oscillator is in no way impaired.

### In Conclusion

You may have replaced some of these LNBs during the hot summer weather. I hope you didn't throw any of them away – never throw away old LNBs! These MTI LNBs are very well built. How they were made for the price at which they were sold is a mystery. The LNA section has rarely given me any trouble. Why the oscillator GaAsFET should stop is strange. Occasionally they have lasted out the hot weather only to die when the cold weather arrives!

Temperature change seems to be the problem. We've had MTI LNBs operating for over three years after replacing the oscillator transistor, with no subsequent trouble. Any suggestions as to how and why this problem occurs would be welcome! – write in via the magazine.

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# TV Fault Finding

Reports from Philip Blundell, AMIEEIE, Michael Dranfield, Stephen Leatherbarrow, Chris Watton, John Pitt-Francis, Nick Beer and John Edwards

### Ferguson 20H3 (TX100 Chassis)

This set wouldn't change channels when cold. The channel display went off when the button was pressed, and the a.f.c. could be seen to switch off, but there was no channel change. Application of heat and freezer narrowed the search to the stand-up PC1668 module on the PC1223 TACS board. C261 ( $1\mu F$ ) on the module had dried up. P.B.

### Philips 14PT156A (Anubis A-AB Chassis)

There was no teletext, with E3 displayed on the screen. All other functions were o.k. The teletext decoder in on a subpanel in this model. When it was removed we could see from the soldering that someone had already replaced the SAA5246 chip. Scope checks here showed that the clock oscillator wasn't working. A new crystal (1701) restored the teletext.

P.B.

### **Philips GR1-AX Chassis**

This set came in with no picture. When the tube's first anode voltage was turned up a blank, unmodulated raster appeared. After much searching we discovered that a small, brown disc ceramic capacitor, C2045 (22nF), was leaky. It's in the a.g.c. circuit, connected to pin 10 of the TDA8305 jungle chip IC7020. The readings we obtained were  $3k\Omega$  both ways. A replacement restored the picture.

### **Ferguson TX99 Chassis**

The complaint with this set was loss of the sound after an hour. A soak bench test confirmed that this was so. After checking the loudspeaker we turned our attention to the audio amplifier, but touching R72 at its input with a finger produced a healthy buzz from the speaker. Our next check was at the volume control pin (11) of the TDA4505 jungle chip IC2. As the voltage here didn't change when the volume control button was pressed we moved to the M494F chip IC241 on the remote control board. But surprise, surprise pin 34 and the output from the emitter-follower TR246 ramped up and down.

The only components between the emitter of TR246 and pin 11 of the TDA4504 chip are C66 and R12, which were both o.k., and the red LED D5. This was the culprit. going open-circuit when hot. It's easy to find, being mounted just behind the tuner. When working, its brightness intensifies as the volume is increased. In fact you can see it through the cabinet back. Remember the green LED in the TX10 chassis? Ferguson seems to like using LEDs!

M.Dr.

### Matsui 1455

High h.t. is a common fault with this set. The cause is C607  $(47\mu F)$  in the power supply drying out, the result being

weak chopper transistor turn-off drive. Usually the 2SD1426 line output transistor is damaged.

So we quoted a price and began work. After replacing the above two items we were left with a string of other faults – and the profit margin rapidly dwindled. Field collapse was caused by loss of the 12V supply to the TA7698AP chip. We had to replace R310 ( $10\Omega$ ) near the line output transformer and the 12V zener diode D219 which was short-circuit. Look around the luminance delay line for this component. For loss of the luminance signal we had to replace Q202 (2SA562), Q408 (2SC1815) and D417 (1N4148) which were all leaky. Finally the colour was wrong. This took us to the tube base where presets VR503 ( $10k\Omega$ ) and VR504 ( $500\Omega$ ) were burnt up, R510 ( $1.5k\Omega$ ) and R511 ( $4.7k\Omega$ ) were open-circuit and C505 (180pF) was short-circuit.

### **Grundig CUC52KT Chassis**

There was a snowy raster with no signals. When we removed the tuner/i.f. can for inspection we saw that someone else had been looking for a dry-joint – the soldering was a right mess, and several pins of the tuner control chip (TVA2000) were shorted together. After desoldering and cleaning up, the tuner still failed to work. The cause was traced to a burnt-up resistor that supplies 7.5V to pin 3 of the TVA2000 chip. A new  $56\Omega$  resistor restored good pictures and sound.

When we tried the set next day it would receive channel 31 but only snow was present when the other local channels (21, 24 and 27) were tried. The channels reappeared when the set had warmed up. Use of freezer failed to get us to the cause of the fault, but we found that tapping the can would instigate it. We then found that the voltage at pin 10 of the TVA2000 chip varied. As the 12V supply at pin 12 of the main PCB connector was stable, the cause of the fault lay within the tuner/i.f. can. There was a dry-joint at pin 12 of the socket connector inside the can. This is not visible by just removing the bottom: pins 11 and 12 are beneath the small screening can that covers the prescaler. So you have to remove this can to get at them. After resoldering these pins the set was given a long soak test and declared fit. M.Dr.

### Philips K35 Chassis

Intermittent low gain was the complaint with one of these sets. A tap on the tuner instigated the fault, so a new tuner was fitted. This seemed to cure the trouble, but the set bounced back three weeks later with the same complaint. As before, a tap on the tuner produced the fault. But so did tapping the PCB. We eventually found that the r.f. a.g.c. potentiometer R414 was intermittent. A replacement – not a squirt of Servisol – cured the fault.

M.Dr.

### Ferguson A51F (IKC2 Chassis)

This set was tripping. We found that TV01 (BC558C) in the electronic trip circuit was leaky. When we'd replaced this item the set still tripped, but at a slower rate. The cause was excessive current being drawn by the thyristor field output stage. To cure the trouble we had to replace the TL082 field

### TV FAULT FINDING

oscillator/driver chip IF01. For a quick check, just remove it. In this particular set it was providing excessive drive. M.Dr.

### Matsui 1481B

If the trouble is weak red, most noticeable with colour bars and teletext, replace C964 (1µF, 50V). It's part of the red cut-off network connected to pin 29 of the TA8807N chip on the tube base and tends to go open-circuit.

M.Dr.

### Hitachi CPT2578 (G8Q Chassis)

The complaint with this set was no sound. Its audio section was o.k., and pin 34 of the SAA1293H chip ramped up and down as the volume control was operated. But the voltage at pin 12 of the d.c. volume/tone control chip didn't. Replacing this chip made no difference however. The TDA2579 time-base generator chip is linked to the chip via D701 (1N4148), presumably to mute the sound on channel change. D701 was found to be leaky, measuring about  $200\Omega$ . We had to replace the TDA2579 chip as well as D701.

### **Grundig CUC70 Chassis**

The display had very badly corrugated verticals for about the first two minutes. We carried out all sorts of freezer and hairdryer tests without success, then brought out the scope. A check on the 12V rail showed that C662 (600µF, 63V) in the power supply wasn't at home until it had warmed up—like a lot of us!

### Ferguson 3787 (NordMende chassis)

We sold hundreds of these sets second-hand a few years ago. As some of them are now approaching seventeen years old, they are still working very well. This one had a fault we'd not seen before. The picture appeared at switch on, but there was a large blanked out area in the top half of the raster – it looked like a map of India. After a while it changed to South America! The culprit turned out to be CM21 ( $22\mu F$ , 35V) on the field output panel. C.W.

### Doric Mk 4 Chassis

Tripping when cold is a very common fault with these sets. You can be misled, as disconnecting the load enables the power supply to run. So if the set is tripping and this stops when you disconnect the tripler, but a new tripler makes no difference, go back to the power supply and check 4R5  $(68k\Omega)$ . If it's all right, change it anyway, along with the 1N4148 diodes 4D7, 4D10 and 4D11. This will stop the tripping.

### Hitachi CPT2650 (Salora J Chassis)

This set was dead. A scope check at the collector of TB701, the lower chopper transistor in the Ipsalo circuit, showed that the normal pulse was present. This led us to check the voltages at pins 1, 2 and 3 of the hybrid LF0041 chopper control chip HB1. Pin 1 was at 20V but pins 2 and 3 were at zero. We decided that HB1 had failed and fitted a replacement. This restored normal operation. Out of curiosity we took a look at the LF0041 circuit and found that between pins 1, 2 and 3 there is a stabiliser circuit that consists of two transistors and a zener diode. Resistance

tests showed that the zener diode was short-circuit. So we removed the hybrid chip and fitted a BZX61-8V2 zener diode, basically between pins 2 and 6. This restored operation of the device!

### **Philips CF1 Chassis**

There was no colour, with the voltage at the wiper of the customer colour control very low. When the control was set to maximum the picture darkened slightly. This suggested a short across the control line. Disconnecting the feed to the TDA3560/N3 colour decoder chip (pin 6) restored the control voltage, which could now be varied from about 1V to 3V. With a new chip fitted the colour was back, though I was then told that the symptom will occur if the reference oscillator is off frequency. The old chip had hit the bin before I heard this – why do people always tell you these things after you've chucked the bit away?!

C.W.

### Hitachi C2118T

No signals was the complaint here. The tuning display could be called up, and the bar moved across the screen when search tuning was started. But there was no variable voltage at pin TU of the tuner. A wet finger test between the 12V supply and the tuning voltage input proved that the tuner was working, as some sort of picture appeared - albeit with hum from the finger. When we traced back to the source of the tuning voltage we found that R044 ( $12k\Omega$ ), which provides the link to the hat line, was open-circuit. C.W.

### Dansai TAI1051

When this set was switched on using the standby button, the voltage at the collector of the power regulator transistor Q131 rose to 10.9V. It then dropped to zero, after about a second. Q131's output is fed to the line output transformer via D107, also to the line driver stage. The print goes around the edge of the panel, to a wire link between the transformer and the line output transistor's heatsink. This link hadn't been fitted correctly – it hadn't been pushed through the panel before being soldered. Fitting the link correctly restored normal operation. C.W.

### **JVC 7170GB**

This ancient portable had poor sync, with the picture rolling on scene changes and the colour dropping out on some channels. Checks in the sync section revealed that R216 (470 $\Omega$ ) had gone high to almost twice its correct value. A replacement restored solidly locked pictures, the set working perfectly despite its age. They don't make 'em like that any more! C.W.

### Philips 17CE1230 (CP90 Chassis)

This portable's remote control range was very poor. The cause turned out to be the TDA3047 RC receiver chip. After replacing it the range was excellent.

J.P-F.

### **Bush 2321T**

The symptoms produced by this set were most peculiar. Sometimes it would come on normally and stay on; sometimes it would come on, trip off and go totally dead; usually

### TV FAULT FINDING

it would start up then, after just a couple of seconds and often before the picture put in an appearance, it would trip to standby with faint thumps from the loudspeaker. In fact there were two faults competing for our attention! The mains input plug to the mother board was badly crimped. And C802 (100µF, 16V), which couples the drive to the base of the chopper transistor, had gone low in value. J.P-F.

### Binatone 01/9014

There was no life in the power supply. The cause was traced to R622 which supplies the start-up voltage.

J.P-F.

### Akura CX10 (Nikkai Baby 10)

There was normal sound but the line output transistor Q403 was overheating and there was no raster. The cause of the trouble was traced to D411 (FR155), which produces the 160V supply for the RGB output stages. It was very leaky.

J.P-F.

### Ferguson D14R (TX805 Chassis)

This was far too new a set for us to be familiar with the chassis, and we didn't have the manual in stock. The problem was that the set was stuck in the standby mode, with no voltages on the secondary side of the chopper power supply. Checks brought us to RP85  $(270\Omega)$  which was open-circuit. There was no apparent cause for its early failure.

### **Goodmans CTV20XRT**

There was very little contrast. The on-screen display gave a normal indication, but the voltage at pin 6 of the TDA3562A colour decoder chip IC800 was low, at 1.3V, and didn't vary. After looking at the relevant circuit diagram we checked back to the beam limiter section where R414 (33k $\Omega$ ) was found to be open-circuit. When this had been replaced the contrast control voltage could be varied between 2.95V (full) and 1.9V (zero).

### Panasonic Alpha 2 Chassis

There was no picture because the tube's heater supply was missing. Inspection around the line output transformer revealed a crack in the PCB, though this didn't affect the heater supply — what did was the fact that the winding between pins 7 and 10 was open-circuit, presumably caused by the impact that had damaged the board. As a test I wound a small coil of wire around the transformer's core to provide a heater supply.

N.B.

### **Grundig TVR5504**

The TV section of this combined unit was in trouble. It would either come on with an over-bright raster and flyback lines then return to standby, or would come on with no raster. The cause of the fault was a dry-joint at the cathode of D617.

N.B.

### Mitsubishi CT2206BX

This set was dead with the 2A fuse F901 black and Q991 (2SC1114) short-circuit. There was a very low resistance

reading across the h.t. line. The cause was traced to the MB1F EW modulator diode D579, which was very leaky, and the 2SC2073 EW modulator driver transistor Q491, which was short-circuit collector-to-emitter.

N.B.

### Salora 20L37

This set was arcing, the symptoms being a line across the screen and an audible addition to the sound. The cause of the trouble was dry-joints at one end of both C512 and R606. This arcing had led to the destruction of the MDA2062 memory chip, which couldn't recall anything.

N.B.

### Saisho CT14R

This set wouldn't tune in any stations. We soon found that the tuner's 12V supply was missing because of open-circuit print beneath the tuner. It had been eaten away by the fixative used to hold an  $0.47\mu F$  electrolytic to the back of the board. Normal operation was restored by cleaning up this glue, repairing the print and replacing the capacitor – it's fitted across the tuning supply voltage.

### Tashiko 16E891 (Tatung 160 Chassis)

There were teletext lines over the top half of the screen (slow field flyback). The cause was dry-joints on most legs of the field output chip, which is mounted on the rear chassis rail. You get the same problem with some Sony chassis.

N.B.

