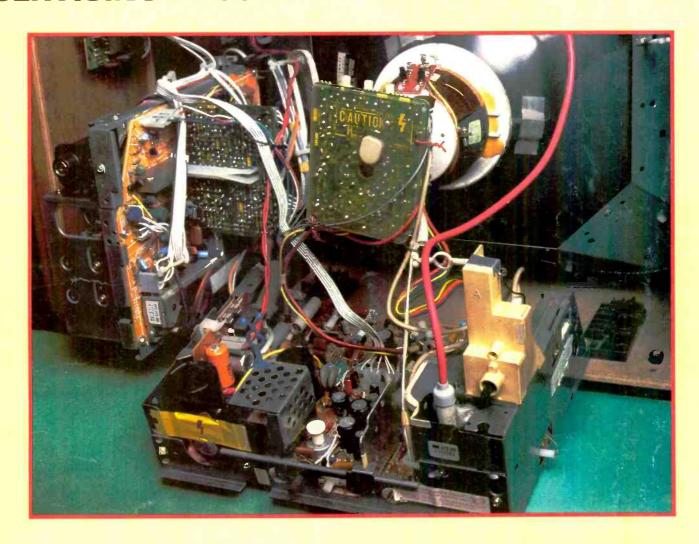
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VHS the Philips Way
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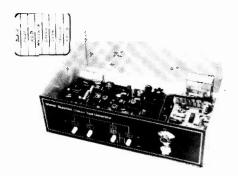
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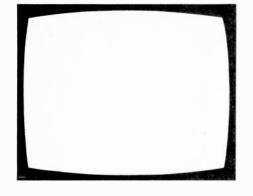
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March 1986 Vol. 36, No. 5 Issue 425

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We regret that we cannot answer technical queries over the telephone nor supply service sheets. We will endeavour to assist readers who have queries relating to articles published in *Television*, but we cannot offer advice on modifications to our published designs nor comment on alternative ways of using them. All correspondents expecting a reply should enclose a stamped addressed envelope.

Requests for advice on dealing with servicing problems should be directed to our Queries Service. For details see our regular feature "Service Bureau". Send to the address given above (see "correspondence").

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2SA 1175 SLC7UB 2SB 733 KV2204UB 2SB 740C TCK88B 2SB 856 GEN 2SC 403C GEN 2SC 867A GEN 2SC 1034 GEN 2SC 1034 GEN 2SC 1114 GEN 2SC 1114 GEN 2SC 11124 GEN 2SC 1362-7 GEN 2SC 1362-7 GEN 2SC 1364 GEN 2SC 1364 GEN 2SC 1475 KV1810UB	25 2.34 5.28 46 5.28 3.18 25 7.38	BELTS	Service Manual 3V00 17.50 Service Manual 3V16 26.24 Supplement to 3V00 3V22 1.28 Service Manual 3V23 30.62 Service Manual 3V24 28.42 Service Manual 3V29 29.00 Instruction Manual 3V29 3.28 Service Manual 3V29 3.28 Service Manual 3V30 14.91 Instruction Manual 3V30 14.91 Instruction Manual 3V31 25.84 Instruction Manual 3V35 1.63 Service Manual 3V35 1.63 Service Manual 3V35 1.63 Service Manual 3V35 1.63 Service Manual 3V35 1.63 Supplement to 3V35 3V38 1.24	FHT Transformer	25.53 33.80 15.00 23.85 6.18 3.45 15.36 15.03 1.77 60
2SC 1982 GFN SY8-725-800-00 SY8-725-800-00 GFN SY8-	25 96 7.38 98 25 4.08 2.34 2.34 96 6.42 96 4.08 4.08	Capistan Belt	39\42 23,9\4 30.72	Audio Control Head Sub Assembly 3292/3V00/3V01/3V16/3V22 4 Fast Forward Idler 3292/3V00/3V16 Fast Forward Tyre 3V00/3V16 Pinch Roiler 3292/3V00/3V01/3V16/ 3V22/3V23 Stop Solenoid 3V16 Pause Solenoid 3V16 Pause Solenoid 3V16 Take Up Idler Assmb 3V00 up to Serial No. 19006 3V16 up to Serial No. 27700 3V22 up to Serial No. 27700	60 60 3.97 42.38 1.63 60 7.30 10.42 16.60 7.54
SUNDRIES UHF Tuner BT-871 KV1810UB Booster Antenna SLC7UB RF Modulator SLC6UB	37.20 31.38 60.38	SWITCHES KV2022UB 96	Tape Spool Drive Belt 39/25/39/39/39/39/39/39/39/39/39/39/39/39/39/	3V16 Serial No. 16510 onwds 3V22 Serial No. 27701 onwds Rewind Idler 3V16 Take Up Tension Brkt 3V23	5.28 8.52 80 4.08
SONY REMOTE CONTROL SLCSUB SLCSUB SLC7UB	-S 19.80 17.40 42.00	Switch, Slide Record SL8000UB 96 Switch, Slide Record- Playback Switch, Push KV1512UB 4.08 Switch, Push KV1512UB 4.08 Switch, Power KV-6EN 5.50 Button, Stop/Eject WM4 96 Knob, Control SLC7UB 96	Upper Drum Assmb 3V22 35.94 Upper Drum Assmb 2200/3660/3V16/3V23/ 3V24/ 3V31/3V35/3V36/3V38/ 3V39 3739 Upper Drum Assmb 3V29/3V30 35.74	Take Up Spool Idler Assmb 3y29/3V30 Pinch Roller 3y29/3V30 Idler Counter Pulley 3V29/3V30 Idler Counter Housing Assmb 3V29/3V30 Take Up Clutch Assmb3V29/3V30	2.12 8.66 60 20.85 2.36
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SPECIFIC COMPONENTS Philips G8 knobs sm/lg 90° transductor Thom 1591 speakers sm Ig Thom 1500 controls 390K frame 470K line contrast 1k5 Focus control Thom/GEC Thom 9000 focus unit Thom 8500 focus unit Thom 8500 focus unit Thom Tx10 focus cont. Decca bridge trans.	50 2.60 6.20 6.20 6.20 599 each 2.95 8.40 4.75 10.20	F Gain module	8R 3.75 Tripler 10.65 Luminance chroma panel 24.00 20.03 UF module 14.95 20.03 UF module 13.50 3.60 5.30 8.6.8 5.30 8.6.8 5.30 8.6.8 5.30 8.6.8 5.30 8.6.8 5.30 8.6.8 5.30 8.6.8 5.30 8.50 20.04	K30 EHT lead Selector unit 1002 (early) 1 TMS 1000 panel 1234 1 Euro decoder panel 1234 2 Power supply 1234 2 A1 gun switches 0 Drivff switches 1 Selector unit 1002 (late) K30/K35 sound panel 1	17.50 2.90 8.30 11.20 11.20 46.00 23.50 70 2.60 9.90 12.50 10.00

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TRADE COUNTER OPEN	MUN-FRI 9 a.m.—5	<u>p.m. 5A1 9.</u>	3U 8.III.—3	p.m. IKADE COUNT	EU CLOSED M	EUNESUAT P.III	•
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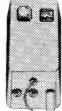
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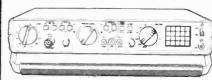