### Bang and Olufsen 5102 (7XXX Chassis)

This set had been to another dealer for a teletext fault, but there was still no teletext operation. When text was selected all you got was \$100 in the top left corner and the page header about a third of the way up the screen. The number could be entered, but there was no clock. When I examined the text board I saw that at least two of the chips looked very new, as did most of the solder. Unfortunately it hadn't reached pin 13 of 65IC3, which was dry-jointed. N.B.

### Logik 4298 (Ferguson TX100 Chassis, 110° Version)

This set was dead. For a change there was no short-circuit reading across the h.t. line. We found that D28 (BY299), which is in series with the h.t. feed to the line output transformer was short-circuit. When this was replaced there was a concave raster. R711 ( $2.7\Omega$ , fusible) on the EW correction PCB had failed. It's in series with the emitter of the Darlington driver transistor TR73.

### **Ferguson TX85 Chassis**

The complaint with this set was that it would come out of standby of its own accord. Noise from the SL486 IR preamplifier chip was found to be the cause of the trouble. N.B.

### Ferguson TX9 Chassis (TDA4600 Version)

This set was fitted with the final version of the chassis, which has a TDA4600-based chopper power supply. Very occasionally the set would either fail to start up or go off at random. It would work normally for hours, days or even weeks. To cut a very long story short, the cause of the

trouble was at pin 8 of the chopper transformer T1. It wasn't the usual dry-joint at the connection to the PCB: the actual winding termination to the pin itself was poorly jointed. The cure was to remove the transformer then scrape and resolder the connections.

J.E.

### Hitachi CPT2226 (NP81CQ Chassis)

Sound was present and there was a picture, but the chopper power supply transformer was screaming and there was severe line tearing across the centre portion of the raster. The mains bridge rectifier's reservoir capacitor C906 (220 $\mu$ F, 400V) was open-circuit.

### **Tandberg CTV3 Chassis**

This set was dead. Fuse F725 had blown apart because the BU126 chopper transistor Q735 was short-circuit. Further checks showed that the BU208A line output transistor had also died. After renewing the above items we switched the set on. The sound came up but there was no raster and the e.h.t. tripler was very hot to touch. A new tripler finally got the set working.

J.E.

### Granada C59GZ5 (Salora K Chassis)

When this set had been on for about five seconds the picture would fluctuate rapidly in and out, followed by shut-down. Sometimes it wouldn't bother to produce a display, just tripping and going into standby. The Salora

chassis in this set uses the Ipsalo-3 power supply, which is well known for failure of the S2000AF chopper transistor TB701 and the  $22\Omega$ , 5W filter resistor RB703. We repaired many suspect joints in the power supply and the line output section but this made no difference. The LF0059 hybrid chopper control chip HB600 then fell under suspicion. Fortunately, replacing it with one from a scrap set provided a cure.

### Sanyo CTP3131

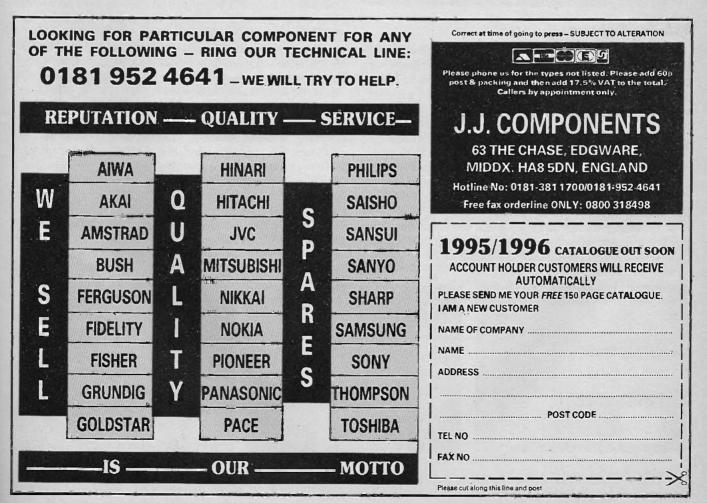
There was a blank raster with flyback lines. The first anode and focus controls worked normally but R464 ( $100\Omega$ ) was open-circuit. It's in the 85V supply to the RGB output stages.

### Hitachi CPT2028 (NP83CQ Chassis)

There was no sound or picture though the power supply and the line output stage were working. R716 (2 $\Omega$ ) in the line output stage derived 12V supply was open-circuit. J.E.

### Sanyo CTP3131

There was severe raster distortion at the sides, also fast vertical rolling. Because the mains bridge rectifier's reservoir capacitor C308 ( $100\mu F$ , 400V) was completely opencircuit there was a 400V peak-to-peak square waveform across it. A replacement produced a nice picture and the correct 1V peak-to-peak sawtooth ripple.



# Long-distance Television

Roger Bunney

Autumn has brought little distant terrestrial TV reception, either via Sporadic E propagation or the traditional autumn tropospheric uplift. The only glimmer of TV-DX was reported by Peter Schubert, who received an SpE signal of unknown origin in Band I on September 16th.

There's more cheerful news from the other side of the globe. Todd Emslie, who lives near Sydney, Australia, reports remarkable results during their winter period, both with Band II f.m. radio reception and Band I TV reception. His Band II radio log includes Radio Djiido Montdo, New Calidonia, at 95-2MHz; 4IFO radio, a tourist information feed from Whitsunday Islands, at 88MHz, 10W; KSBS American Samoa at 92-1MHz, 3kW, a distance of 2,700 miles; VL2NI Norfolk Islands at 93-9MHz; and two Fijian transmitters at a distance of some 2,000 miles. The Band I listing includes numerous Malaysian, Philippine and Chinese transmitters, also American Samoa and possibly KGMV-TV ch. A3 (61-249MHz vision carrier) from Wailuku, Hawaii. Todd uses a National TV receiver which he has modified by including Philips G8 chassis selectivity modules and a Toshiba EG522F tuner.

### Satellite Sightings

In early July I logged what I took to be an Italian prison riot at the Questra goal, Brescia, the feed being to Rome via SNG unit ITA 30. Maltese reader Charlot Zahra tells me that it was not a prison riot but an interrogation of a former anti-corruption magistrate at Brescia police HQ in northern Italy. The 'Questra', seen in the ITA 30 caption, was a misspelling in place of 'Questura', meaning police HQ.

On September 26th, during the late evening, Eutelsat II F4 (7°E) carried news for ABC, New York from Palermo. The coverage was of mafia trials with background information – some of the material showed extreme violence and was unlikely to have hit UK screens.

A refreshing change from the usual coverage from the Yugoslav area consisted of football inserts following the caption 'SKOPJE 28-9-95 DEWE TELEVISION ul', again

via Eutelsat II F4, on the 28th. The carrier switched off at 2300, preceded by 'INTRAX HOL-9'. A conventional analogue signal provided the sound with the sports coverage, a welcome change from the sound-in-syncs you usually get with this satellite. A pan-European Quorum sales conference via this satellite (at 11-08GHz vertical) a few nights earlier also had conventional audio (at 6-6/7-4MHz).

John Dickaty is using, at his Bromborough, Wirral location, an Echostar 7700 receiver, a tracking 90cm dish, a Chaparral 0.7dB noise figure LNB and Lenco D2MAC decoder. The results, which I've seen on a video, are truly excellent. John can track from Turksat-1 at 42°E to PAS-1 at 45°W.

A mystery weather report by 'NTV' was seen at 1400 on September 23rd via the France Telecom transponder on Eutelsat II F1 at 13°E. It featured all the Russian regions from the Pacific across to Europe. The tape was then rewound and repeated. After a blank carrier, the transmission came to an end. Can anyone identify NTV and suggest the intended destination of the feed?

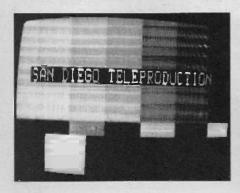
The Chris Eubank v. Steve Collins fight in mid-September was carried by Orion 1 at 45°W for Sky Sports, in the clear. The following afternoon (Sunday) I checked Hispasat at 30°W and found numerous sports programmes. At the same time the US Tennis Open was seen via Orion, the feed being to Hong Kong, presumably with onwards uplinking via Intelsat at 57°E. International sports fans will of course not overlook the various offerings via Intelsat K at 21.5W.

Bandula Gunasekera (Sri Lanka) reports strong C band reception from the PAS-4 satellite, with ESPN and the new Sony entertainment channel. He mentions that the Discovery Channel is being downlinked via Intelsat 704 at 66°E – the Goonhilly test pattern was previously carried. This is another strong signal. Other recently logged signals via 704 are the Indian channels YES and EETV. Insat 2B at 93.5°E is now transmitting CNNI across India at 4.17GHz (transponder C12).

### News Items

Africa: South Africa's Independent Broadcasting Authority has recommended that SABC's third channel, NNTV, should become a commercial service. The Ugandan Minister of Information has arranged with South Africa for future satellite distribution of radio and TV services across the country.

Middle East: The existing MMDS network in Bahrain is to carry at least ten more channels. Over thirty channels will be available when the network is complete.







Left: A live TV feed from California to the UK via Intelsat K at 21.5°E. Centre: A TV reporter glances at his uplink SNG dish at a site in former Yugoslavia – picture received via Eutelsat II F3 at 16°E. Right: An expected news feed from Rome via Eutelsat II F1 at 13°E fails to appear!



A French Air Force radar station (right) and microwave relay tower with local relay TV aerial (left) at the dusty top of Mount Mentaux, Provence, France – height 1,909m. Photo from Bob Sibbald, Southampton.

India: The new DD3 terrestrial TV service is now available in the main population areas – Bombay, Calcutta, Madras and Delhi.

Digital TV: Latvia, Estonia and Lithuania plan to start digital broadcasting services using five or six frequency blocks. Latvia plans to make a start in 1997. The states are in talks with the European Union to establish a common single-decoder (apart from the smart card) digital broadcasting standard for Europe.

DAB has started in the UK, from five transmitters around London. The present plan is to extend services to the West Midlands in March 1996; the centre south/Oxford in August 1996; Liverpool, Manchester, Yorkshire and North Wales in March 1997; the North East in August 1997; South Wales and the Bristol Channel in November 1997; Central Scotland in January 1998; and Northern Ireland in February, 1998.

Singapore: A fourth terrestrial service, 'Premiere 12', is now in operation.

Sunspots: We are now in the declining section of solar cycle 22. Recent sightings of a sunspot cluster in the 'right' part suggest that cycle 23 may start sooner than expected.

### Transmitters

The Kiel ch. E44 allocation has been transferred to Hamburg.

There are now fourteen Canal Plus Polska transmitters in operation. Apart from Opole ch. E10 all the transmitters operate at u.h.f., with 1kW e.r.p. or less. Polsat is now available via fourteen u.h.f. transmitters between chs. R35 (Warszawa) and R60 (Tarnow).

New local transmitters include NTV ch. E38 in Norway and TVS KANAL-1 chs. E51 and E58 in Denmark.

The Dutch Nederland 2 transmitters all now use the modified 16:9 PM5544 test pattern, with the identifications 'Nozema Ned 2' at the top and 'PALplus 16:9' below. The Belgian BRTRN TV1 and TV2 services have also adopted the 16:9 PM5544 pattern.

### **EBU TV Station List No 40**

The official European Broadcasting Union List of Television Stations No. 40 will be available in March 1996. It's a massive book that provides details of all transmitters in Europe, from milliwatt to megawatt powers. Orders are now being accepted by EBU Publications, Case Postale 67, CH-1218 Grand-Saconnex GE, Switzerland. The publica-



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tion is priced at 70 Swiss francs in either book form or on an IBM compatible diskette – a user guide for the diskette costs an extra 15 Swiss francs. The prices include postage.

### Echosphere SR50 Repairs

The Echosphere SR50 receiver is extremely popular with satellite enthusiasts. Although it's no longer in production, many are available second-hand. I use two myself, and have had the same fault with both of them.

Flashing on picture, tuning drift and/or abrupt loss of programme seems to be a common problem. Tapping the tuning control knob will provide a clue. The cause is that the tuning potentiometer's slider is making intermittent contact. A quick squirt of Ambersil or other cleaner will provide a temporary cure, but the flashing intermittency will return. It's best to replace the miniature potentiometer with a standard (larger) control of the same value  $-10 \mathrm{k}\Omega$  linear. Though this may sound simple, there are several problems to overcome. I hope the following notes will help.

Remove the main cover by unscrewing four cross-headed screws, two at each side of the receiver. Lift the cover gently, withdrawing it towards the rear and upwards. The front panel escutcheon fits over all the knobs and switches: the controls themselves are bolted to the receiver's chassis. To remove the plastic escutcheon, unscrew the three countersunk cross-headed screws along the top side (revealed when the outside cover has been taken off) and the matching three screws along the bottom side. The plastic face can then be pulled forwards – but wait. Three LEDs and the signal-strength meter are

attached to the face plate. It's a simple task to trace out the wire connections and unsolder them. Take care not to overheat the small diode between two of the meter's pins – and make a drawing of the connections before you unsolder them.

The potentiometer can now be replaced. Remove the main tuning knob by pulling forwards gently until it is released. Make a note of the connections, then unsolder them and unbolt the potentiometer. As the original miniature control has a smaller spindle than the standard type, a cone-cutter is required to widen the hole. Do this slowly, so that you don't make the hole too wide and that there's central fixing between the tuning knob and the plastic face plate, with no friction between them. Compare the spindle lengths of the original and the replacement potentiometers. Match and cut to size. Throw the old control away, then fit and solder in the new one. Refit the plastic faceplate, screw it to the chassis then resolder the wiring.

The tuning knob's spindle hole now needs to be enlarged. You can do this by hand – turn a twist-drill bit of the correct diameter in the relatively soft plastic, then ream out just sufficiently to accommodate the new spindle length. Push the knob on, aligning the calibration mark with the dotted scale. Repair completed.

Thinking that the small bulb in the signal meter would eventually blow, I decided to fit two 12V bright LEDs in series across the respective meter connection pins. Dismantle the meter when the front panel is free – it's stuck on with double-sided tape. Carefully prize off the cover, unsolder the bulb and fit the two LEDS in series, ensuring that they don't impede the meter movement/needle. Get them the right way round! The scale will not be as brightly lit – just a green glow – but this is sufficient and avoids future bulb failure. The 12V LEDs have integral surge resistors.

In over three years' use these are the only things I've had to do with the SR50. Should you get a noisy potentiometer problem with the later RR50 similar steps can be taken, but note that the front panel component mounting differs.

### Satellite TV

Good news for Dutch people living outside the country: from next year NOS is to provide a satellite service with a footprint that covers Europe. The 'best of Dutch' programme will have a format similar to TV5/Deutche Welle.

Associated Press and NTL are now using MPEG-2 digital compression for AP-TV's world coverage. The feed is still via Eutelsat II F3 at 13°, but is invisible without a digital decoder.

TLI London International has commissioned a dedicated earth station for use with the Orion-1 satellite at 37.5°W. It's offering up and down links across North America and Europe.

Finally some news in brief. Deutsche Welle has booked

a ten-year lease aboard Intelsat 702 for radio/TV transmissions to Africa. German broadcaster Pro 7 has booked three transponders on Astra 1E, F and G for future digital broadcasting. The EU is seeking agreement on a singlebox encryption standard. Arianespace is to launch the Swedish Sirius-2 satellite at 5°E in the summer of 1997: its 32 transponders will be used for TV (direct-to-home and cable) and data communications across Northern Europe. NHK Tokyo is to use PanAmSat's PAS-4 satellite at 68.5°E for news gathering and programme distribution. Australian Pay-TV operator Galaxy has started MPEG-2 test transmissions for its DTH subscription service via the Optus-B3 satellite: it assumes that 65cm dishes will be used in the well-populated eastern regions of the country, with up to 1.5m dishes in more remote areas. The recently launched JSAT-3 craft, at 128°E with twelve C-band and 28 Ku-band transponders, is likely to become a powerful force in East Asia and Australasia. It is another in the growing list of satellite downlink providers such as PAS, Rimsat, Palapa, AsiaSat, Insat, Measat and Chinasat, along with Intelsat and the various Gorizont craft.

### Answer to Test Case 396

- see page 119 -

The sort of interference breakthrough described on page 119 is not unusual, though very often a CB rig rather than an RT set is the source of the trouble. Despite the very different frequencies of the v.h.f. transmitter and the u.h.f. TV channels to which the victim tuned, if the interfering r.f. field is strong enough some of it will find its way, by sheer brute force, to the receiver's front-end, where it will drive the r.f. amplifier transistor way beyond its normal operating-point. The resultant non-linear operation jangles and mixes up all the carriers present. completely destroying signal reception.

Even so, the use of a blocking filter of the 'notch' or 'brick-wall' type tried by Stick-em-Up usually works, by reducing the interference signal to a level at which it is too low to cause mischief. It would have done so for Mrs Simes's installation had Tex Rogers realised that the cross-modulation was occurring within the masthead amplifier, up-stream from the position he'd selected for the wonder filter which was thus unable to provide any significant benefit.

The solution of course was to weatherproof the filter and fit it between the output from the u.h.f. aerial and the masthead amplifier's input. Once this had been done, using an ugly but effective wrapping of thick plastic sheeting to make the filter weatherproof, Mrs Simes's picture had become a little snowier but was now immune from the calls to pick up in the High Street and drop the party at the station.

Stick-em-Up got its money - in the end.

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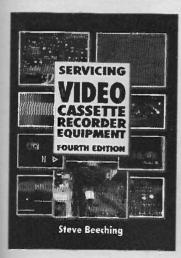
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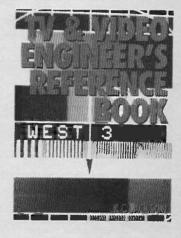
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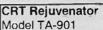
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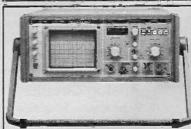