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ARCHIVE 1.75 CA158		AN203	£2.20 CX15	7 £3.95	HA11816NT							C1 80					
ARCITIGO	1	AN210	£1.75 CX15	8 £3.50	HA11828NT												Al
ARCHIVED 1.88 CASIGN 1.89 CASIGN 1	- 1	AN211A	\$2.25 CX16	60 £2.50					TA7145P								AK
ARCIFIGO C.240 C.160 C.240 A.1140 C.250 A.1240 A.1240					HA12413	C2 58			TA7146P						2SC1664		
AAZ-BP C.75 CX170				2 63.40	HA12400	C2 50					UPC103/II		2SA1102	€1.90	2SC1682	€0.30	
AR2390 C. 2.6 AR1194 C. 2.5 AR1195 C. 2.5 AR1196 C	- 1		C2 75 CY13				MB3731	€2.50	TA7150D				2SA1103	£1.90	2SC1741	FD 30	HS
ARZ-90	- 1			10.00		27.30	MB3756	62.60	1A7132P								H
ARZ-14 P. 1.50			22.30 UAIC			13.50			IA/1/3P								
ARZ47 P. 1.50 HA1157 17,5 LA1252 Di. 80 PLUSS 49,5 LA7200 C. 20 UPC1170C DI. 70 SSEP2 DI. 80 SSE2									IA7176P		UPC1161C						
ARZ-90 P. 2.59 Hal149	4	AN240P	£1.50 HA1		LA1201	£0.85						20.60					
AAA274	1	AN241P	£1.50 HA11		LA1 22 2	08.03			TA7200	€2.00	UPC1167C	£0.70	2SA1198	£0.35	2SC1945	£3.50	JV
AR259 C2.75 Ma1151 C2.50 L47240 C1.75 ST0011 C2.75 L72728P C2.00 UPC1171C C1.70 S2854 C1.70 S201987 C1.00 PA274 C2.50 Ma1158 C1.75 L41328 C1.75 ST0013 D2.75 L72728P C1.00 UPC1171C C1.70 S28547 C2.60 S202021 C1.30 PA274 C2.50 Ma1158 C1.75 L41388 C1.75 ST0015 D2.00 L72728P C1.00 UPC1171C C1.70 S28547 C2.60 S202021 C1.30 PA274 C2.50 Ma1158 C1.75 ST0015 D2.00 L72728P C1.50 UPC1178C C1.70 S28547 C2.60 S202021 C1.30 PA274 C2.50 Ma1158 C1.75 ST0020 D2.50 Ma1158 C1.75 Ma1158 C	-1	AN247P			LA1230	£1.50	SI-1125H	£7.50	TA7201	£2.00	UPC1168C		2SB22	FO 40	2SC1946A	C9 50	
AA271A C. 21.50 HA1156 C.1.50 LA1200 C.1.50 ST0014 D. 25 C.2.50 C.2.	-1	AN259	£2,75 HA11	151 £2.50	LA1240	£1.75	STK011	C3 75		62 80							
AA271A C 2.50 Ha1166	-1	AN262	£1.50 HA1						TA7203P								
AA734 Q 2.5 0 AA139 C 2.5 0 C 2.0 0 C	1		£2.50 HA1						TA7204P			CH 20					PA
AAV330 C. 25 6 HA1197 C. 15.6 LA1480 C. 15.8 STROM AAV331 C. 27 5 HA1506W C. 16.0 LA2100 C. 17.5 STROM AAV331 C. 27 5 HA1506W C. 16.0 LA2100 C. 17.5 STROM AAV331 C. 27 5 HA1506W C. 16.0 LA2100 C. 17.5 STROM AAV331 C. 27 5 HA1506W C. 16.0 LA2101 C. 16.0 STROM AAV331 C. 17.5 HA1506W C. 16.0 LA2101 C. 17.0 STROM AAV331 C. 17.5 HA1506W C. 16.0 LA2101 C. 17.0 STROM AAV331 C. 17.5 HA1506W C. 16.0 LA2101 C. 17.0 STROM AAV331 C. 17.5 HA1506W C. 17.0 LA2300 C. 17.0 STROM AAV331 C. 17.5 HA1506W C. 17.0 LA2300 C. 17.0 STROM AAV331 C. 17.5 HA1506W C. 17.0 LA2300 C. 17.0 STROM AAV331 C. 17.5 HA1506W C. 17.0 LA2300 C. 17.0 STROM AAV340 C. 17.0 LA2300 C. 17.0 STROM AAV340 C. 17.0 LA2300 C. 17.0 STROM AAV3500 C	-1	AN274	C2 50 HA1	196 63.75	LA1368											£0.30	PΛ
AA833 27 AA199	-1		C3 25 HA1	107 61 50	1 1 1 1 1 1 1 1 1	C4 06	STK015	£5.00	TA7207D			£1.20	2SB405	08.03	2SC2026	£0.65	
AM315 12 27 M4136W 13 20 12 13 14 15 15 12 15 14 15 15	-	AN303	C2 50 HA11	100 €1.40	LA2200		STK016	£4.75	TA72000				2SB426	C2 60			
AM315 C. 2.00 AM318	-1				LA2200	CH . FO	STK020		TA7208P	£1.50			2CB#71				SA
AM316 C.1.59 AM327 C.1.50 C.1	-1								TA721UP	₹2.00	UPCTIBIH						SH
AM318	-1	ANDIO															
AM331 C.7.5 Hal364W E1.50 L.3300 E1.40 STRO77 E3.95 Ta7220P E1.75 UPC1187 E1.30 SS8536 E1.50 C.3300 E1.40 STRO78 E3.95 SS8536 E3.95	١		£3.50 HA13		LA3160	£0.90			TA7215P								
AM360	-1									£1.20	UPC1185H				2SC2092	£0.95	
AMBSUL 11.20 HA196WW 11.50 LA391 11.20 STR080 C7.72 IA7222P ft.20 UPC1187V 11.50 U.39 SES546 01.39 SESC228 01.65 SESC238 0	-1	AN331					STK077	25.95	TA7220P	£1.75	UPC1186	£0.80	2SB536	20.95	2SC2098	50.95	SH
AMS6PZ	ı					£1.20	STK078	€5.50	TA7222AP	€1.20	UPC1187V	£1.30	2SB546	£1.50			
AM610P C1.55 HA1568 C1.60 LAG39P L.20 STR062 C7.75 TA7224P C2.75 UPC1191W D0.56 285968 D0.30 SSC2278 D0.75 AM610P C1.75 HA1568 C1.60 LAG39P C1.00 STR066 C9.25 TA7226P C2.00 UPC120RC D0.59 2859756 C2.50 C850278 D0.75 AM610P C1.75 HA1568 C1.60 LAG39P C1.40 STR430 D1.75 TA7226P C2.00 UPC120RC D0.59 2859756 C2.50 C850278 D0.75 AM6720 C1.86 HA1371 C2.55 LAG32P C1.40 STR435 S3.00 TA722P C3.00 UPC120RC D0.59 SSC2278 D0.75 AM6730 C1.86 HA1371 C2.50 LAG51P C1.50 STR435 S3.00 TA723P C3.00 UPC120RC D0.59 SSC2278 D0.75 C2.00 HA1389 C1.40 LAG51P C1.50 STR435 S3.00 TA723P C3.00 UPC120RC D0.59 SSC2278 D0.75 C2.00 HA1389 C1.40 LAG10P C1.00 STR435 S3.00 TA723P C3.00 UPC121W C1.50 SSC2278 D0.75 C2.00 HA1389 C1.40 LAG10P C1.00 STR435 S3.00 TA723P C3.00 UPC121W C1.50 SSC2278 D0.75 C2.00 HA1389 C1.40 LAG10P C1.00 STR435 S3.00 TA723P C3.00 UPC121W C1.50 SSC2278 D0.75 C2.75 CAN710 C2.00 HA1389 C1.40 LAG10P C1.00 STR435 S3.00 TA723P C3.00 UPC121W C1.50 SSC2278 D0.75 C2.75 CAN7114 C1.60 HA1394 C2.75 LAG10P C3.00 STR443 D6.95 TA7313AP C1.50 UPC122W C1.50 SSC2278 D0.75 C2.75 CAN7114 C1.60 HA1394 C2.75 LAG10P C3.00 STR445 D6.95 TA7313AP C1.50 UPC122W C3.00 SSC2278 D0.75	١	AN362L	£1.30 HA13	366WR £1.50	LA3350 !	£1.20	STK080	£7.20	TA7223P	€1.95	UPC1190C						