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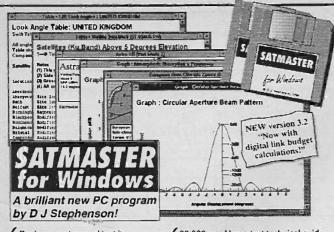
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BY299 BYX55600 TIP110 TIP111 TIP112 TIP112H TIP115 TIP116	.18 .33 .35 .62 .78 .82 .78 .65	AN5515 AN5521 AN6810 AN6612 AN7141 AN7161NFP AN717K AN7173K	2.69 1.59 89 1.79 .66 3.69 4.23 5.78	BUZ71A BUZ80A CD4011BE CD4012 CD4023 CD4068 CD4069 FR605	1,40 .95 2,40 .59 8.98 9.97 9.87 10.47 8.21	LA7837 LA7851 LC7151 LM1303 LM1881N LM308N LM317T LM324 LM339N	1.58 2.79 14.78 4.40 .82 1.22 1.39 _29	STK5451 STK5464 STK5466	5.88 2.98 5.59	TBA231 TBA331 TBA540	ST U 80 79 221	'ED S TDA1510 TDA1515e TDA1516Q	3.29 2.43 3.79	TDA2600 TDA2611a TDA2653a TDA2795 TDA2822m TDA3047 TDA3083 TDA3190 TDA3310	3.63 .99 3.12 1.88 .60 2.25 1.99 .98 1.15	TDA7222 TDA7240A TDA7250 TDA7255 TDA7275 TDA7275 TDA7275 TDA8115 TDA8138	1.99 2.20 4.95 5.21 1.75 .96 5.70 2.12 2.79	UPC1488H UPC1519HA UPC566 UPC574J UPD1937 XOO65CE 2SA1013 2SA1015GR	1.52 1.00 1.00 .88 4.24 1.99 .33 .10	2581036 2581143 25C710 25C945 25C1000 25C1008 25C1213AC 25C1318	.72 .87 .27 .26 .75 .23 .25 .26
BY299 BYX55600 TIP110 TIP111 TIP112 TIP112H TIP115 TIP116 TIP117	.18 .33 .35 .62 .78 .82 .78 .65	AN5515 AN5521 AN6610 AN6612 AN7141 AN7161NFP AN717K AN7173K AN7173K	2.69 1.59 .89 1.79 .66 3.69 4.23 5.78 2.59	BUZ71A BUZ80A CD4011BE CD4012 CD4023 CD4068 CD4069 FR605 MJE2955T	1,40 .95 2,40 .59 8.98 9.97 9.87 10.47 8.21	LA7837 LA7851 LC7151 LM1303 LM1881N LM308N LM317T LM324	1.58 2.79 14.78 4.40 82 1.22 1.39	STK5451 STK5464 STK5466 STK5471	5.88 2.98 5.59 4.79	TBA231 TBA331 TBA540 TBA800	80 .79 2.21 .49	TDA1510 TDA15160 TDA15160 TDA1517	3.29 2.43 3.79 2.50	TDA2600 TDA2611a TDA2653a TDA2653a TDA295 TDA3047 TDA3083 TDA3190 TDA3310 TDA3410	3.63 .99 3.12 1.88 .60 2.25 1.99 .98 1.15 1.49	TDA7222 TDA7240A TDA7250 TDA7255 TDA7272 TDA7275 TDA7275 TDA350 TDA8115 TDA8138 TDA8170	1.99 2.20 4.95 5.21 1.75 .96 5.70 2.12 2.79 1.94	UPC1488H UPC1519HA UPC566 UPC574J UPD1937 XOO65CE 2SA1013 2SA1015GR 2SA1020	1.62 1.00 1.00 .88 4.24 1.99 .33 .10 .42	2581036 2581143 25C710 25C545 25C1000 25C1008 25C10383 25C1318 25C1383	.72 .87 .27 .26 .75 .23 .25 .26 .21
BY299 BYX55600 TIP110 TIP111 TIP112 TIP112H TIP115 TIP116 TIP117 TIP120	.18 .33 .35 .62 .78 .92 .78 .65 .76	AN5515 AN5521 AN6610 AN6612 AN7141 AN7161NFP AN717K AN7173K AN7173K AN7173K AN7178 AN7205	2.69 1.59 .89 1.79 .66 3.69 4.23 5.78 2.59	BUZ71A BUZ80A CD4011BE CD4012 CD4023 CD4068 CD4069 FR605	1,40 .95 2,40 .59 8.98 9.97 9.87 10.47 8.21	LA7837 LA7851 LC7151 LM1303 LM1881N LM308N LM317T LM324 LM339N	1.58 2.79 14.78 4.40 .82 1.22 1.39 _29	STK5451 STK5464 STK5466 STK5471 STK5473	5.88 2.98 5.59 4.79 3.47	TBA231 TBA331 TBA540 TBA800 TBA820M	80 79 221 49	TDA1510 TDA15154 TDA15160 TDA1517 TDA1519	3.29 2.43 3.79	TDA2600 TDA26113 TDA2653a TDA2795 TDA2622m TDA3047 TDA3083 TDA3310 TDA3310 TDA3410 TDA3410 TDA3420	3.83 .99 3.12 1.88 .60 2.25 1.99 .98 1.15 1.49 1.98	TDA7222 TDA7240A TDA7250 TDA7255 TDA7275 TDA7275 TDA7275 TDA8115 TDA8118 TDA8170 TDA8170	1.99 2.20 4.95 5.21 1.75 .96 5.70 2.12 2.79 1.94 2.60	UPC1488H UPC1519HA UPC566 UPC574J UPD1937 XOO65CE 2SA1013 2SA1015GR 2SA1020 2SA1029D	1.52 1.00 1.00 .88 4.24 1.99 .33 .10 .42 .25	2581036 2581143 25C710 25C945 25C1000 25C1008 25C1213AC 25C1318 25C1318 25C1318 25C1373	.72 .87 .27 .26 .75 .23 .25 .25 .26 .31
BY299 BYX55600 TIP110 TIP111 TIP112 TIP112H TIP115 TIP116 TIP117 TIP120 TIP120	.18 .33 .35 .62 .78 .82 .78 .65 .76	AN5515 AN5521 AN6610 AN6612 AN7141 AN7161NFP AN7177K AN7173K AN7173K AN7178 AN7205 AN8387S	2.69 1.59 .89 1.79 .66 3.69 4.23 5.78 2.59 .52 5.98	BUZ71A BUZ80A CD40118E CD4012 CD4023 CD4068 CD4069 FR605 MJE2955T MJE340 HA11235	1.40 .95 2.40 .59 8.86 9.97 9.87 10.47 8.21 .83 .48 1.89	LA7837 LA7851 LC7151 LM1303 LM1881N LM308N LM317T LM324 LM339N LM358 LM386N LM386N	1.58 2.79 14.78 4.40 82 1.22 1.39 _29	STK5451 STK5464 STK5466 STK5471 STK5473 STK5481	5.88 2.98 5.59 4.79 3.47 7.99	TBA231 TBA331 TBA540 TBA800 TBA820M TBA920	80 79 221 49 49 269	TDA1510 TDA15160 TDA15160 TDA1517 TDA1519 TDA1519 TDA1521	3.29 2.43 3.79 2.50 3.99 3.12	TDA2600 TDA2611a TDA2653a TDA2653a TDA2653 TDA3047 TDA3047 TDA3083 TDA3190 TDA3310 TDA3410 TDA3410 TDA3420 TDA34510	3.83 .99 3.12 1.88 .60 2.25 1.99 .98 1.15 1.49 1.98 3.48	TDA7222 TDA7240A TDA7250 TDA7255 TDA7275 TDA7275 TDA7275 TDA8115 TDA8138 TDA8170 TDA8172 TDA8173	1.99 2.20 4.95 5.21 1.75 .96 6.70 2.12 2.79 1.94 2.60 2.95	UPC1488H UPC1519HA UPC566 UPC574J UPD1937 XOO65CE 2SA1013 2SA1015GR 2SA1029D 2SA1029D 2SA1048	1.52 1.00 1.00 .88 4.24 1.99 .33 .10 .42 .25 .18	2581036 2581143 25C710 25C945 25C1000 25C1008 25C1213AC 25C1318 25C1383 25C1473 25C1675	.72 .87 .27 .26 .75 .23 .25 .26 .31 .20 .45
BY299 BYX55600 TIP110 TIP110 TIP111 TIP112 TIP112H TIP115 TIP116 TIP117 TIP120 TIP122 TIP125	.18 .33 .35 .62 .78 .82 .78 .65 .76 .67	AN5515 AN5521 AN6610 AN6612 AN7141 AN7161NFP AN717K AN7173K AN7178 AN7205 AN8387S BA5406	2.69 1.59 89 1.79 .66 3.69 4.23 5.78 2.59 .52 5.98 2.04	BUZ71A BUZ80A CD4011BE CD4012 CD4023 CD4068 CD4069 FR605 MJE2955T MJE340 MA11235 HA11423	1,40 ,95 2,40 ,59 8,98 9,97 9,67 10,47 8,21 ,83 ,48	LA7837 LA7851 LC7151 LM1303 JM1881N LM308N LM317T LM324 LM339N LM358 LM368	1.58 2.79 14.78 4.40 .82 1.22 1.39 .99 1.45	STK5451 STK5464 STK5466 STK5471 STK5473 STK5481 STK5481	5.88 2.98 5.59 4.79 3.47 7.99 6.35	TBA231 TBA331 TBA540 TBA800 TBA820M TBA920 TCA440	80 79 221 49 49 269 269	TDA1510 TDA15150 TDA15150 TDA15160 TDA1517 TDA1519 TDA1521 TDA1521 TDA1522	3.29 2.43 3.79 2.50 3.99 3.12 1.08	TDA2600 TDA2611s TDA2653a TDA2795 TDA2822m TDA30047 TDA3083 TDA3190 TDA3310 TDA3410 TDA3420 TDA3420 TDA3420 TDA34510 TDA34510	3.63 .99 3.12 1.88 .60 2.25 1.99 .98 1.15 1.49 1.88 3.48 1,84	TDA7222 TDA7240A TDA7250 TDA7255 TDA7275 TDA7275 TDA7275 TDA350 TDA8115 TDA8176 TDA8172 TDA8173 TDA8173 TDA8173	1.99 2.20 4.85 5.21 1.75 .96 6.70 2.12 2.79 1.94 2.60 2.95 4.12	UPC1488H UPC1519HA UPC566 UPC574J UPD1937 XOO65CE 2SA1013 2SA1015GR 2SA1020 2SA1029D 2SA1048 2SA1110	1.52 1.00 1.00 .88 4.24 1.99 .33 .10 .42 .25 .18	2581036 2581143 25C710 25C545 25C1000 25C1008 25C1213AC 25C1213AC 25C1318 25C1473 25C1675 25C1675 25C1826	.72 .87 .27 .26 .75 .23 .25 .25 .25 .26 .27 .20 .45 .97
BY299 BYX55600 TIP110 TIP111 TIP112 TIP112H TIP115 TIP116 TIP117 TIP120 TIP122 TIP125 TIP125	.18 .33 .35 .62 .78 .82 .78 .65 .76	AN5515 AN5521 AN6610 AN6612 AN7141 AN7161NFP AN7173K AN7173K AN7173K AN7173B AN7205 AN83875 BA5406 BA5410	2.69 1.59 89 1.79 .66 3.69 4.23 5.78 2.59 .52 5.98 2.04	BUZ71A BUZ80A CD40118E CD4012 CD4023 CD4068 CD4069 FR605 MJE2955T MJE340 HA11235	1,40 ,95 2,40 ,59 8,86 9,97 9,87 10,47 8,21 ,83 ,48 1,89 2,79	LA7837 LA7851 LC7151 LM1303 LM1881N LM308N LM317T LM324 LM339N LM358 LM386N LM386N	1.58 2.79 14.78 4.40 .82 1.22 1.39 .99 1.45 53	STK5451 STK5464 STK5466 STK5471 STK5473 STK5481 STK5482 STK6962	5.88 2.98 5.59 4.79 3.47 7.99 6.35 2.55	TBA231 TBA331 TBA540 TBA800 TBA820M TBA920 TCA440 TCA900	80 79 221 49 49 2.69 2.65 75	TDA1510 TDA15150 TDA15150 TDA15160 TDA1517 TDA1519 TDA1521 TDA1522 TDA1524A	3.29 2.43 3.79 2.50 3.99 3.12 1.08 1.72	TDA26013 TDA26113 TDA2653a TDA2795 TDA2822m TDA3047 TDA3083 TDA3310 TDA3310 TDA3410 TDA3410 TDA3510 TDA3510 TDA3541 TDA3560TFK	3.63 .99 3.12 1.88 .60 2.25 1.99 .98 1.15 1.49 1.88 3.48 1.84 2.80	TDA7222 TDA7240A TDA7250 TDA7255 TDA7275 TDA7275 TDA3250 TDA8115 TOA8138 TOA8170 TDA8172 TDA8172 TDA8173 TDA8173 TDA8175 TDA8190	1.99 2.20 4.85 5.21 1.75 .96 5.70 2.12 2.79 1.94 2.60 2.95 4.12 2.80	UPC1488H UPC1519HA UPC565 UPC574J UPD1337 XOO65CE 2SA1013 2SA1015GR 2SA1029D 2SA1048 2SA1110 2SA11115	1.52 1.00 1.00 .88 4.24 1.99 .33 .10 .42 .25 .18 .58	2581036 2581143 25C710 25C945 25C1000 25C1008 25C1213AC 25C1318 25C1318 25C1318 25C1675 25C1675 25C1826 25C1923	.72 .87 .27 .26 .75 .23 .25 .26 .31 .20 .45 .97 .23
BY299 BYX55600 TIP110 TIP1112 TIP112 TIP112H TIP115 TIP116 TIP117 TIP120 TIP122 TIP125 TIP125 TIP126 TIP127	.18 .33 .35 .62 .78 .82 .78 .65 .76 .67	AN5515 AN5521 AN6610 AN6612 AN7141 AN7161NFP AN717K AN7173K AN7178 AN7205 AN8387S BA5406	2.89 1.59 .89 1.79 .66 3.69 4.23 5.78 2.59 .52 5.98 2.04 2.49	BUZ71A BUZ80A CD4011BE CD4012 CD4023 CD4068 CD4069 FR605 MJE2955T MJE340 MA11235 HA11423	1,40 95 2,40 ,59 8,86 9,97 9,87 10,47 8,21 ,83 ,48 1,89 2,79 2,39	LA7837 LA7851 LC7151 LM1303 LM1881N LM308N LM317T LM324 LM339N LM368 LM380N LM380N LM380N LM386N LM393N	1.58 2.79 14.78 4.40 .82 1.22 1.39 .99 1.45 .53 1.12	STK5451 STK5464 STK5466 STK5471 STK5473 STK5481 STK5482 STK5482 STK6962 STK7308	5.88 2.98 5.59 4.79 3.47 7.99 6.35 2.55 5.84	TBA231 TBA331 TBA540 TBA800 TBA820M TBA920 TCA440 TCA900 TCA900	80 .79 2.21 49 2.69 2.69 2.65 .75	TOA1510 TDA1515a TDA1516Q TDA1517 TDA1519 TDA1521 TDA1521 TDA1521 TDA1524 TDA1524A TDA1524A TDA1543	3.29 2.43 2.50 3.12 1.08 1.72 2.95	TDA2600 TDA26513 TDA2653a TDA2795 TDA2822m TDA3083 TDA3190 TDA3610 TDA3410 TDA3410 TDA3510 TDA3560TFK TDA3560TFK TDA3560TFK	3.83 .99 3.12 1.88 .60 2.25 1.99 .98 1.15 1.49 1.98 3.48 1.84 2.80 4.47	TDA7220 TDA7240A TDA7250 TDA7250 TDA7275 TDA7275 TDA2350 TDA8115 TOA8138 TOA8138 TOA8172 TDA8172 TDA8173 TDA8173 TDA8175 TDA8190 TDA8196	1.99 2.20 4.85 5.21 1.75 .96 6.70 2.12 2.79 1.94 2.60 2.95 4.12 2.80 1.68	UPC1488H UPC1519HA UPC556 UPC574J UPD1937 XOO65CE 2SA1013 2SA1015GR 2SA1020 2SA1020 2SA1048 2SA1110 2SA1115 2SA1115 2SA1155	1.62 1.00 1.00 .88 4.24 1.99 .33 .10 .42 .25 .18 .58 .17	2581036 2581143 25C710 25C545 25C1000 25C10008 25C1213AC 25C1318 25C1333 25C1473 25C1675 25C1826 25C1827 25C1847	.72 .87 .27 .26 .75 .23 .25 .26 .31 .20 .45 .97 .23 .490