AM610P C1.75 HA1586R C1.65 LA4031P C1.40 STR409 C1.75 LA4031P C1.75 LA4051P C1.75 LA4051P C1.75 STR405 C1.75 STR405 C1.75 LA4051P C1.75 STR405 C1.75 LA4051P C1.75 C1.75 STR405 STR405 C1.75 STR405 STR405 C1.75	-1	AN366P	£1.50 HA13	67 🗯 23.25	LA3361 !		STK082	67 75	TA7224P		UPC1191V						
AM5122	J	ANG10P	£1.75 HA13	68 £1.60	LA4030P	£2.00	STK086		TA7225P	62.50	UPC1198H						SU
AM5732	-1	AN612	£1.75 HA13	68R F1 65			STK430	C4 75	TA7226P	C2 20		00.70	2CB755			£1.50	TO
AM5730	-1	AN5722	£1.50 HA13				ST#422		TA7227D		UDC12004				2SC2365	£4.25	
AN5732	1	AN5730					CTW435		TA72200		UPG12000	EQ. 93	2007720		2SC2540		
AM5753 C1.99 HA1388	-1	AN5732		774 62.30		CH 00	CTIVAGE	CE 00	TA7020D	23.00	UPCTZITY	£1.90	236372				10
AM6520 C2.30 HA1389 C1.75 IA4102 C1.20 STK439 C5.50 TA7312P C1.40 UPC1217G C1.60 SEA66 D39 SSC2578 C2.20 AN7105 C2.20 HA1392 C2.30 UA4112 C1.30 STK441 C6.95 TA7313P C1.30 UPC12181 C1.40 SEA66 D39 SSC2578 C2.20 AN7105 C2.20 HA1394 C2.75 LA4120 C2.50 STK443 C6.95 TA7315P C1.30 UPC1227C C1.90 SEA66 D39 SSC2580 C2.20 AN7114E C1.60 HA1394 C2.75 LA4120 C2.50 STK445 C5.75 TA7315P C1.30 UPC1227C C1.90 SEA66 D39 SSC2580 C2.20 AN7114E C1.60 HA1397 C2.50 LA4125 C2.00 STK459 C5.75 TA7315P C1.30 UPC1237C C1.75 UPC1227C C1.90 SSC36 C1.75 SSC539 C2.20 AN7114E C1.60 HA1398 C2.40 LA4140 C0.70 STK460 C7.50 TA7315P C1.75 UPC1227C C1.95 SSC539 C2.20 LA4192 C1.00 STK460 C7.50 TA7315P C1.75 UPC1227C C1.95 SSC539 C1.25 SSC539 C2.20 LA4192 C1.00 STK460 C7.50 TA7315P C1.75 UPC1227C C1.95 SSC539 C2.20 LA4192 C1.00 STK460 C7.50 TA7315P C1.75 UPC1227C C1.95 SSC539 C1.75	1	AN5753				C1.00	S1K430	1.0.00	TA7230P	11./5	UPC 1215V	£1.25	2503/3				_
ANTIOS C.20 HA1932 C.23 LA 14112 C.140 STK441 C.5.00 TA7313P C.130 UPC1228C C.150 SEA66 C.130 SEC579 C.20 ANTIO C.140 HA1932 C.275 LA4120 C.250 STK443 C.5.51 TA7313P C.150 UPC1226C C.150 SEA66 C.130 SEC579 C.20 ANTIO C.140 HA1939 C.2.75 LA4120 C.2.00 STK445 C.5.51 TA7313P C.150 UPC1226C C.150 SEA66 C.150 SEC580 C.20	1	ANCOEO	C2 20 UA13			E1.00	S1K437		IA/232P		UPU1216V	£0.95					
AN71105 C2.20 HA1392 C2.30 LA112 C1.30 STK443 C6.95 TA7313AP C1.30 UPC122C C1.90 SZ6461 C0.30 SZ62500 C2.20 A7114E C1.60 HA1394 C2.75 LA120 C2.00 STK459 C5.75 TA7312SP C1.60 LA1409 C2.60 STK469 C7.60 STK460 C7.50 TA7312SP C1.60 LA14109 C2.60 STK460 C7.50 TA7312SP C1.60 LA14109 C2.60 STK460 C7.50 TA7312SP C1.60 LA14109 C2.60 STK460 C7.50 TA732SP C1.60 LA14109 C2.60 STK460 C7.60 TA7312SP C2.60 LA14109 C2.60 STK460 C7.60 TA7311 C2.60 STK460 C7.60 TA7311 C2.60 STK460 C7.60 TA7311 C2.60 STK460 C7.60 TA7311 C2	1	ANCOLL	12.30 MAIS					13,50	TA/310P		UPC1217G		2SC458				
AN7110	1	AN0344	14.75 HA13			E1.40					UPC1218H					€2.20	
ANT116	1	AN7105	12.20 HA13			E1.30	STK443				UPC1222C			£0.30	2SC2580	€7.20	
ANTISE 11.60 H31996 2.40 A4125 2.00 SIK469 E3.75 F1.7328 F1.60 DPC12256 E1.25 SSS37 D.26 250170 P1.60 ANTISO E1.60 H31996 2.40 A4140 E3.60 E3.76 SIK460 E3.50 A767074 E3.75 DPC12277 E3.50 DPC12279 E3.50 E3	1	AN7110				C2.50	STK457				UPC1223C	£1.75	2SC503Y	£0.70			
ANT-120 C1-60 HA198 C2-40 LA4140 D2-70 STK460 C7-50 TA75078 C1-60 UPC126C C1-25 SSC820 D3-30 SSB313 D1-95 ANT-130 C1-50 HA11212 C2-30 LA4192 C1-50 STK461 E5-50 TA75078 TA75078 C1-50 UPC1270 C1-50 SSC820 D3-30 SSB313 D1-95 ANT-145M C1-85 HA11221 C2-30 LA4200 C1-50 STK465 E5-50 TA75078 TA75078 C1-50 UPC1270 C1-50 SSC861 C2-30 SSD313 D1-95 ANT-156N C1-75 HA11225 C1-95 LA4220 C1-20 STK0025 C1-50 STK465 E5-50 TA75078 TA7508 C1-75 UPC1277 C1-75 SSC861 C2-30 SSD313 D1-95 ANT-156N C1-75 HA11225 C1-95 LA4230 C1-75 STK0029 C1-75 TA7508 C1-75 UPC1277	1	AN7114E	£1.60 HA13	197 52.50			STK459	£5.75	TA7325P	€0.85	UPC1225H	£1.60	2SC536				
ANT-120	-1		£1.60 HA13	98 €2.40	LA4140 §	20.70	STK460	£7.50	TA7328	£1.60	UPC1226C						- (
APT-130	-1	AN7120	£1.40 HA14	57W £0.90	LA4182	F2.00	STK461	66 50	TA7607AP	62 75	HPC1227V		290620				_ (
AN7145M	ı	AN7130	£1.50 HA11	215A £4.25			STK463	67 AN			LIPC1230H	C2 50	250620			£0.95	-
ANT146M	I						STK465	CR 50		C2 30	HDC1230H				2SD325	22.65	- 6
ANT156N C2.40 HA11235 C2.00 L44400 C1.90 STR0039 C2.51 HHC001 C2.50 H	-					M 20	CTK0036	C4 05	TA7611	₩.JE	UPC1230V			22.20			1.5
APT158N C.2.49 HA11235 C.7.50 C.4.400 C.1.90 STK00.039 C.2.52 UHICIDON C.4.80 UHICIDON C.2.50 STSC717 C.0.50 SSD371 C.1.50 APT168 C.2.50 HA11702 C.4.90 L.4.402 C.1.20 STK00.40 C.5.75 UHICIDON C.3.75 UHICIDON C.	1					75	CTMOO23			M.73	UPC1243V	21.00	20000TA				-
ANT168N C2.56 Ha11423 C2.67 C2.6420 C1.40 STK0040 C3.50 UPIC1004 C4.80 UPIC1350C C1.75 C3.62732 C0.30 SSD4011 C1.50 ANT311 C1.80 Ha11701 C4.50 L44420 C1.20 STK0049 C5.75 UPIC160 C2.20 UPIC1350C C1.75 C3.62733 C1.30 SSD4011 C1.50 ANT311 C1.80 Ha11703 C4.50 L44430 C1.30 STK0059 C6.00 UPIC200C C2.20 UPIC1350C C1.75 C3.62738 C1.30 SSD4011 C1.75 C4.76 C4.75 L44460 C1.75 STK2028 C6.50 UPIC30C C2.20 UPIC1350C C1.50 C3.62798 C1.75 C3.62798	1		C2 40 HA11	225 (2) 00		C1.73				21.30	UPC 1277H	12.75					-
AN7116 C1.50 H411701 C4.50 L44422 C1.20 STK0049 C5.75 UPC16C C1.30 UPC13SC C1.50 SSC739 C2.56 SSC749 C2.56 S	-1		C3 26 HA11	400 E4.00		1.30	O1K0039	24.20	UNICODI	24.00	UPC1278H	12.50	250/17				- ?
AN7311	ı	AM7160	CO ED HATT	704 04 50				13.30	UHILUU4		UPC1350C		290/32				- 5
APT-3111 C1.00 Hal1703 E4.50 C1.4440 C2.20 STK0080 C6.50 UPC136C C1.80 UPC136C	- 1			701 14.30				13.75	UPU 16U			11.75	2SC/33			20.30	- 4
RAST	ł					1.30			UPC20C	12.20	UPC1356C	£1.50	250792		2SD4688	20.50	- 5
BA311 D. 1-5 CA111706 E. 1-5 CA4480 L. 1-7 STRC1/29 D. 3-7 CA511 D. 1-7	1	AN7311	£1.00 HA11	703 £4.50				€6.50	UPC30C				2\$C799				-
BA313 DL75	1					1.75		26.50	UPC41C	\$2.00	UPC1360C		25C828				
BA313 11.76 HA11710 15.50 LA4505 12.50 STR2240 19.75 LPG561 LPG566 11.50 LPG566 15.50 C56900 LPG566 15.50 LPG576 LPG566 LPG5	4	BA311			LA4461 1	C1.75				£1.25	UPC1363C	£1.95	2SC840	£1.50			
BA402 CL.78 HA11713 E.9.50 LA6458 CD.99 STK3042 C6.50 UPC566H CD.60 UPC1367C C1.50 25.09300 CD.35 SSU276 C1.50 BA5114 CL.78 HA11713 E.9.50 LA7800 C2.59 STK5421 C6.50 UPC573C C2.20 UPC1370C C1.59 C1.59 C3.09300 CD.35 SSU30300 CD.35 CD.37	1		£0.75 HA11		LA4500 §	2.50				£0.60	UPC1365C	€3.00	250867	€2.75			
BA402 CL.78 HA11713 E.9.50 LA6458 CD.99 STK3042 C6.50 UPC566H CD.60 UPC1367C C1.50 25.09300 CD.35 SSU276 C1.50 BA5114 CL.78 HA11713 E.9.50 LA7800 C2.59 STK5421 C6.50 UPC573C C2.20 UPC1370C C1.59 C1.59 C3.09300 CD.35 SSU30300 CD.35 CD.37	1				LA4505 1	2.50	STK2240	£9.75	UPC561C	€2.00	UPC1366C	£1.50	250900	£0.35			
BA5114	1				LA6458 9	0.90		€6.50	UPC566H	20.60	UPC1367C						
BA521 C1.75 HA11714 C5.75 LA7806 C2.50 STKS421 C6.50 UPG573C C2.20 UPC1370C C1.50 S25945 C0.7120 C3.50 STKS421 C6.50 UPG573C C2.20 UPC1370C C1.50 C1.75	1	BA511A	£1.80 HA11	713 £6.00	LA7800 S	1.95	STK5211	£6.75			UPC1368H	£1 75	2509300	FR 30	2SJ49	£4.00 1"	_
BA521 C1.75 HA11716 C5.25 LC7120 C3.59 STK6451 C6.75 UPC5732 C0.35 UPC5732 C0.35 UPC1373H C1.75 SSC1034 C3.75 SSK19 C2.76 BA532 C1.59 HA11716 C5.25 LC7130 C3.59 STK5720 C5.80 C5.75 UPC5732 C1.75 UPC1373H C1.75 C5.75 C5.75 UPC1373H C1.75 UPC1373H UPC1373H C1.75 UPC1373H	1	BA514	£1.75 HA11	714 £5.75	LA7806					\$2.20	UPC1370C						
BA527	1							C6 75	UPC574 I	00.35	LIPC1373H				2CK10		
BA532 C1.59	1	BA527							HPC575C		HDC+279H	C1 06	2001004	CO 05	20013	CO. 70	
BA536 C2.25 HA11718 C4.75 LC7136 C2.75 TA7050P C1.80 D1.50 D2.85 C7137 C4.75 C7.75	1	BA532	\$1.50 HA11	717 06.25	I C7121	276			LIDCE 7CH	CH 75	UPC1370H	E1.30	2001001				
BA612	1	BA536			LC7136	27.75		CO 90	UPCS70FI	21./3	UPG13020						Cal
BA1310	1	BA612	CH 90 HA11							10.70	UPU1384U	12.50	25011114	13.50		10.90	Odi
BA1320	1	DATIZ	CH 75 HA11		LU/13/	2.75			UPU580						25K134		
BA1330	1	DA1310							UPC585C	10.95	UP0277	£4.50	2SC1124				
8A1359	ı	DA 1320	11.25 HA11						UPC592		2SA103				3SK22	£1.75	
ARASSY CZ.20	1	BA1330			M5134P I	2.75				£1.70	2SA350			22.95	3SK45		
CX06642	1	BA6304			M5135P 1					£1.50	2SA495	€0.35	2SC1172	\$2.75	3SK88		
CX05658 C2.50 H411747 N C9.50 M51513L C1.50 TA7074P C1.95 UPC10090; C1.20 28.8562 09.30 SC1308 C2.70 TA.2002 09.80 CX0758 C2.70 TA71747N C9.50 M51514AL C1.75 TA7104P C1.35 UPC10176 C3.00 28.8634 09.60 SC1316 C2.55 TA2108 C2.50 TA7108 C1.50 UPC1018C 09.50 C3.85643 09.65 SC1317 C9.30 TA2004 C2.20 CX1000 C3.75 H411759N C3.60 M51516L C2.50 TA7108 C3.70 UPC10276 C3.75	ı	CX0642	£8.50 HA11				TA7073			\$2.00	2SA539	€0.30	2SC1307	£1.25	TDA1515		
CX075B C2.20 HA11747API C9.50 M51516I C1.75 TA7104P C1.35 UPC10175 C1.30 Z58A834 D1.60 Z501316 C2.95 TDA2003 E9.90 CX095C C2.80 HA11749 C2.50 M51516I C2.50 TA7109 C1.50 UPC1018C C1.75 Z58643 D1.65 Z501317 C1.75 D1.50 D1.75	ı	CX065B	£2.50 HA11								2SA562	ED 30	2SC1308	62 70	TDA2002		
CX1000 C	ı	CX0758	£2.20 HA11		M51514AL 6					C1 30	2SA634						
CX1000 C5.75 HA11750 C5.00 M51516L C2.50 TA7109 E2.30 UPC1020 E1.75 Z5.8673 E2.8673 E2.867	ı	CX095C	£2.80 HA11		M51515BL 9	2.50		CL 50		PR 95	254643	CD 65	2501317	20 30	TDA2004	C2 20	
CX101G C7.50 HA11758NT D8.50 M51517L D2.50 TA7119 E1.75 UPC1023H E0.60 28A684 E0.70 28C1364 E0.40 TDA2006 E1.20 T CX130 C4.50 HA11758NT D8.50 M51518L E1.75 TA7120P E0.50 UPC1025H E2.30 28A689A E0.85 28C1417 E0.30 TDA2020 E1.40 T	ı	CX1000	£5.75 HA11	750 £5 nn	M51516I	2 50				C1 75	254673	CO 35	2001317	E0.30		C2 75	
CX130 E4.50 HA11758NT E8.50 M51518L E1.75 TA7120P E0.50 UPC1025H E2.30 2SA699A E0.85 2SC1417 E0.30 TDA2020 E1.40	1				M515171	2 50							2001392			12.75	_
1 00.00 25.00 (10.17.001) 20.00 (10.10) (10.10) (10.10) (10.00	ı											EU. /U	2001304	10.40	TDA2000	11.20	- [
100 000 000 000 000 000 000 000 000 000	1			768 C4 En												£1.40	•
	L	07.100	20.50 TATT	700 £4.30	I MID I DE I ME.	1.73	IA/ IOUP	11.00	UF 0 10200	£1.00	20A/02	£1.95	20014198	£0./5	TDA2030	£1.40	