BY259 BY255600 TIP110 TIP1110 TIP1112 TIP112H TIP115 TIP116 TIP117 TIP120 TIP120 TIP125 TIP125 TIP126 TIP127 TIP127 TIP127	.18 .33 .35 .62 .78 .82 .78 .65 .76 .67 .67	AN5515 AN5521 AN6610 AN6612 AN7141 AN7161NFP AN7173K AN7173K AN7173K AN7173B AN7205 AN83875 BA5406 BA5410	2.89 1.59 .89 1.79 .66 3.69 4.23 5.78 2.59 .52 5.98 2.04 2.49 1.79	BUZ71A BUZ80A CD4011BE CD4012 CD4023 CD4068 CD4069 FR605 MJE2955T MJE340 HA11235 HA11235 HA13001	1,40 ,95 2,40 ,59 8,86 9,97 9,67 10,47 8,21 ,48 1,89 2,79 2,39 19,41	LA7837 LA7851 LC7151 LM1303 LM1881N LM308N LM317T LM324 LM339N LM368 LM380N LM386N LM386N LM386N LM389N LM389N	1.58 2.79 14.78 4.40 .82 1.22 1.39 .99 1.45 .53 1.12 6.46	STK5451 STK5464 STK5466 STK5471 STK5473 STK5481 STK5482 STK5482 STK7308 STK7308	5.88 2.98 5.59 4.79 3.47 7.99 6.35 2.55 5.84 4.84	TBA231 TBA331 TBA540 TBA540 TBA820 TBA820M TBA920 TCA440 TCA900 TCA910 TDA1001A	80 .79 2.21 .49 .49 2.69 2.69 .75 1.00 2.97	TDA1510 TDA15160 TDA15160 TDA1517 TDA1519 TDA1521 TDA1522 TDA1524 TDA1524 TDA1543 TDA1543 TDA1546	3.29 2.43 3.79 2.50 3.99 3.12 1.08 1.72 2.95 2.95	TDA2600 TDA26113 TDA2653a TDA2653a TDA2795 TDA2622m TDA3063 TDA3190 TDA3310 TDA3410 TDA3410 TDA3510 TDA3510 TDA3560TFK TDA3561 TDA3561	3.83 .99 3.12 1.88 .60 2.25 1.99 .98 1.15 1.49 1.88 3.48 1.84 1.84 4.47 4.60	TDA7222 TDA7240A TDA7250 TDA7255 TDA7275 TDA7275 TDA7275 TDA8115 TOA8115 TOA8172 TDA8172 TDA8172 TDA8173 TDA8173 TDA8173 TDA8173 TDA8175 TDA8190 TDA8196 TDA8380	1.99 2.20 4.85 5.21 1.75 98 5.70 2.12 2.79 1.94 2.60 2.95 4.12 2.80 1.68 2.50	UPC1488H UPC1519HA UPC556 UPC5574J UPD1837 XO065CE 2SA1013 2SA1015GR 2SA1020 2SA1028D 2SA1028D 2SA1159 2SA1110 2SA1115 2SA1115 2SA1286 2SA1301	1.62 1.00 1.00 .88 4.24 1.99 .33 .10 .42 .25 .18 .58 .17 .57 3.23	2581036 2581143 25C710 25C545 25C1000 25C10008 25C1203AC 25C1318 25C13383 25C1473 25C1675 25C1626 25C1923 25C1947 25C1947 25C1959	.72 .87 .27 .26 .75 .23 .25 .26 .27 .25 .26 .27 .20 .45 .97 .23 .490 .28
BY259 BYX55600 TIP110 TIP111 TIP112 TIP112H TIP115 TIP116 TIP117 TIP120 TIP121 TIP126 TIP125 TIP125 TIP126 TIP127 TIP131	.18 .33 .35 .62 .78 .82 .78 .65 .76 .87 .67 .69 .67	ANSS15 ANSS21 ANSS21 ANSS10 ANSS10 ANSS12 ANT141 ANT178 ANT173K ANT173K ANT173K ANT205 ANS387S BAS406 BAS410 BAS109	2.89 1.59 .89 1.79 .86 3.69 4.23 5.78 2.59 .52 5.98 2.04 2.49 1.79 1.39	BUZ71A BUZ80A CD40118E CD4012 CD4023 CD4068 CD4068 FR605 MJE340 HA11235 HA11423 HA13001 HA13008	1,40 ,95 2,40 ,59 8,86 9,97 9,67 10,47 8,21 ,48 1,89 2,79 2,39 19,41 3,47	LA7837 LA7837 LA7851 LC7151 LM1303 LM1881N LM308N LM317T LM324 LM399N LM368 LM380N LM380N LM393N LM393N LM393N LM3930N LM3930N LM3930N	1.58 2.79 14.78 4.40 .82 1.22 1.39 .99 1.45 5.3 1.12 6.46 7.95 4.87	STK5451 STK5464 STK5466 STK5473 STK5473 STK5481 STK5482 STK6962 STK7308 STK7348 STR4211	5.88 2.98 5.59 4.79 3.47 7.99 6.35 2.55 5.84 4.84	TBA231 TBA331 TBA331 TBA540 TBA800 TBA820M TBA920 TCA440 TCA900 TCA910 TDA1001A TDA1001B	.80 .79 2.21 .49 .49 2.69 2.65 .75 1.00 2.97	TDA1510 TDA15180 TDA15180 TDA1517 TDA1517 TDA1521 TDA1521 TDA1522 TDA1524 TDA1524 TDA1524 TDA1524 TDA1526 TDA15270	3.29 2.43 3.79 2.50 3.99 3.12 1.08 1.72 2.95 2.95 2.70	TDA2600 TDA26513 TDA2653a TDA2735 TDA2822m TDA3047 TDA3047 TDA3083 TDA3190 TDA3410 TDA3410 TDA3511 TDA35614 TDA35617 TDA35617 TDA35617 TDA35614 TDA35614 TDA35614 TDA35614	3.83 .99 3.12 1.88 .60 2.25 1.99 .98 1.15 1.49 1.98 3.48 1.84 2.80 4.47 4.60 3.82	TDA7220 TDA7240A TDA7250 TDA7250 TDA7255 TDA7275 TDA7275 TDA8115 TDA8115 TDA8173 TDA8173 TDA8173 TDA8173 TDA8173 TDA8173 TDA8173 TDA8190 TDA8190 TDA8380 TDA8380 TDA8380	1.99 2.20 4.85 5.21 1.75 .98 5.70 2.12 2.79 1.94 2.60 2.95 4.12 2.80 1.68 2.50 3.66	UPC1488H UPC1519HA UPC556 UPC556 UPC574J UPD1937 XOO65CE 2SA1013 2SA1015GR 2SA1020 2SA1020 2SA1020 2SA1110 2SA1115 2SA1285 2SA1301 2SA1301 2SA1352	1.62 1.00 1.00 .88 4.24 1.99 .33 .10 .42 .25 .18 .58 .17 .57 3.23 .51	2581036 2581143 25C210 25C345 25C1000 25C1008 25C1213AC 25C1333 25C1473 25C1675 25C1826 25C1947 25C1947 25C1959 25C1959	.72 .87 .27 .26 .75 .23 .25 .26 .21 .25 .26 .81 .20 .45 .97 .23 .490 .246
BY259 BYX55600 TIP110 TIP111 TIP112 TIP112 TIP115 TIP116 TIP116 TIP112 TIP120 TIP120 TIP127 TIP126 TIP127 TIP130 TIP131 TIP131	.18 .33 .35 .62 .78 .82 .78 .65 .76 .67 .67 .69 .67	ANS515 ANS521 ANS610 ANS612 AN7141 AN7147141 AN717173K AN7173K AN7173K AN7173K AN7173K AN7173K AN74173	2.89 1.59 .89 1.79 .86 3.69 4.23 5.78 2.59 .52 5.98 2.04 2.49 1.79 1.39	BÚZ71A BÚZ80A CD4011BE CD4012 CD4023 CD4068 CD4068 CD4068 CD4069 FR605 MJE2955T MJE340 HA11235 HA11423 HA13001 HA13108	1,40 ,95 2,40 ,59 8,86 9,97 10,47 8,21 ,83 ,48 1,89 2,79 2,39 13,47 2,49	LA7837 LA7851 LC7151 LM1303 LM1881N LM308N LM317T LM324 LM339N LM368 LM386N LM386N LM386N LM386N LM386N LM386N LM386N LM393N LM356S	1.58 2.79 14.78 4.40 .82 1.39 .99 1.45 .53 1.12 6.46 4.87 4.85	STK5451 STK5464 STK5466 STK5471 STK5473 STK5482 STK5482 STK5482 STK7348 STK7348 STK7348 STK7348	5.88 2.98 5.59 4.79 3.47 7.99 5.35 2.55 5.84 4.84 10.22 5.79	TBA231 TBA231 TBA331 TBA540 TBA800 TBA820M TBA920 TCA440 TCA900 TCA910 TDA1001A TDA1001B TDA1001B TDA1002	.80 .79 2.21 .49 2.69 2.65 .75 1.00 2.97 1.39	TDA1510 TDA1515a TDA15160 TDA1517 TDA1517 TDA1521 TDA1521 TDA1521 TDA1524 TDA1524 TDA1524 TDA1524 TDA1524 TDA1596 TDA1670a TDA1670a TDA1675a	3.29 2.43 3.79 2.50 3.99 3.12 1.08 1.72 2.95 2.70 3.85	TDA2650 TDA2653a TDA2653a TDA2795 TDA2822m TDA3047 TDA3047 TDA3047 TDA3410 TDA3410 TDA3410 TDA3410 TDA3510 TDA3560TFK TDA3561 TDA3561 TDA3561 TDA3561A TDA35624 TDA3561A TDA3562TFK	3.63 .99 3.12 1.88 60 2.25 1.99 .98 1.15 1.49 1.88 3.48 1.84 2.80 4.47 4.60 3.82 3.78	TDA7222 TDA7240A TDA7250 TDA7255 TDA7275 TDA7275 TDA7275 TDA8115 TOA8176 TDA8173	1.99 2.20 4.85 5.21 1.75 .96 5.70 2.12 2.79 1.94 2.80 2.95 4.12 2.80 1.68 2.50 3.65 2.95	UPC1488H UPC1519HA UPC565 UPC574J UPD1337 XOO85CE 2SA1013 2SA1015GR 2SA1029D 2SA1029D 2SA1029D 2SA1048 2SA1115 2SA1115 2SA1115 2SA1361 2SA1361 2SA1361 2SA1362 2SA1361 2SA1362 2SA1362 2SA1362 2SA1362 2SA1362 2SA1362 2SA1362	1.62 1.00 1.00 .88 4.24 1.99 .33 .10 .42 .25 .18 .58 .17 .57 .323 .51 2.35	2581036 2581143 25C710 25C545 25C1000 25C1008 25C1008 25C1213AC 25C13138 25C1473 25C1473 25C1675 25C1826 25C1923 25C1923 25C1959 25C1969 25C2001	.72 .87 .27 .26 .75 .23 .25 .26 .31 .20 .45 .97 .23 .4.90 .246 .26
BY259 BYX55600 TIP110 TIP111 TIP112 TIP112 TIP112 TIP115 TIP116 TIP117 TIP120 TIP125 TIP126 TIP127 TIP130 TIP131 TIP131 TIP132 TIP132	.18 .33 .35 .62 .78 .82 .78 .65 .76 .67 .67 .67 .69 .67 .56	AN5515 AN5521 AN6610 AN6612 AN7141 AN7161NFP AN7177K AN71778 AN71778 AN7205 AN8387S BA5406 BA5109 BA5209 BA5209	2.89 1.59 .89 1.79 .86 3.69 4.23 5.78 2.59 .52 5.98 2.04 2.49 1.79 1.39 1.21	BÚZ71A BUZ80A CD4011BE CD4012 CD4012 CD4023 CD4069 FR605 MJE295T MJE340 HA11235 HA11423 HA13000 HA13000 HA13000 HA13108	1,40 ,95 2,40 ,59 8,88 9,97 9,87 10,47 8,21 ,48 1,89 2,79 2,39 19,41 3,47 2,49 1,79	LA7837 LA7851 LC7151 LM1303 LM1881N LM308N LM317T LM324 LM399N LM386N LM386N LM399N LM399N LM390N M51320P M567321 M56555P MC13002P	1.58 2.79 14.78 4.40 .82 1.22 1.39 .99 1.45 53 1.12 6.46 7.85 7.50	STK5451 STK5464 STK5466 STK5471 STK5481 STK5482 STK7308 STK7308 STK7308 STK7348 STK7348 STK74211 STR58041	5.88 2.98 5.59 4.79 3.47 7.99 6.35 2.55 5.84 4.84 10.22 5.79 1.48	TBA231 TBA331 TBA331 TBA540 TBA540 TBA820 TBA820M TBA920 TCA900 TCA910 TCA910 TDA1001A TDA1001B TDA10021 TDA10022	80 .79 2.21 .49 .49 .269 2.69 .75 1.00 2.97 1.90	TDA1510 TDA15160 TDA15180 TDA15181 TDA1519 TDA1521 TDA1521 TDA1524 TDA1524 TDA1524 TDA1543 TDA15675a TDA1675a TDA1675a	3.29 2.43 3.79 2.50 3.99 3.12 1.08 1.72 2.95 2.70 3.85 1.98	TDA2600 TDA26513 TDA2653a TDA2795 TDA32627m TDA3047 TDA3047 TDA3083 TDA3310 TDA3410 TDA3420 TDA3511 TDA3561 TDA3561 TDA3561A TDA3561A TDA35627FK TDA3561A TDA35627FK TDA3561A TDA35624	3.63 .99 3.12 1.88 .60 2.25 1.99 .98 1.15 1.49 3.48 1.84 2.80 4.47 4.60 2.82 3.78 3.20	TDA7222 TDA7240A TDA7240A TDA7250 TDA7275 TDA7275 TDA7275 TDA7275 TDA8115 TDA8170 TDA8172 TDA8173 TDA8170 TDA8190 TDA8202 TDA8202 TDA8203	1.99 2.20 4.85 1.75 .96 5.70 2.12 2.79 1.94 2.60 2.95 4.12 2.80 1.68 2.50 3.66 2.95 1.99	UPC1488H UPC1519HA UPC556 UPC574J UPD1937 XOO65CE 2SA1013 2SA1015GR 2SA1020 2SA1028D 2SA1048 2SA1110 2SA1110 2SA1115 2SA1286 2SA1352 2SA1489 2SA1489 2SA52Y	1.62 1.00 1.90 .88 4.24 1.99 .33 .10 .42 .25 .18 .58 .17 .57 .323 .51 2.35 .16	2581036 2581143 25C710 25C945 25C1000 25C1000 25C1008 25C1213AC 25C1213AC 25C1383 25C1473 25C1675 25C1826 25C1947 25C1969 25C2001 25C2000 25C2000	.72 .87 .27 .26 .75 .23 .25 .26 .31 .20 .45 .97 .23 4.90 .28 2.46 .25 .26 .25