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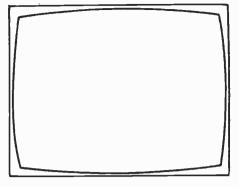




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COVER PHOTO

This month's cover photo shows a set fitted with the Hitachi NP6C chassis. See article on page 294.

CORRECTIONS

The line output valve used in the Thorn 1500 chassis was given as a PL509 in our February issue (page 176). This should of course have been type PL504.

A couple of modifications to the Sharp VC9700 were mentioned in VCR Clinic last month (page 255). The recommended value for R693 should have been given as $10k\Omega$, not 10Ω .

Two corrections to the Spectrum 48K colour bar program on page 241 last month appear in a letter on page 319 this month.

ADDRESSES ETC.

Several readers wrote to provide us with the address for Nikkai colour sets. These are distributed by Nikkai Imports, Nikkai House, Unit 3, Ashley Industrial Estate, Sackville Street, Leeds LS7 2BS (0532 622 404). Our thanks for this help.

Does anyone know the spares agents for the Sonar 77 portable? The set was made in Taiwan.

Cable Standstill

In November 1983 eleven broadband cable TV franchises were awarded. It was to be the beginning of a great new era, with groups of five franchises being advertised by the Cable Authority at four monthly intervals - remember all that talk about "recabling" UK? To date one such group of franchises has been awarded and a second, after the Authority delayed its last advertising exercise, is about to be announced, extending the new style services to Camden, Cardiff, Edinburgh, Preston and Southampton. It's hardly been a dynamic start to the new era, and in practice there's a huge difference between being awarded a franchise and actually starting a service. This difference is caused by the problem of raising the finance required once a franchise has been obtained: it's been estimated that current franchise holders are at present seeking around £250 million of risk capital. They are finding it far from easy – it can't help that one of the original eleven franchise companies, Shaw Cable (Wandworth), went into receivership before laying any cable at all. Just four of the original franchise holders have started to provide services, in Swindon, Aberdeen, Coventry and Croydon. One of the problems in obtaining finance is the length of time required to show any profit – an estimate of ten years "at the earliest" has been made. And that of course is pure guesswork since no one is likely to make a profit from the new style networks for a good few years to come. It has often been said that the City is slow to provide finance for new ventures, especially where new technology is concerned, and that it should be prepared to invest with a view to a longer profitability time scale. That might be reasonable with real high technology,

but ten years seems a fair enough time scale for an activity like a cable franchise.

How are current cable operations faring? During 1985 the number of homes connected to a cable TV service declined by three per cent. Not a large drop, but on the other hand one would expect a reasonable increase if the new services are making any impact. The drop occurred despite the fact that the number of homes with cable TV available increased by over 41 per cent last year. For the record, at the end of December there were 126,262 cable TV subscribers in the UK while cable services were available to 976,671 homes. Just 12-9 per cent of those who could take a cable TV service chose to

A distinction has to be made between the newer broadband services and the older networks originally set up to provide services in areas where off-air reception was poor. Some of the latter have been updated to provide extra channels, and you might think that this would help keep them going. In fact the drop in the number of cable TV subscribers is due to disconnections from the older networks. By far the largest provider of these older type services is Robert Maxwell's British Cable Services, which took over the Rediffusion networks a while back. British Cable Services has some 75,000 subscribers in over forty towns and recently announced that active selling in 24 of these areas is to stop. The sales force is being reduced from 130 to 100 and will concentrate on the sixteen areas considered to have the best long-term potential. Without a detailed knowledge of local conditions it's hard to see why Bristol, Hastings, Oxford, Reading and Southampton should be considered good prospects while Exeter, Hartlepool, Newcastle and Plymouth are to be put on ice, though the areas selected for continued sales effort are in the more prosperous parts of the country.

This last point leads to what could be regarded as a serious criticism of cable TV as a broadcasting medium. Traditionally in the UK the aim has been to make broadcasting available to all. The BBC and the IBA have gone to great lengths to maximise the coverage provided by their transmitter networks – the cost per viewer of providing services soars in the more remote parts of the country. Even when enthusiasm for cable as an exciting new medium was at its height during the ill fated Information Technology Year it was never envisaged that cable TV would serve more than half the country – those viewers who could be reached at a reasonable cost. It now seems that the potential cable TV network will be much more severely restricted. For a cable service to be viable the area it serves will have to be compact, reasonably homogeneous and relatively prosperous. It's sensible to start off in areas that provide the best economic prospects, but it all seems a far cry from the idea of broadcasting as a public service.

While optimism is still being expressed by some of those in the cable TV industry the omens are at present not very reassuring. Thorn EMI, a company that was expected to become a major operator of the new style broadband services, has decided to reduce its involvement in both programme and network provision: talks have taken place on the sale of its operations in Swindon, Coventry and Belfast. There has already been cost cutting at Swindon, where the local news service has been closed down. This employed nine people to provide two bulletins a day and three fifteen-minute programmes a week for the network's 12,000 subscribers, which was hardly an economic proposition. Raising finance and getting subscribers is proving far harder than was once envisaged – it's a sort of chicken and egg situation of course. Relief has been expressed by the Cable Authority that applications for franchises are still being made. But each franchise recently advertised has attracted only one applicant, which is a bit different from the original idea that the Authority would be responsible for making a careful selection between competing groups of prospective cable TV operators.

Servicing the Hitachi NP6C Chassis

John Coombes

The NP6C chassis was used in a number of Hitachi models that were on sale from late 1976 to 1980, including the CWP132, CRP143, CTP203, CTP213, CTP215, CTP216 and CTP217. Tube sizes range from 13 to 20in. and some models have an ultrasonic remote control system for channel selection, volume and standby. The chassis is in two main sections, the power supply and deflection circuits being on a large horizontal panel at the base of the cabinet while the signal stages are on a vertically mounted panel at the left-hand side – the chroma panel, which includes some but not all of the decoder circuitry, is mounted on this. The RGB output stages are on the c.r.t. base panel. Our front cover photograph shows the general arrangement.

The circuitry is mostly in discrete component form. Early sets have just two i.c.s, an HA11580A (IC501) in the decoder and an HA1124D (IC401) as the intercarrier sound/audio preamplifier channel. In later sets an HA1126DW (IC001) a.f.c. chip appeared while a μ PC1351C (IC502) took over most of the decoder circuitry not contained in IC501. There's a transistor line output stage with diode-split transformer and a chopper power supply. The latter includes a multivibrator start-up arrangement. Two thick-film voltage divider/reference voltage modules (CP901, CP902, type HM9102) are used in the power supply. They are none too reliable. Another thick-film module is used for the field driver and output stages (M601, type HM6231) – faulty connections can give problems here.

Poor Soldered Joints

Poor soldered joints are in fact a common problem with these sets – dry-joints on the chopper (T902), chopper driver (T901) and line output (T703) transformers are often responsible for intermittent operation. Dry-joints also tend to occur on the resistors mounted above the board in the power supply – R918, R924, R928, R933 and R935. R937 is another resistor in this area whose connections are worth checking. Suspect joints should be cleaned and fluxed before resoldering.

Power Supply Circuitry

As with most modern TV receivers the chopper power supply is the heart of the set. The circuit is shown in Fig. 1 and to assist with fault-finding it's helpful to appreciate how this works. Mains bridge rectifier CR901-4 produces across C909 a d.c. supply which is fed to the collector of the chopper transistor TR906 via the primary winding of the chopper transformer T902. CR908 rectifies the pulses developed across the secondary winding, producing a stabilised 110V h.t. supply across C925. Stabilisation is achieved by adjusting the mark-space ratio of the drive to the chopper transistor, i.e. its on/off times.

TR905 is the chopper driver transistor while TR904 is responsible for adjusting the mark-space ratio of the drive. Pulses from the line output transformer are integrated by R910 and C915 to produce a sawtooth at the base of TR903. This transistor acts as an inverting

amplifier whose output is coupled to the base of TR904 via C916. The point at which TR904 conducts during the sawtooth at its base is set by TR907, which is controlled by the thick-film unit CP901. The latter produces a reference voltage for the emitter of TR907 and a feedback sample for its base, derived from the h.t. line via a divider. The use of this thick-film unit enables precise control of the h.t. to be achieved without the need for any adjustment.

During normal operation the circuit depends on the presence of pulses from the line output transformer, so a start-up system is required. For this purpose R908/R935/R909/CR906 provide a supply for TR904 and TR905 while the multivibrator TR901/2 provides a squarewave to drive TR904. At switch on C910 begins to charge via R902, enabling TR901/2 to operate. Once C901 has charged TR901/2 can no longer function. When the h.t. line has been established TR904 and TR905 are supplied via CR907.

Overload protection is provided by TR908/9, CP902, CR709, CR712, CR713 and the associated components. CR709 rectifies pulses from the line output transformer, producing across C753 a d.c. supply which is divided down in CP902 and applied to the internal zener diode (via pins 3/2). In normal operation the voltage is insufficient for the zener diode to conduct. Excessive voltages in the line output stage will result in the zener diode conducting, producing a voltage across R931 to bring TR908/9 into conduction. These transistors latch on, shorting the supply to TR904's emitter so that the chopper drive is removed. CR712 is linked to the earthy end of the e.h.t. rectifier system in the line output transformer. CR713 senses the voltage developed across R726 (20Ω, 10W) which is in series with the emitter of the line output transistor TR704. In the event of a leaky or short-circuit line output transistor CR713 will conduct to bring the protection circuit into operation.

The 12V supply for the small-signal stages in the set is derived from a winding on the line output transformer. CR705 (V09C) is the rectifier diode and C735 (1,000 μ F, 16V) the reservoir capacitor. Smoothing is provided by L705 and C736 (2,200 μ F, 16V). The 1 Ω fusible resistor R733 provides protection/surge limiting.

If it's necessary to replace any of the following components only Hitachi supplied/approved types should be used: CP901, CP902, TR907, TR908, TR909, CR705, CR709, R928, R931, R932, R934, C753, C932 and T703 (line output transformer).

No Results

The most common fault with these sets is no sound or raster. The first thing to do is to check for dry-joints around the higher-wattage resistors in the power supply. Next check the voltage at the collector of the chopper transistor TR906. If there's no reading, F903 is probably open-circuit – check TR906 before replacing this. If F903 is all right check the mains fuse F901. If this has blown check the mains bridge rectifier diodes CR901-4. If both fuses are o.k. check TR906 by replacement and check the

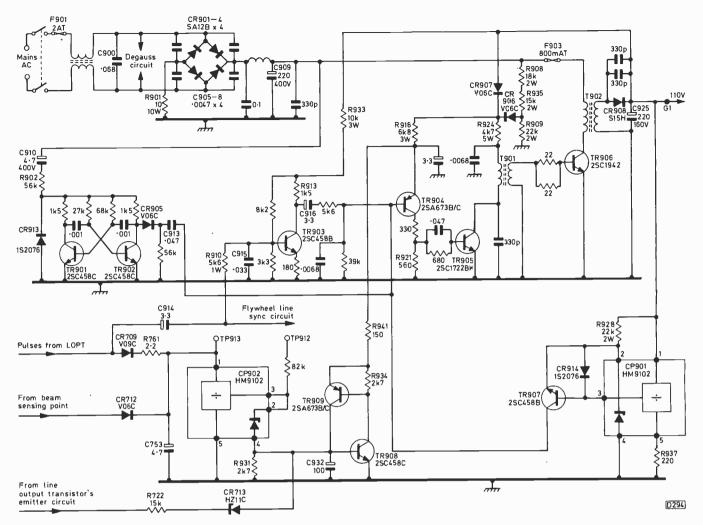


Fig. 1: The switch-mode power supply circuit used in the Hitachi NP6C chassis.

continuity of the chopper transformer's primary winding.

If the voltage at the collector of TR906 is correct something between 230V and 360V should be recorded check whether CR908 is open-circuit. If CR908 is all right but there's no voltage at its cathode, remove R941 and try again. If you now get a reading of 110V and the line sync is normal check TR908 and TR909 by replacement, then CP902. If there's still no voltage at the cathode of CR908 replace R941 and short out C910 briefly. If this fails to restore the voltage at CR908's cathode check TR901 and TR902 by replacement. If necessary go on to check TR904, TR905 and TR907, then both CP901 and CP902 by replacement.

If shorting out C910 produces a reading of about 60V at the cathode of CR908 check the 12V line at terminal B1. If there's no voltage here check CR705 and R733. If the reading is 5V or so check TR903 by replacement.

In our experience the line driver and output stages are remarkably trouble free.

Field Faults

In the event of field collapse, check that the 110V line is correct then check the temperature fuse TF601. If this is open-circuit, check whether the decoupling capacitor $C610 (22\mu F)$ is short-circuit, then check the thick-film module M601 by replacement. If TF601 is all right check the voltage at pin 1 of M601. If the voltage here is less than 70V check the preamplifier transistor TR602 (2SA673B/C) for being short-circuit: if the voltage is more

than 70V check the field oscillator transistor TR601 (2SC458B/C) by replacement – if necessary check capacitors C601 $(0.068\mu\text{F})$, C602 $(1\mu\text{F})$, C603 $(0.01\mu\text{F})$, C604 $(1,000\mu\text{F})$ and C605 $(470\mu\text{F})$ by replacement.

The field output thick-film module can usually be repaired on an outside call - look for dry-joints around the field output transistors. You may get intermittent or permanent field collapse, lack of height, bottom cramp, top foldover or picture jitter. It's best to replace the module however.

If the sync and height are not correct though the 110V line is o.k. check the setting of the hold control R605 and the height control R607. If still confronted with poor sync and excessive height check C602 (1 μ F) and C611 (0·1 μ F) by replacement. For poor sync and lack of height check $C601 (0.068 \mu F)$, $C604 (1.000 \mu F)$, $C607 (100 \mu F)$ and C611 $(0.1\mu\text{F})$ by replacement. For top foldover check C606 $(10\mu\text{F})$ and C610 $(22\mu\text{F})$ by replacement.

Sync Faults

For loss of field sync first try adjusting R605 then check C602 (1 μ F) and R601 (6.8k Ω) for being open-circuit and C601 $(0.068\mu\text{F})$ by replacement.

For incorrect line lock try adjusting T701 then check TR701 (2SC458B/C) and TR702 (2SA844D/E) by replacement. If necessary check the flywheel line sync discriminator diodes CR701/2 (1N34A) which can be leaky, then go on to check the other components associated with

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TV/VCR SPARES GUIDE

A recurrent problem for those in the TV/video servicing business is the unknown set, brand name or manufacturer. A great deal of time can be wasted trying to find a source of spares. By far the most frequent request for help we get from readers is for this type of information. Even well known manufacturers keep changing their service department locations and phone numbers. So we've compiled a list of brand names and spares sources and have made it as comprehensive as we can. It will be up-to-date at the time of printing and will be supplied with the April issue, printed on a separate card so that it can be kept in a handy place for reference.

The guide will be available only with copies of *Television* sold in Eire and the UK since readers in other countries will have their own local sources of supply.

MODERN RECEIVER CIRCUITRY

Advances in component and circuit technology mean that today's sets differ substantially from the type of receiver common only a few years ago. It seems time to take a look at current techniques: J. LeJeune kicks off with switch-mode power supplies.

● QUICK CHECKS: THE FIDELITY CTV14R

S. Simon on how to go about fault-finding in the Fidelity CTV14R (ZX2000 chassis). Large numbers of these 14in. colour sets were sold.

DEVELOPMENTS IN VCRs

The latest luminance crosstalk cancellation techniques used in VCRs are described in the present issue. Following demodulation and crosstalk elimination further processing can be applied to the luminance signal. Steve Beeching describes an interesting picture sharpening circuit: since this tends to enhance h.f. noise it's used with an h.f. noise reduction system. A dynamic aperture correction circuit – in effect a record picture crispener – is also described.

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TR701/2. Note that TR701 handles both the line and field sync pulses.

If there's complete loss of sync short out diode CR253. If this restores sync check CR253 (1S2076) and the noise-canceller transistor TR251 (2SC458E/C) by replacement. If shorting out CR253 makes no difference check the voltage at the collector of the sync separator transistor TR252 (2SA673B/C/D). If there's no voltage check TR252: if the reading is normal (0·7V) check whether TR701 (2SC458B/C) is open-circuit. If necessary check whether R701 (15k Ω), R702 (1·5k Ω) or R703 (430 Ω) is open-circuit. The voltage at the base of TR252 should be about 8·8V. If this is incorrect check the a.g.c. transistors TR254 (2SC458B/C) and TR253 (2SA836/2SA844D/E). If the picture is dark check the first two i.f. transistors TR201 and TR202 (both 2SC1855).

Brightness Faults

If the sound is all right but the brightness cannot be adjusted check TR304 (2SA836/2SA844D/E) and TR305 (2SA673C/D) either of which can go open-circuit. If there's no raster check the setting of the brightness control R328 then the voltage at the collector of TR304. If the voltage is high at around 10V check TR304. If the voltage is slightly high at around 7-8V check TR305. If the voltage is correct at about 6.5V check TR305 and IC501 (HA11580A). If a raster still cannot be obtained, the line output transformer T703 could be defective – if the c.r.t. heaters are out check fuse F701 (630mAT).