BY259 BYX55600 TIP110 TIP110 TIP111 TIP112 TIP112 TIP115 TIP116 TIP116 TIP116 TIP120 TIP122 TIP126 TIP127 TIP130 TIP131 TIP131 TIP131 TIP132	.18 .33 .35 .62 .78 .85 .76 .65 .76 .67 .67 .69 .57 .58 .55 .89	AN5515 AN5621 AN6610 AN6612 AN7141 AN717174 AN7178 AN7178 AN7178 AN7178 AN647178 AN647178 BA5406 BA5410 BA5410 BA54109 BA5209 BA5209 BA62198	2.89 1.59 .89 1.79 .86 3.69 4.23 5.78 2.59 .52 5.98 1.79 1.39 1.21 2.39 3.09	BÚZ71A BUZ80A CD40118E CD4012 CD4012 CD4068 CD4069 FR605 MJE2367 MJE3367 HA11235 HA11235 HA113006 HA13117 HA13118 HA13118	1,40 ,95 2,40 ,59 8,88 8,97 9,87 10,47 8,21 ,48 1,89 2,79 2,39 19,41 3,47 2,49 1,79 1,99	LA7837 LA7851 LC7151 LM1303 LM1881N LM308N LM317T LM324 LM358 LM380N LM390N LM393N LM393N LM393N LM393N LM393N LM393N LM393N LM393N M56732L M5685SP MC13002P MC1301P	1.58 2.79 14.78 4.40 .82 1.22 1.39 .99 .99 1.45 .53 1.12 6.46 7.95 4.87 7.50 6.78	STK5451 STK5464 STK5466 STK5471 STK5481 STK5481 STK5482 STK7348 STK7348 STK7348 STK7348 STK7348 STK7348 TTK5661 TTK5661 TTK5661 TTK5661	5.88 2.98 5.59 4.79 3.47 7.99 6.35 2.55 5.84 4.84 10.22 10.27 1.48 1.59	TBA231 TBA231 TBA331 TBA540 TBA800 TBA820M TBA820M TCA900 TCA910 TCA910 TCA910 TDA1001A TDA1001B TDA1002s TDA1002s TDA1003A	.80 .79 2.21 .49 2.69 2.65 .75 1.00 2.97 1.99 1.99 3.44	TDA1510 TDA15150 TDA15150 TDA1516Q TDA1517 TDA15219 TDA1521 TDA1521 TDA1524 TDA1524 TDA1543 TDA1596 TDA16706 TDA16706 TDA16706 TDA16706 TDA16904 TDA1904 TDA1905	3.29 2.43 3.79 2.50 3.99 3.12 2.95 2.95 2.70 3.85 1.99 2.99	TDA2560 TDA25113 TDA2653a TDA2795 TDA2822m TDA3047 TDA3063 TDA3190 TDA3310 TDA3410 TDA3410 TDA3410 TDA3561 TDA3561 TDA3561 TDA3561 TDA3561 TDA3561 TDA3562 TDA3562 TDA3562 TDA3562 TDA3562 TDA3562 TDA3564 TDA3564 TDA3564 TDA3564 TDA3564 TDA3564 TDA35680	3.83 .99 3.12 1.88 .60 2.25 1.99 .98 1.15 1.49 1.88 3.48 1.84 4.47 4.60 3.82 3.72 3.99	TDA7222 TDA7240A TDA7240A TDA7250 TDA7275 TDA7275 TDA7275 TDA7275 TDA8115 TDA8115 TDA8172 TDA8173 TDA8173 TDA8173 TDA8173 TDA8175 TDA8	1.99 2.20 4.85 5.21 1.75 .96 6.70 2.12 2.79 1.94 2.60 2.95 4.12 2.80 1.68 2.50 3.66 2.95 2.95 2.95 2.95 2.95 2.95 2.95 2.95	UPC1488H UPC1519HA UPC556 UPC574J UPD1937 XO065CE 2SA1013 2SA1015QR 2SA1020 2SA1020 2SA1048 2SA1115 2SA1116 2SA1116 2SA1115 2SA1286 2SA1301 2SA1322 2SA1489 2SA522 2SA1489 2SA622 2SA668	1.62 1.00 1.00 .88 4.24 1.99 .33 .10 .42 .25 .18 .57 .323 .51 2.35 .16 .22	25811036 2581143 25C710 25C345 25C1000 25C1008 25C1213AC 25C1318 25C1333 25C1675 25C1823 25C1826 25C1923 25C21923 25C21923 25C21923 25C21923 25C21923 25C2120	.72 .87 .27 .26 .75 .23 .25 .26 .31 .20 .490 .246 .28 .58 .25
BY259 BYX55600 TIP110 TIP111 TIP112 TIP112 TIP112 TIP115 TIP116 TIP117 TIP120 TIP127 TIP125 TIP127 TIP127 TIP130 TIP131 TIP131 TIP131 TIP132 TIP137 TIP29 TIP29 TIP29 TIP29 TIP29 TIP29 TIP29	.18 .33 .35 .52 .78 .65 .76 .67 .67 .67 .57 .59 .55 .55 .89 .65	AN5515 AN5521 AN6610 AN6610 AN7141 AN7161NFP AN71717 AN7173K AN71738 AN7205 AN8387S BA5406 BA5109 BA5109 BA52198 BA6222	2.69 1.59 .89 1.79 .86 4.23 5.78 2.59 .52 5.98 1.79 1.39 1.21 2.39 2.29	BÚZ71A BUZ80A CD4011BE CD4012 CD4023 CD4068 CD4069 FR605 MJE2955T MJE340 HA11235 HA11423 HA13001 HA13108 HA13117 HA13118	1,40 ,95 2,40 ,59 8,88 9,97 9,67 10,47 8,21 ,83 ,48 1,89 2,79 19,41 3,47 2,49 1,79 1,98	LA7837 LA7851 LC7151 LM1303 LM1881N LM308N LM317T LM324 LM399N LM386N LM386N LM399N LM399N LM390N M51320P M567321 M56555P MC13002P	1.58 2.79 14.78 4.40 .82 1.22 1.39 .99 1.45 .53 1.15 6.46 7.95 4.87 4.85 7.50 8.78 3.96	STK5451 STK5464 STK5466 STK5471 STK5481 STK5481 STK5482 STK7308 STK7308 STK7348 STK211 STK5964 T-7205AP TA77222AP	5.88 2.98 5.59 4.79 3.47 7.99 6.35 2.55 5.84 4.84 10.22 5.79 1.48 1.59 1.79	TBA231 TBA331 TBA340 TBA800 TBA820M TBA920 TCA900 TCA910 TCA910 TCA1001A TDA1001A TDA1001B TDA1002 TDA1002 TDA1003A TDA1005	.80 .79 2.21 .49 2.69 2.65 .75 1.00 2.97 1.99 1.99 3.44 2.21	TDA1510 TDA1515a TDA15160 TDA15160 TDA1519 TDA1521 TDA1522 TDA1522 TDA15243 TDA15243 TDA15243 TDA1596 TDA1675a TDA1675a TDA1905 TDA1905 TDA1905 TDA1905	3.29 2.43 3.79 2.50 3.12 1.08 1.72 2.95 2.70 3.85 1.99 2.12	TDA26501 TDA26513 TDA26533 TDA2795 TDA2822m TDA3047 TDA3083 TDA3190 TDA3410 TDA3410 TDA3410 TDA3410 TDA3410 TDA3561 TDA3561 TDA3562TFK TDA35624 TDA35801	3.83 .99 3.12 1.86 2.25 1.99 .98 1.15 1.49 1.88 3.48 1.84 2.80 4.47 4.60 3.82 3.78 3.99 3.88	TDA7222 TDA72240A TDA7250 TDA7255 TDA7275 TDA7275 TDA7275 TDA8115 TOA8138 TOA8138 TOA8172 TDA8173 TDA8173 TDA8175 TDA8190 TDA8190 TDA8190 TDA8390 TDA8443 TDA8403 TDA8503 TDA8503 TDA8503 TDA9503 TDA9503 TDA9503	1.99 2.20 4.85 1.75 .96 5.70 2.12 2.79 1.94 2.80 2.95 4.12 2.80 3.65 2.95 1.99	UPC1488H UPC1519HA UPC556 UPC574J UPD19377 XOO65CE 2SA1013 2SA1015GR 2SA1020 2SA1020 2SA1048 2SA1110 2SA1115 2SA1286 2SA13115 2SA1352 2SA1364 2SA1352 2SA1489 2SA4562Y 2SA668 2SA668	1.62 1.00 1.00 .88 4.24 1.99 .33 .10 .42 .25 .18 .58 .17 .57 3.23 .51 2.35 .16 .22 .41	25811036 2581143 25C710 25C945 25C1000 25C1000 25C1008 25C1213AC 25C1333 25C1675 25C1947 25C1947 25C1969 25C1969 25C2001 25C2000 25C2120 25C2120 25C2140	.72 .87 .27 .26 .75 .23 .25 .25 .26 .31 .20 .45 .97 .23 .4.90 .24 .25 .58 .25 .58 .26 .46
BY259 BYX55600 TIP110 TIP111 TIP112 TIP112 TIP112 TIP112 TIP115 TIP116 TIP116 TIP117 TIP120 TIP122 TIP126 TIP126 TIP127 TIP131 TIP133 TIP133 TIP132 TIP132 TIP132 TIP132 TIP295 TIP295 TIP295 TIP295 TIP295	.18 .33 .35 .62 .78 .65 .76 .67 .67 .69 .57 .58 .55 .56 .55	AN5515 AN5521 AN6610 AN6612 AN7141 AN7161NFP AN7171 XA AN7173K AN7173K AN7173K AN7205 AN8387S BA5410 BA5410 BA54109 BA6209 BA62198 BA6229 BA6229	2.89 1.59 .89 1.79 .66 3.69 4.23 5.78 2.59 2.04 2.49 1.79 1.21 2.39 3.09 2.29 1.89	BUZ271A BUZ280A CD4011BE CD4012 CD4023 CD4068 CD4069 FR605 MJE2956T MJE340 HA111235 HA13001 HA13108 HA13118 HA13118 HA13119 HA13119	1,40 ,95 2,40 ,59 8,88 9,97 9,87 10,47 8,21 3,48 1,89 2,79 2,39 19,41 3,47 2,49 1,79 1,98 2,89	LA7837 LA7851 LC7151 LM1303 LM1881N LM308N LM317T LM324 LM358 LM380N LM390N LM398N LM3980N LM393N LM393N M51320P M51320P MC1391P MC1489 MC1391P MC1489 MFSL01	1.58 2.79 14.78 4.40 .82 1.22 1.39 .99 1.45 .53 1.12 6.46 7.50 4.87 4.85 7.50 8.78 3.96 1.42	STK5451 STK5464 STK5466 STK5471 STK5473 STK5481 STK5482 STK7348 STK7348 STK7348 STK7348 TTF58041 T-9064 TA7205AP TA7225AP TA7225AP	5.88 2.98 5.59 4.79 3.47 7.99 5.35 2.55 5.84 4.84 10.22 5.79 1.48 1.59 1.79 1.88	TBA231 TBA231 TBA331 TBA331 TBA540 TBA820M TBA820M TBA820M TCA910 TCA910 TCA1001A TDA1001B TDA1001B TDA10022 TDA1003A TDA1003A TDA1003A TDA10010A	.80 .79 2.21 .49 .2.69 2.69 2.69 1.00 2.97 1.99 1.90 3.44 2.21 1.43	TOA1510 TDA15150 TDA15160 TDA15160 TDA1517 TDA1519 TDA1521 TDA1521 TDA1524 TDA1524 TDA1524 TDA1524 TDA1526 TDA16706 TDA16706 TDA16706 TDA1904 TDA1905 TDA1908	3.29 2.43 3.79 2.50 3.99 3.12 1.08 1.72 2.95 2.70 3.85 1.99 2.99 2.99 2.91 2.31 2.31 2.31	TDA2560 TDA2513 TDA2653a TDA2795 TDA2822m TDA3047 TDA3049 TDA3190 TDA3310 TDA3410 TDA3410 TDA3410 TDA3510 TDA3560TFK TDA3561 TDA3561 TDA3561 TDA3562A TDA3562TFK TDA3562 TDA3582 TDA3582 TDA3582 TDA3582 TDA3582 TDA3582 TDA3582 TDA3582 TDA3582 TDA3582 TDA3582 TDA3582 TDA3582 TDA3582 TDA3582 TDA3582 TDA3582 TDA3582 TDA3584	3.83 .99 3.12 1.88 .60 2.25 1.99 1.15 1.49 1.84 2.80 4.47 4.60 3.82 3.78 3.20 3.98 5.80	TDA7222 TDA7240A TDA7250 TDA7259 TDA7275 TDA7275 TDA7275 TDA7275 TDA8115 TDA8118 TDA8172 TDA8172 TDA8173 TDA81	1.99 2.20 4.85 5.21 1.75 .96 2.70 2.12 2.79 1.94 2.60 2.95 4.12 2.80 1.68 2.50 3.65 2.95 1.99 2.10 1.58 1.99 2.15 1.95 1.95 1.95 1.95 1.95 1.95 1.95 1	UPC1488H UPC1519HA UPC569 UPC5774J UPD19377 XO065CE 2SA1013 2SA1015GR 2SA1020 2SA1048 2SA1115 2SA1116 2SA1116 2SA1116 2SA1186 2SA1301 2SA1286 2SA1362 2SA1682 2SA662 2SA662 2SA662 2SA662	1.62 1.00 1.00 1.00 .88 4.24 1.99 .33 .10 .42 2.55 .18 .58 .17 .57 .57 .51 2.35 .16 .22 .41 .11	25811036 2581143 25C710 25C345 25C1000 25C1000 25C1008 25C1213AC 25C1318 25C1473 25C1675 25C1823 25C1823 25C1823 25C1923 25C1923 25C1923 25C1923 25C1923 25C2001 25C2001 25C2000 25C2314 25C2314 25C2078	.72 .87 .27 .26 .75 .23 .25 .26 .31 .20 .45 .97 .23 4.90 .24 .28 .28 .28 .28 .28 .28 .29 .29 .29 .20 .20 .20 .20 .20 .20 .20 .20 .20 .20
BY259 BYX55600 TIP110 TIP111 TIP112 TIP112 TIP112 TIP115 TIP116 TIP116 TIP117 TIP120 TIP120 TIP125 TIP125 TIP127 TIP130 TIP131 TIP132 TIP132 TIP137 TIP29 TIP29E TIP29E TIP29E TIP29E	.18 .33 .35 .52 .78 .65 .76 .67 .67 .67 .57 .59 .55 .55 .89 .65	AN5515 AN5521 AN6610 AN6610 AN6612 AN7141 AN7161NFP AN7173K AN7173K AN7173K AN7173K AN7205 AN8387S BA5410 BA5410 BA5410 BA5410 BA5410 BA54209 BA6229 BA6222 BA6222 BA6222 BA6227	2.89 1.59 .89 1.79 .66 3.69 4.23 5.78 2.59 2.04 2.49 1.79 1.21 2.39 3.09 2.21 2.39 1.89 1.02	BUZ271A BUZ80A CD4011BE CD4012 CD4023 CD4068 CD4069 FR605 MJE3956T MJE3940 HA11235 HA11423 HA13000 HA130117 HA13118 HA13117 HA13119 HA1377 HA13377 HA13377	1,40 ,95 2,40 5,99 8,86 9,97 9,87 10,87 1,89 1,89 2,39 19,41 3,48 1,79 1,59 1,59 1,58 2,89 1,59 1,59 1,59 1,58 2,89 3,98	LA7837 LA7851 LC7151 LC7151 LM1303 LM1881N LM308N LM3917 LM324 LM339N LM368 LM380N LM380N LM380N LM3930N LM3930N M51320P M51320P MC13002P MC13031P MC1489 MP5L01 MPSL01	1.58 2.79 14.78 4.40 .82 1.22 1.39 .99 1.45 .53 5.12 6.46 7.95 4.85 7.50 6.78 3.96 4.85 7.50 6.78 3.96 4.22 4.23 4.23 4.23 4.23 4.23 4.23 4.23	STK5451 STK5464 STK5464 STK5465 STK5473 STK5482 STK5482 STK7308 STK7348 STK7348 STK7348 STR4211 T-9064 TA7205AP TA7222AP TA7222AP	5.88 2.98 5.59 4.79 3.47 7.99 6.35 2.55 5.84 10.22 5.79 1.48 1.59 1.79 1.88 2.68	TBA231 TBA231 TBA331 TBA540 TBA800 TBA8200 TCA900 TCA900 TCA910 TDA1001A TDA1001B TDA1002s TDA1002s TDA1003a TDA1001S TDA1001S TDA1001D	80 79 2.21 .49 .49 .269 2.65 .75 1.00 2.97 1.59 1.99 3.43 2.21 1.43	TDA1510 TDA1515a TDA15160 TDA15160 TDA1519 TDA1519 TDA1521 TDA1522 TDA15243 TDA15243 TDA15243 TDA1596 TDA1675a TDA1675a TDA1905 TDA1905 TDA1905 TDA1906 TDA1906 TDA1906 TDA1906 TDA1906 TDA1906 TDA19406 TDA19406	3.29 2.43 3.79 3.50 3.99 3.12 1.02 2.95 2.95 2.70 1.99 2.12 3.12 2.95 2.96 2.96 2.96 2.96 2.96 2.96 2.96 2.96	TDA2500 TDA25113 TDA2653a TDA2795 TDA2795 TDA3083 TDA3309 TDA3310 TDA3310 TDA3310 TDA3410 TDA3561 TDA3561 TDA3561A TDA35624 TDA35624 TDA35624 TDA35624 TDA3580	3.63 .99 3.12 1.88 .60 2.25 1.99 .98 1.15 1.49 3.48 1.84 2.80 4.47 4.60 2.82 3.99 3.88 3.20 3.99 3.88 5.241	TDA7222 TDA7240A TDA7250 TDA7250 TDA7255 TDA7275 TDA7275 TDA7275 TDA7275 TDA7275 TDA8115 TOA8115 TOA8117 TDA8117 TDA8172 TDA8173 TDA8190 TDA8190 TDA8202 TDA8203 TDA8503 TDA8503 TDA9503 TDA9503 TEA1009 TEA2018 TEA20258	1.99 2.20 4.85 5.21 1.75 .96 5.70 2.12 2.79 1.94 4.12 2.80 2.95 4.12 2.50 3.66 2.50 3.66 2.99 2.10 1.58 2.10 1.68 2.50 3.66 2.10 2.10 2.10 3.66 2.10 3.66 2.10 3.66 2.10 3.66 2.10 3.66 2.10 3.66 2.10 3.66 2.10 3.66 2.10 3.66 2.10 3.66 2.10 3.66 3.66 3.66 3.66 3.66 3.66 3.66 3.6	UPC1488H UPC1519HA UPC1559 UPC574J UPD1337 XOO65CE 2SA1013 2SA1015GR 2SA1020 2SA1020 2SA1020 2SA1020 2SA1110 2SA1115 2SA1352 2SA1352 2SA1489 2SA1489 2SA662 2SA662 2SA673 2SA684	1.62 1.00 1.00 .88 4.24 1.99 .33 .10 .42 .25 .18 .57 3.23 .51 2.35 .16 .22 .41 .30	25811036 25C210 25C345 25C1000 25C1000 25C1000 25C1000 25C1000 25C1000 25C1000 25C1000 25C1000 25C1000 25C1000 25C1000 25C1000 25C1000 25C2000 25C2000 25C2000 25C2000 25C2000 25C2000 25C2000 25C2000 25C2000 25C2000 25C2000	.72 .87 .27 .26 .75 .23 .25 .26 .25 .26 .27 .23 .4.90 .246 .25 .26 .58 .26 .49 .23 .49 .246 .25 .26 .26 .26 .26 .26 .26 .26 .26 .26 .26