Colour Faults

In the event of no colour or floating colours connect a $20k\Omega$ resistor from pin 21 of IC501 (HA11580A) to chassis. If there's still no colour check for about 0·2V p-p of chroma at pins 19, 2 and 3 of the i.c. If any of these waveforms are absent, replace the i.c. If adding the $20k\Omega$ resistor produces unlocked colour check for a 1·8V p-p reference oscillator signal at pin 8. If the waveform is correct, check the adjustment of the phase control R525 and if necessary the associated circuitry around pins 9 and 10 of the i.c. If no faults can be found here replace the i.c. If the waveform at pin 8 is incorrect check the 4·43MHz crystal X501 and associated components as necessary.

For Hanover blinds first check the setting of the gain balance control R564 and the adjustment of coil L551. If necessary check the chroma delay line DL551 by replacement. Other things worth checking are T551, TR551 (2SC458B/C) and the condition of R564's track.

Sound Faults

In the event of no sound make a hum check at terminal F3 on the signals panel – apply a screwdriver with finger on the blade. If hum is present check the intercarrier sound i.c. (IC401, HA1124A). If there's no hum check the voltages around the audio output transistors TR401 and TR402 (both either 2SD478C/D or 2SD401K/H) and the coupling capacitor C415 (10μ F). There should be 110V at the collector of TR401, 40V at its emitter and at TR402's collector. If these voltages are missing, check R422 (100Ω , 1W), the temperature fuse TF401 and the transistors. If everything is in order check the continuity of the speaker – a reading of 8Ω should be obtained across terminals D1 and D2. C415 can be responsible for poor/distorted sound.

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You won't believe me

Les Lawry-Johns

Last month I commented on the fact that TV sets can do some strange things. Here's another case, this time involving a Thorn TX9 chassis.

The TX9

A chap brought the set in and put it on the bench. I was busily engaged on a portable but he asked me to do a quick job, at the same time looking anxiously at the clock. So I put the portable to one side and whipped the back off the TX9. The 1.6A mains fuse had shattered and a light shone on the board revealed that the bridge rectifier diodes were in a sorry condition. I removed them and the red cover and wired the replacement diodes underneath for a quick test. After fitting a new fuse I switched the set on. The e.h.t. rustled up, a picture appeared and a look of profound relief showed on the chap's face. The picture then suddenly disappeared and a bright blank screen took its place. Very bright, as you get on certain GEC sets (PIL/20AX chassis) when the $82k\Omega$ resistor in the RGB output stage clamp circuit goes open-circuit. Before I could take any action the 1.6A fuse failed again, with a pop. This time a check on the bridge rectifier diodes revealed that they were innocent, and no shorts could be recorded. I fitted another fuse and tried again. The picture came on and seemed fine. Suddenly the blank screen appeared and while I was making some quick checks in the RGB output stages the fuse once more failed. Since the screen appeared blank white I reasoned that something was affecting all three RGB output stages, but why this should have blown the fuse puzzled me.

The chap became very agitated and said that if it was going to take any longer he'd rather return the set "to her". I didn't argue as I could see that he was upset, so I removed the bridge diodes to allow the red cover to be refitted and he took the set away.

Upon reflection, the strange thing was that the full h.t. was present at the collectors of the RGB output transistors, which are d.c. coupled to the tube's cathodes. I'd have thought that some 190V here would have blanked the tube instead of being accompanied by a bright, blank raster. The only conclusion I can come to is that C209 $(0.1\mu\text{F})$, which decouples the bias applied to the tube's grids, must have been going short-circuit intermittently. It's taken to the 190V line instead of to chassis to provide hum cancellation. But why should this have blown the fuse? I wish he hadn't been in such a hurry.

The Philips G6

You may recall the Philips G6 I mentioned a couple of months back – the one I sold many years ago when I could have sold my first G8. Well Mr. Furnace has since died but the set still carries on under the guidance of Mrs. Furnace. She phoned recently to say that the colour was now very slow to appear, so I went along to investigate. I was amazed at the clarity of the picture, though there was no colour. So I changed the EF183 and EF184 valves in turn. This made no difference, and the voltages all seemed about right. I then tried a cautious turn on the

core of the reference oscillator's coil. "Colour" cried Mrs. Furnace. "Bingo" I replied.

So there it still is, working and giving a perfect picture – with a tripler in place of the previous e.h.t. overwinding etc. Supplied in 1970. How about that?!

Infra Red

Ray brought in this Fidelity handset and was moaning because it wouldn't work. I had a radio set on the bench at the time so I switched it to long wave, tuned it to 200 metres and directed the handset at it. Nothing. I replaced the battery (Alkaline MN1604) and again pointed it at the radio. There was a series of clicks as the buttons were pressed.

"Well I'm blowed" said Ray. "Is that all it was? It's three years since I bought that set from you and I never thought about it having a battery in it". I nipped upstairs and tried it on our CTV14S and it worked perfectly, as the radio set had said it would.

Thanks Denis

I'd like to thank those of you who offered me help with the Network colour portable whose start-up resistor would intermittently spring open. Special thanks are due to Network's service manager Denis Mott. I took down all you said Denis — about directing heat at the suspect components — and will follow this advice when the set comes back, as you all say it will.

Bounce, bounce, bounce

I was quite annoyed with a well known store that expressed doubt about taking my cheque (business account). Having identified myself, they accepted the cheque and overcharged me sixty three pounds. I got that put right and went away mumbling about their strange way of doing business.

Later that same day a nice man came into the shop and said he wanted a portable set for his daughter. He selected a nice black and white Pye and said he'd collect it later but would pay for it now. He presented me with a cheque for sixty nine pounds, on his business account, and wrote his address on the back. H.B. gift wrapped it and it looked splendid there waiting to be collected. He came back next day and expressed delight with H.B.'s efforts. He left in high spirits and we were pleased.

Next week we were not so pleased. The cheque had been returned as his account had been cancelled. I wrote a note to him at the address he'd given. This came back from the Post Office marked "gone away". Oh well, a small price for experience – it could have been a lot more.

Problems with Scotch

As I write this the festive season (Christmas through to the New Year) is at its peak. Here's a little story about a friend who's also a reader. He was at this party and had had a few beers. The host brought him a scotch (neat) which he was not used to drinking. So he topped up his glass from a nearby water jug. "Um, not bad" he thought. There was a repeat performance and after that he began to feel funny but quite happy. Before he passed out like a light he was vaguely aware of a young lady emptying her glass into the water. "Wassat?" he enquired. "Vodka" she replied, "I've been doing it all evening — can't stand the stuff but you can't very well say so".

Next day he was decidedly out of salts. Daft you may say, but it can happen – especially if you're basically a beer man.

While on the subject of Scotch, an apology. Some time ago I did a job which was a bit of a swine for Mr. Webb. He gave me a china bottle in the shape of a ship's bell. Now I drink a lot of that brand of whisky and I said the contents were nice but not that brand. A few days ago I was presented with an ordinary shaped bottle of the same brand, with a black label marked twelve years old. It was identical to the scotch in the china bottle. Sorry Mr. Webb, I'm so used to the cheaper stuff. I feel ashamed of myself . . .

Developments in VCRs

Part 2

The first long-play VHS machines were introduced in 1983. For long-play operation the tape is run at half speed (11·7mm/sec). This has several implications. First the track width is reduced by half, from 49 to 25 microns: as this reduces the signal-to-noise figure new noise reduction techniques have been adopted. Secondly for stable playback in the long-play search modes special "jump" circuits have been designed. Further luminance signal correction is used to reduce h.f. noise.

LP Track Characteristics

The characteristics of the LP track are determined by the slower tape speed and the extra set of LP video heads fitted to the dead drum. In some early models the LP heads were mounted at an angle of 70° with respect to the standard-play heads, though in later models the two sets of heads are mounted on single assemblies as described in Part 1 last month.

With standard-play VHS operation the tracks are laid down side-by-side with a 1.5 TV line offset between the start of each track to ensure that lines with the same colour phase lie next to each other on adjacent tracks and that the line sync pulses on adjacent tracks line up. It's not possible to achieve this symmetry in the LP mode, due to the effects of tape speed and track angle. Fig. 1 shows the difference between the SP and LP tracks: you can see that with the LP tracks shown at (b) the 0.75 line offset (half the 1.5 line SP offset) results in the adjacent line patterns being displaced. The adjacent colour phasing is also displaced: whereas lines 2 and 316 in the SP mode carry the same PAL phasing the correlation between lines 2 and 316 is shifted by 0.75 of a line in the LP mode.

The standard colour crosstalk system used in VHS machines will cope with colour crosstalk in the LP mode but extra measures are required to eliminate the increased luminance crosstalk.