BY259 BYX55600 TIP110 TIP111 TIP112 TIP112 TIP112 TIP112 TIP115 TIP116 TIP116 TIP117 TIP120 TIP122 TIP126 TIP126 TIP127 TIP131 TIP133 TIP133 TIP132 TIP132 TIP132 TIP132 TIP295 TIP295 TIP295 TIP295 TIP295	.18 .33 .35 .52 .78 .57 .57 .57 .57 .57 .55 .55 .55 .55 .55	ANS515 ANS521 ANS610 ANS612 AN7141 AN7161NFP AN7175K AN7173K AN7173K AN7173K AN7173K AN7173K AN7205 AN8387S BA5410 BA5410 BA5410 BA5109 BA6209 BA6229 BA6229 BA6229 BA6229 BA6229 BA6229 BA6229 BA6227 BA6247	2.89 1.59 .89 1.79 .66 3.69 4.23 5.78 2.59 2.04 2.49 1.79 1.21 2.39 3.09 2.21 2.39 1.89 1.02	BUZ271A BUZ280A CD4011BE CD4012 CD4023 CD4068 CD4069 FR605 MJE2365T MJE340 HA11235 HA13001 HA13108 HA13108 HA13117 HA13118 HA13917 HA13917 HA13917 HA13917 HA13917 HA13917	1,40 ,95 2,40 ,59 8,86 9,97 10,47 8,21 ,83 1,89 2,79 2,39 1,39 1,39 1,39 1,39 1,39 1,39 1,39 1	LA7837 LA7851 LC7151 LM1303 LM1881N LM308N LM308N LM339N LM368 LM380N LM380N LM380N LM380N M50732L M50732L M50732L M50732L M50732L M50732L M50732L M50732L M50732L M50732L M50732L M50732L	1.58 2.79 14.78 4.40 .82 1.22 1.39 .99 1.45 .53 1.12 6.46 7.55 4.87 7.50 6.78 3.96 1.42 2.34 .19	STK5451 STK5464 STK5466 STK54671 STK5473 STK5481 STK5482 STK7308 STK7348 STK7348 STK7348 STK7348 STR4211 STR59041 T-9064 TA7205AP TA7222AP TA7222AP TA7222AP TA7223AP TA72240 TA72508P	5.88 2.98 4.79 3.47 7.99 5.35 5.84 4.84 10.22 5.79 1.48 1.59 1.79 1.89 1.79 1.89 4.35	TBA231 TBA231 TBA331 TBA540 TBA8200 TBA8200 TBA8200 TCA440 TCA910 TDA1001A TDA1001B TDA10022 TDA10023 TDA10023 TDA1010A TDA1010A TDA1010A TDA1011DA	.80 .79 .221 .49 .49 .265 .75 1.00 2.97 1.99 1.99 1.99 1.99 1.49 2.21 1.43 2.21 1.43 2.247	TDA1510 TDA1510 TDA15159 TDA15160 TDA15160 TDA15167 TDA1519 TDA1519 TDA1521 TDA1521 TDA1521 TDA1524 TDA1524 TDA1596 TDA16706 TDA16706 TDA16706 TDA1905 TDA1905 TDA1905 TDA1905 TDA1905 TDA1905 TDA1905 TDA1906 TDA1905 TDA1906	3.29 2.43 3.79 2.50 3.99 1.08 1.72 2.95 2.70 3.85 1.99 2.12 3.25 9.46 1.76	TDA2600 TDA26113 TDA2653a TDA2795 TDA2822m TDA3083 TDA3190 TDA3410 TDA3410 TDA3510 TDA3510 TDA3561 TDA3561A TDA3562TFK TDA3562 TDA3562 TDA3562 TDA3563 TDA3562 TDA3564 TDA3564 TDA3564 TDA3564 TDA3564 TDA3564 TDA3564 TDA3651	3.83 .99 3.12 1.88 .60 2.25 1.99 1.15 1.49 3.48 1.84 2.80 3.82 3.78 3.88 5.80 3.79	TDA7222 TDA72404 TDA72501 TDA72501 TDA72505 TDA7275 TDA7275 TDA7275 TDA7275 TDA7350 TDA8113 TDA8113 TDA8113 TDA8113 TDA8130 TDA8130 TDA8130 TDA8130 TDA8130 TDA8150 TDA8200 TDA8200 TDA8200 TDA8300	1.99 2.20 4.25 5.21 1.75 .96 6.70 2.12 2.79 1.94 2.80 2.95 1.68 2.95 1.99 1.58 1.85 1.85 1.85 1.85	UPC1488H UPC1519HA UPC1566 UPC574J UPD1937 XOO85CE 2SA1013 2SA1019GR 2SA1020 2SA1020 2SA1020 2SA1020 2SA1110 2SA11115 2SA1115 2SA1136 2SA1352 2SA1362 2SA1362 2SA1489 2SA622 2SA642 2SA664 2SA664 2SA664 2SA664 2SA664 2SA664	1.62 1.00 1.00 1.00 4.24 1.99 .33 .10 .42 .25 .18 .57 .323 .51 2.35 .16 .22 .41 .11 .30 .49	2581/036 25C710 25C9145 25C1000 25C1000 25C10008 25C10008 25C1213AC 25C11213A	.72 .87 .27 .26 .75 .22 .25 .26 .81 .20 .45 .97 .23 4.90 .28 2.46 .28 .26 .58 .26 .58 .26 .26 .27 .28 .29 .28 .29 .28 .28 .29 .29 .29 .29 .29 .29 .29 .29 .20 .20 .20 .20 .20 .20 .20 .20 .20 .20
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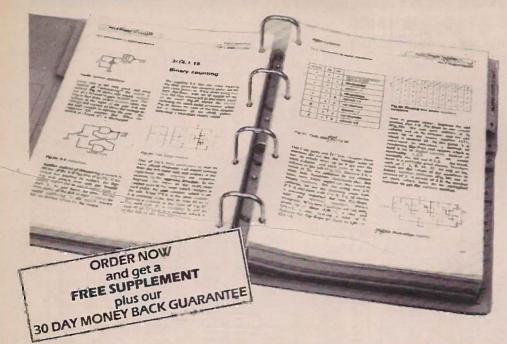
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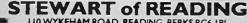
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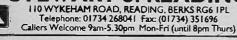
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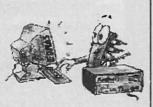
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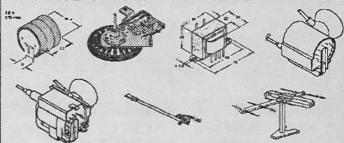
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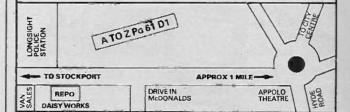
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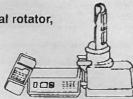
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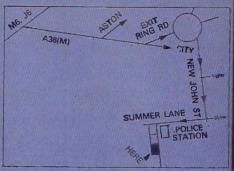
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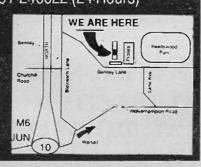
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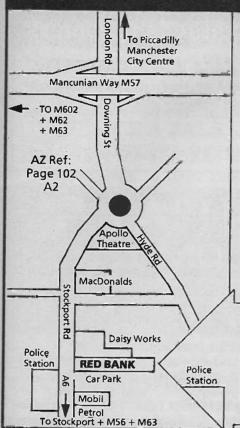
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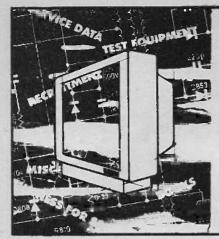
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TX10 LOPT	T3/K30 Chassis  o. RC5150-RC5176-RC5071- C5177 Special Price C4001 KT3 and Teletext X10 Handset Text X9 with Text X9 with Text X10 Focus Pots  Iains Stand-by Switch ith Coil  icam Boards cxas Instruments MkII  DA3561A £3.00 BYX55/600  DA3566 £3.00 Bead) DA3565 £3.00 BYV95C DA3581 £3.00 BYV95C DA3590 £3.00 BYV95C DA3591 £1.00 BYZ106 DA3592A £3.00 BYV95C DA3592 £3.00 BYV96C DA3592 £3.00 BYV96C DA3592 £3.00 BYV95C DA3591 £1.00 BYZ106 DA3592 £3.00 BYV96C DA3591 £1.00 BYZ106 DA3592 £3.00 BYV96D DA3591 £1.00 BYZ106 DA3591 £3.00 BYV96D DA3651 £3.00 BYW56 2A/ DA3651 £3.00 BYW5950	£8.00 £12.50 £12.50 £1.00 £4.00 £1.00 £1.00 £6.00	TR3506 CPT1408T CPT2176 CPT2176 CPT2178 CPT2176 CPT2478  £10 INVERTER 12V IN 24V OUT 9 AMPS  TV DIODES MIXED 100 for £3 Handsets for models: TC1632, TC1642, TC TX2044, TX2204, TX	All modules £8 each ITT IF Modules 5827-01-51 5827-02-51 5827-02-51 5829-02-58 5829-02-58 5829-05-52 ITT – NOKIA RF-IF Modules 4828-04-10 5827-01-51 5827-02-51 5827-03-51 5829-01-05 5828-03-41 ONIC-TV	Amstrad 6000 Head with motor LP Good Lower Drum Tuners Nat. Pan. Small, UHF/VHF U321 - U341 - U342 - U343 - U344 - U94 Tuners U743 - U744 Tuner. IF TERC8-022A TBJZ4-00ZA Alps 15 Mixed hand set LCD Video T/V Keyboard Mains Adaptor 12v/800m/a U411 - U412 Tuners LNB'S MARCONT Ex Rental Black Cap	£10.00 £3.00 £3.00 £3.00 £3.00 £3.00 £7.00 £7.00 £5.00 £5.00 £5.00
No.	o. RC5150-RC5176-RC5071-C5177 Special Price C5177 Special Price C4001 KT3 and Teletext X10 Handset Text	£8.00 £12.50 £12.50 £1.00 £4.00 £1.00 £1.00 £6.00	CPT1408T CPT2176 CPT2178 CPT2176 CPT2478  £10 INVERTER 12V IN 24V OUT 9 AMPS  TV DIODES MIXED 100 for £3  PANAS Handsets for models: TC1632, TC1642, TC TX2044, TX2200, TX TX2204, TX2203, TX	ITT IF Modules 5827-01-51 5827-02-51 5827-02-51 5828-04-10 5829-02-58 5829-05-52 ITT – NOKIA RF-IF Modules 4828-04-10 5827-01-51 5827-01-51 5827-03-51 5827-03-51 5829-01-05 5828-03-41	Amstrad 6000 Head with motor LP Good Lower Drum Tuners Nat. Pan. Small, UHF/VHF U321 - U341 - U342 - U343 - U344 - U94 Tuners U743 - U744 Tuner. IF TERC8-022A TBJZ4-00ZA Alps 15 Mixed hand set LCD Video T/V Keyboard Mains Adaptor 12v/800m/a U411 - U412 Tuners LNB'S MARCONT Ex Rental Black Cap	£3.00 £3.00 44 ch £5.00 £3.00 £7.00 × £20.00 £5.00 ch £5.00
White Spot	C5177 Special Price C4001 KT3 and Teletext X10 Handset Text X9 with Text X9 & TX10 Button Print X10 Focus Pots  Iains Stand-by Switch ith Coil iteam Boards cxas Instruments MkII  Oshiba Nicam Board  DA3561 £3.00 BYX55/600 DA3566 £3.50 (Bead) DA3564 £4.00 BYT71/600 DA3565 £3.00 BYV95C DA3590 £3.00 BYV95C DA3590 £1.00 BYV95C DA3591 £1.00 BYZ106 DA3592A £3.00 BYW46D DA3592 £3.00 BYW56 ZA/DA3651 £3.00 BYW5950	£8.00 £12.50 £12.50 £1.00 £4.00 £1.00 £1.00 £6.00	CPT2176 CPT2178 CPT2176 CPT2478  £10 INVERTER 12V IN 24V OUT 9 AMPS  TV DIODES MIXED 100 for £3  Handsets for models: TC1632, TC1642, TC TX2044, TX2200, TX TX2204, TX2203, TX	5827-01-51 5827-02-51 5827-03-51 5828-04-10 5829-02-58 5829-05-52 ITT – NOKIA RF-IF Modules 4828-04-10 5827-01-51 5827-03-51 5827-03-51 5829-01-05 5828-03-41	Good Lower Drum  Tuners Nat. Pan. Small. UHF/VHF  U321 - U341 - U342 - U343 - U344 - U94  Tuners U743 - U744  Tuner. IF TERCS-022A TBJZ4-00ZA Alps  15 Mixed hand set LCD Video T/V  Keyboard Mains Adaptor 12v/800m/a  U411 - U412 Tuners  ENC LNB'S MARCONT  ER Cental Black Cap	£3.00 44 ch £5.00 £3.00 £7.00 × £20.00 £5.00 ch £5.00
Blue Spot	X10 Handset Text X9 with Text X9 with Text X10 Focus Pots  Iains Stand-by Switch ith Coil  Icam Boards cxas Instruments MkII  DA3561A £3.00 BYX55/600  DA3566 £3.50 (Bead)  DA3565 £3.00 BYV95C DA3581 £3.00 BYV95C DA3581 £3.00 BYV95C DA3590 £3.00 BYV96D DA3591 £1.00 BYZ106 DA3592A £3.00 BYV96D DA3592 £3.00 BYV96D DA3591 £1.00 BYZ106 DA3592 £3.00 BYV96D DA3591 £1.00 BYZ106 DA3591 £3.00 BYV96D DA3591 £3.00 BYV95C DA3591 £3.00 BYV95C DA3591 £3.00 BYV95C DA3591 £3.00 BYV95C DA3651 £3.00 BYV95C	£12.50 £12.50 £1.00 £4.00 £1.00 £1.00 £6.00	CPT2478  £10 INVERTER 12V IN 24V OUT 9 AMPS  TV DIODES MIXED 100 for £3  PANAS Handsets for models: TC1632, TC1642, TC TX2044, TX2200, TX TX2204, TX2234, TX	5827-02-51 5827-03-51 5828-04-10 5829-02-58 5829-05-52 ITT – NOKIA RF-IF Modules 4828-04-10 5827-01-51 5827-02-51 5827-03-51 5829-01-05 5828-03-41	Nat. Pan. Small, UHF/VHF  U321 - U341 - U342 - U343 - U344 - U94 Tuners eac U743 - U744  Tuner. IF TERCS-022A TBJZ4-00ZA Alps  15 Mixed hand set LCD Video T/V All new Keyboard Mains Adaptor 12v/800m/a  U451 - U412 Tuners Ex Rental Black Cap	14 ch £5.00 £3.00 £7.00 v £20.00 £5.00 ch £5.00
Yellow Spot	X9 with Text  X9 & TX10 Button Print  X10 Focus Pots  (ains Stand-by Switch ith Coil  licam Boards  cxas Instruments MkII  DA3561A £3.00 BYX55/600  DA3566 £3.50 (Bcad)  DA3565 £3.00 BYV95B  DA3581 £3.00 BYV95C  DA3590 £3.00 BYV95C  DA3590 £3.00 BYV96D  DA3591 £1.00 BYZ106  DA3592A £3.00 BPW41  DA3650 £7.00 BYW56 2A/  DA3651 £3.00 BYW56 2A/  DA3651 £3.00 BYW562A/  DA3651 £3.00 BYW562A/  DA3651 £3.00 BYW562A/  DA3651 £3.00 BYW562A/	£12.50 £1.00 £4.00 £1.00 £10.00 £10.00 £10.00 £10.00 £10.00 £10.00	£10 INVERTER 12V IN 24V OUT 9 AMPS  TV DIODES MIXED 100 for £3  Handsets for models: TC1632, TC1642, TC TX2204, TX2200, TX TX2204, TX2234, TX	5828-04-10 5829-02-58 5829-05-52 ITT – NOKIA RF-IF Modules 4828-04-10 5827-01-51 5827-02-51 5827-03-51 5829-01-05 5828-03-41	U321 - U341 - U342 - U343 - U344 - U94 Tuners eac U743 - U744 Tuner. IF TERC8-022A TBJZ4-00ZA Alps 15 Mixed hand set LCD Video T/V All new Keyboard Mains Adaptor 12v/800m/a U451 - U412 Tuners Exception of the control	14 ch £5.00 £3.00 £7.00 v £20.00 £5.00 ch £5.00
DECCA LCD	X9 & TX10 Button Print X10 Focus Pots  Iains Stand-by Switch ith Coil  icam Boards cxas Instruments MkII  Oshiba Nicam Board  DA3561	£1.00 £4.00 £1.00 £1.00 £6.00 10p 15p 10p 12p 10p-10p	£10 INVERTER 12V IN 24V OUT 9 AMPS  TV DIODES MIXED 100 for £3  Handsets for models: TC1632, TC1642, TC TX2044, TX2200, TX TX2204, TX2234, TX2234	5829-02-58 5829-05-52 ITT – NOKIA RF-IF Modules 4828-04-10 5827-01-51 5827-02-51 5827-03-51 5829-01-05 5828-03-41	Tuners eac U743 - U744 Tuner. IF TERC8-022A TBJZ4-00ZA Alps 15 Mixed hand set LCD Video T/V All new Keyboard Mains Adaptor 12v/800m/a U4f1 - U412 Tuners eac LNB'S MARCONI Ex Rental Black Cap	£3.00 £3.00 £7.00 £5.00 £5.00 ch £5.00
DECCA LCD	X10 Focus Pots  fains Stand-by Switch ith Coil  ficam Boards cxas Instruments MkII  oshiba Nicam Board  DA3561A £3.00 BYX55/600  DA3566 £3.50 (Bead)  DA3565 £3.00 BYV95C  DA3590 £3.00 BYV95C  DA3591 £1.00 BYZ106  DA3592A £3.00 BYW41  DA3650 £7.00 BYW46 DA3650  DA3650 £7.00 BYW46 2A/  DA3651AQ £3.50 BYW95C	£4.00 £10.00 £6.00 10p 15p 10p 12p 10p	12V IN 24V OUT 9 AMPS  TV DIODES MIXED 100 for £3  PANAS Handsets for models: TC1632, TC1642, TC TX2044, TX2200, TX TX2204, TX2234, TX	5829-05-52 ITT – NOKIA RF-IF Modules 4828-04-10 5827-01-51 5827-02-51 5827-03-51 5829-01-05 5828-03-41	U743 - U744 Tuner. IF TERC8-022A TBJZ4-00ZA Alps  15 Mixed hand set LCD Video T/V All new Keyboard Mains Adaptor 12v/800m/a U411 - U412 Tuners ENB'S MARCONI ER Rental Black Cap	£3.00 £7.00 × £20.00 £5.00 ch £5.00
NICAM HAND SET   E4   ME	fains Stand-by Switch ith Coil licam Boards cxas Instruments MkII coshiba Nicam Board cxas Instruments Cxas In	£1.00 £10.00 £6.00 10p 15p 10p 12p 10p	24V OUT 9 AMPS  TV DIODES MIXED 100 for £3  Handsets for models: TC1632, TC1642, TC TX2044, TX2200, TX TX2204, TX2234, TX	RF-IF Modules 4828-04-10 5827-01-51 5827-02-51 5827-03-51 5829-01-05 5828-03-41	Tuner. IF TERC8-022A TBJZ4-00ZA Alps  15 Mixed hand set LCD Video TV All new Keyboard Mains Adaptor 12v/800m/a U411 - U412 Tuners ENB'S MARCONI EX Rental Black Cap	£7.00 × £20.00 £5.00 ch £5.00
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2435062 AT 2078/25 TI 2436797 AT 2076/78 TI 2433752 AT 2077/81: £15 TI 2433952 AT 2076/88 TI	DA3651AQ £3.50 BYW29/50		STR454 £2.00	Amstrad Export £3.00	FERGUSON CHASSIS Po	ost £5.00
2433752 AT 2077/81-£15 TI 2433952 AT 2076/88 TI		8p 15p	SS2000AF	Amstrad 6800 £4.00	New TV100 Valley Spot	£14.00
2433952 AT 2076/88 TI	DA3652 £3.50 BYW95C	10p	line o.p. £1.00	Amstrad 6000 £15.00	TX100 Yellow Spot	-
	DA3653AQ £2.00 2SC3795	30p	25C940 £1.00 BU105/04 80p	Amstrad 4700 £5.00 Amstrad 4600 £3.00	Ferguson FV31R  Remote and Power Supply FV31R Displa	£5.00
2434141 TFB 3035D TI	DA3654 £1.00 2SC3973B	30p	BU108 £1.00		Panel	£5.00
2424404 612	DA3654Q £2.00 2SC4313 DA3710 £3.50 2SC7350	£1.00	BU124 50p BU126 80p		Post £2	
	DA3710 £3.50 2SC7350 DA3800 £4.00 2SD180 TO3	124	BU180a 65p	FERGUSON	Quartz Halogen	The same of
2434274 TFB 4066AD TI	DA3803A £4.00 80v/t	15p	BU204 - 60p BU205 75p	BSB £1.50	500w. 200v. For outdoor lamps	£1.00
3/22001 FCC/113KF	DA3180 £2.00 2SD200	£2.00	BU206 £1.00	ICC5 £5.00	AMSTRAD	£3.00
2435372 TLF 14567F	DA4260 50p 2SD401 DA4501 53.00 2SD716	£1.00	BU207 £1,00 BU208 80p	IK2000 £5.00 IK7000 £5.00	Plastic Front with Flap 8.900 Clock Display Panel 8.900	£5.00
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	DA4420 £2.00 2SD789	30p	BU208D 90p BU222 £1.00		LOPT No. 260482	£20.00
2432984 £10 EACH	DA4439 £2.00 2SD820	1.00	BU326 £1.00	SRD4 £1.00	£5 Post	
Y260482	TDA4600 £3.00 2SD868 TDA4601 £2.00 2SD880	75p 30p	BU407 60p BU508A 90p	HITACHI	Sharp Tuner & IF	
	DA8190 £3.00 2SD1264	£1.00	BU508AF £1.00	Microwave	1810587 PA1 UK	£3.00
	DA8703 £3.00 2SD1266	£1.00	BU508D 80p BU705 £1.00	I III HEADIC MICEON	KT3/K30 Tripler	£5.00
	DA8349 £3.00 2SD1398	£1.00	BU806A £1.00 BU807 £1.00		U/V Tripler	£4.00
	TDA9403 £1.50 2SD1415 TDA9503 £3.00 2SD1427	£1.00 £1:00	BU808DFI £1,00	SANYO	Grundig Tripler with Focus Pot	€7.00
47000700	DB2033 £1.00 2SD1432	£1.00	BU826 £1.00 BUK454/600 £1.00		BG 2087-642-1005 Triplers	\$7.00
DST 85B 235/40153200 TI	TDD1610S 50p 2SD1453	£1.00	B13824 50m	63	BG 2032-642-3002	£7.00
	TD6303P £2.00 2SD1556	£1.00	BUT11 50p BUT11AF £1.00		PERDIO PV 1188 Handsets	£3,00
Anah	TDA1060 £3.00 2SD1576 TEA1009 50p 2SD1577	£1.00	BUT13 600V-28A £1.00	HICHCABACTTY	BU 208A, BU 508A, BU 508D,	.00 each
	EA1039 £2.00 2SD1878	£1.00	BUT18AF £1.00 BUW84 60p	DATEDNIA TA 210	BU 508AF, BU 508DF £1 BU 801	60p
	TEA1060 £2.00 TDA3560	£2.00	BYW20-08-9 £1.00	9.6V 700 m/A £3	2SD 1398	£1.00
	TEA2029C £3.00 TDA3654	90p	BYW95 10F BUX39 25A-150V £1.00		BUTLIAFeqv	30р
	K7 ST6391 B1 £3.00 TDA3653AQ ST6393 B1/1M £3.00 TDA3562A	00.03	BUX84 50p		Min Sat Receiver with IC M491 BB1; has	
	3YX10 10p STR4211	£6.00	BUY49 20p BUK444/800 £2.00	ES DO CTEVED	tuner modulator etc	€5.00
	3YX38/300 25p STR6020	€6.00	BUK445/600 £2.00	2004 200 201	FERGUSON Sat. Modulator SRD-3-4	£2.00
TV & Video hand set £2.00 B Orion TV & Video Handset £2.00	3YX55/350 10p STR6602D	€4,00	BUK454/600 £2.00 TDA3047 £1.00			25p each
B.Sky, B VHF to IF		-	TDA3048 £3.00	Choke for	Regulated power supply, 500m/a 3-12v	£5.00
Block Converter £1.00	REMOTE LEADS		TDA3083 £2.00 TDA3190 £1.00		HITACHI 620E head and drum	£12.00
10 Panels Ferguson	1 A 100 all pln conn		TDA3301 £3.00	THOPN	AMSTRAD Nicam head and drum	£12.00
Mixed from TX9 to ICC5 £20.00	Front Panel £2.00		TDA3506 £3.00	M494B1	AMSTRAD 6000 head and drum	€12.00
TV Aerial Ring Type 40p	£4 1½ metr	res	TDA3561 £3.00 TDA3560 £4.00		TATUNG universal tuner 205, or eqv wit	
77/200 D XX - L 66.00	TX 9 Remote Panels	85		- Cancian	socket	\$8.00
	TX 10 Remote Panels		Text-Type Replace Handset for	Philips KT3/K30,	U/V REMOTE HANDSET	1
VHF Tuner for ICC5 £5.00 T	TX 90 Remote Panel No. 139-001		K4 ctc	£6.00	5 IN ONE TV1 - TV2 - VCR £15 SAT - AUX	THE REAL PROPERTY.
Amstrad-Double Decker Switch Mode	C Nos. M293B1 & TMS 1000£	10 each	Thom Handsets	Marine Bally and	BURGLAR ALARM	
POWER SUPPLY £5.00 T	TX 100 Remote Panels	610	9000-9600-TX9-TX1	00.01£	Use Infra Red Detector	
Amstrad-Long Chassis and Short Chassis	IC M293BI-SAA5012		Text and Non-Text		Wide or Short Angle	
Power Supply	and ICs		Philips RC5171 Han	13,00	Wall Mount, with Relay £8.00	-
Violets 177101772	TX 85 - 86 - 89 - 90 - 98 -		Sanyo Magnatron Type 2M218H	£10.00	POWER SUPPLY KIT 0,28 volts 11/2 amps with 2 meters	612
	99 – 100 Tuners	£4	1992 to 1993 Mod.	200,000	Printed circuit board and compone	
	Orion Modulator Video MDLK 6B\$13A	£2 50	Orion Video handse	et with LCD £5.00	MODULATOR KIT ES	
	Hitachi Mains Switch with Stand-by		SATELLITE TUNE		5v to 12v for all cameras etc.	
	Scart to 4 Phone Leads 11/2m		with Base Band, Vic		6251 FRAME O/P THICK FIL	M
regulated £2.00 S	SXT2302234 Sat. Tuner with		AMSTRAD Long C		HITACHI GEC £9.00	-
Perguson U/V Camcorder	Base Band Min	£4	Display Panel 1992/	1993 £4.00	THICK FILM HITACHI HM9205A £4.00	0
Battery VA310 £4.00	CEN	77	2011201		PHILIPS NEW TYPE	
Desolder Pump £2.00			COMPONENTS		U/V HANDSET £10	-
IF Panel for	63 BISHOPSTEIGNTO NORMALLY SAME DAY	ON, SHO	DEBURYNESS, ESSE)	K SS3 8AF AILABILITY	06D4-025-001	
Philips CP90-CP110 £5.00					Mains input choke for TX9 f	4
Philips Solder Iron 25w-240v £6.00	Unless specified add £1.70	Prios	mall orders • Additions are PER ITEM • Fo	onal charges for or UK addresses		
Portasol Hobby Gas Solder Iron £10.00	No accounts • Lectinical im Unless specified add £1.70 heavier items • Specific P please add P P TO ORDER TH EC unless VAT No Postal	IEN 171 2	VAT TO TOTAL • 1	This applies for the	TX100	
Philips KT3 . £7.00	EC unless VAT No	Is giver	n ● EXPORTS ~ P P at heque with order	t cost •	REMOTE PANEL	
Text Decoder K40 £7.00	Callers to shop = 212 Lon	ndon Koa	ad. Southend • Open	9.30-1, 2.13-3:	No. 56413IC M293B/ and SAA5012 £10 etc.	
ICCS Tube Base on Panel	Tel: 017023	332992 •	Fax: 01702 338805 • s on official headings		and State VII 210 cm.	-
ICC5 Decoder Panel each £5.00	GVMISENC	or der	3 on omeral nearings		I	-