Picture Search

The main problems occur during picture search however, when due to the increased linear tape speed a video head will cross over a number (usually around five) of its own video tracks as it traverses the width of the tape. In the SP mode the line sync pulses replayed by a video head as it crosses the tracks it recorded occur in regular order – with drum speed correction – at 64μ sec intervals. Picture search at the same speed will with LP tracks produce line sync pulses that are by no means at 64μ sec intervals: without correction the result will be considerable picture skew (sideways pulling).

Steve Beeching, T. Eng.

A section of recorded tape is shown in Fig. 2: the upper edge of the tape is to the right and the lower edge to the left (the slanting recorded tracks are shown horizontally to make things clearer). A ch. 1 head is shown scanning across the tracks in the forward picture search mode. The burst phase is 135° on lines shown as clear blocks and 225° on lines with diagonal-line shading. In this example the head crosses over four of its own recorded tracks.

The top line of the timing part of the diagram, line (1), shows the original signal – it's a reconstruction of the replayed lines and colour phases as the head crosses over its own ch. 1 recorded tracks, i.e. tracks 1, 2, 3 and 4. You

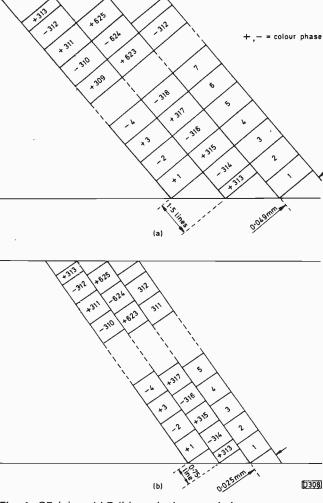


Fig. 1: SP (a) and LP (b) track characteristics.

can see that when demodulated the replayed TV lines do not occur at regular 64μ sec intervals – the irregularities are in fact at half-line intervals, i.e. the small squares of original signal are half a line long. Line (3) shows how the line sync pulses are replayed. It should be clear then that without correction there will be severe line pulling in the LP cue and review modes, due to the half-line errors in the video signal.

Correction of the half-line error is done by producing a half-line (0.5H) jump pulse. A data signal is derived from a phase-locked oscillator working at twice line frequency: when the output from this oscillator is divided by two the signal shown in line (2), a symmetrical squarewave, is produced. This signal is compared with the replayed line sync pulses in a clocked bistable. If the data signal is low when the bistable is clocked by a line sync pulse the output is low: if the data signal is high when the clocking occurs the output is high. With a clocked bistable the input level appears at the output which remains in this state until the next clock pulse arrives. This arrangement provides the 0.5H jump pulse shown in line (4).

A half-line delay is included in the playback signal path. The 0.5H jump pulse controls a switch which selects direct or delayed signals alternately – with line sync pulses as shown in lines (3) and (5). After the switching a corrected output with the errors removed is obtained.

Two methods of obtaining an 0.5-line delay have been used. The earlier method was to f.m. modulate the video on to a 14MHz carrier, feed it through an 0.5-line delay line and then demodulate it. Fairly crude, but don't forget that we're in visual search! The second and more up-to-date method is to use a 423-bit CCD serial delay line, clocking the signal through this with a 13.3MHz clock signal. 13.3MHz is equivalent to a period of 0.075μ sec: clocking 423 bits at 0.075μ sec is 0.075×423 which is 31.8μ sec or about half a line.

If the composite video signal is being switched by a half-line period clearly the colour phase must be inverted to compensate – otherwise the PAL signal will have half a line in one phase and the second half in the other phase. To prevent this happening and to synchronise the colour phase with the video signal switching a 1H jump pulse is produced by the jump pulse generator.

Fig. 2 also shows a simplified block diagram of the above arrangements. The jump pulse generator produces the half-line frequency jump pulses from the replayed line sync pulses and the 1H jump pulse from the 7-8kHz colour ripple signal. The circuitry is usually contained within one or two i.c.s.

Noise Reduction

A video noise reduction system is used to improve the signal-to-noise performance. The noise to be reduced is low-frequency f.m. crosstalk between tracks – frequencies in the range 1-2MHz, forming the lower sideband of the video f.m. carrier. The $\pm 6^{\circ}$ azimuth offset of the two video heads is used to reduce the pickup by one head of the other head's f.m. carrier, but the technique becomes less effective at the lower frequencies. Hence the need for the noise reduction system.

The technique used is to shift the f.m. carrier recorded by one head by 7.8kHz. The ch. 1 head records the normal 3.8-4.8MHz f.m. signal: the ch. 2 head records this with a 7.8kHz shift. Now when the ch. 1 head replays residual ch. 2 f.m. picked up from either side as crosstalk the crosstalk signal has a 7.8kHz shift – half line fre-

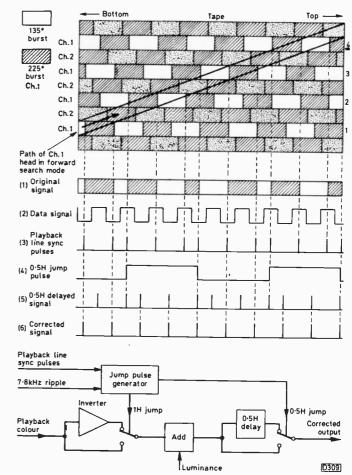


Fig. 2: Picture search in the LP mode.

quency. A signal at half line frequency will complete a cycle over a two-line period: it will have a positive polarity on one line and a negative polarity on the next, i.e. there's phase inversion on every line. The principle also holds for ch. 1 crosstalk picked up by the ch. 2 head. The point to remember is that introducing a half-line frequency shift into the recorded f.m. results in crosstalk noise that changes polarity at line rate.

One method used to apply the 0.5 line frequency shift is shown in Fig. 3. It affects the f.m. modulator in an HA11724 i.c. – you'll be able to identify the circuitry in various makes of machines. The video signal is clipped and clamped and fed to the f.m. modulator internally – though there's a test point at pin 12. The carrier frequency is set to 3.8MHz for the sync pulse tip by the $Ik\Omega$ potentiometer, the thermistor being included to provide

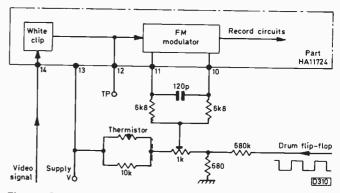


Fig. 3: One method of applying an 0.5 line frequency shift during recording for crosstalk noise reduction.

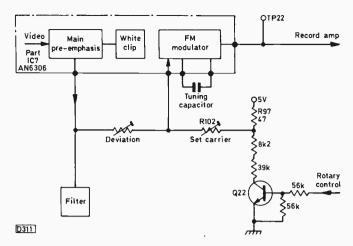


Fig. 4: The technique used in the JVC HRD725.

temperature compensation against drift. The drum flip-flop signal is applied to the circuit via a 1,000:1 potential divider, so its level at the f.m. modulator is very small. The result is that the f.m. oscillator is stepped up by 7.8kHz for the ch. 2 head and back down again to the standard frequency for the ch. 1 head. In some machines the level of the flip-flop signal is set by a potentiometer: don't touch this – setting up requires the use of a spectrum analyser.

The example shown in Fig. 4 is used in the JVC HRD725. This uses the rotary control signal, which is

derived from the drum flip-flop (see Fig. 5 last month). It controls the colour phase selection, hence "rotary". Q22 is switched on and off at 25Hz, taking the junction of R97/R102 to chassis via $47\cdot 2k\Omega$, again a ratio of 1,000:1. The very small shift in the d.c. level of the signal applied to the f.m. modulator results in a $7\cdot 8kHz$ frequency change.

Fig. 5 shows a typical playback system in which the dropout compensation delay line is also used for noise cancelling. It's easier to understand the arrangement used in the HRD725 if we look at this one first. An a.g.c. system stabilises the signal which is then fed via the dropout switch to an f.m. equaliser – in later, dual-speed machines SP/LP compensation is provided at this point. The signal is then sent along two paths, to the direct demodulator and via the one-line delay line to the delayed demodulator. The output from the delay line goes to the dropout switch, for dropout compensation, as well as to the delayed demodulator.

The output from the direct demodulator, (a), is filtered and applied to a mixer. The output from the delayed demodulator, with 180° phase-shifted noise, is filtered and used as one input to a differential amplifier. This is waveform (b). The clean signal output from the mixer, (c), is the other input to the differential amplifier whose output is waveform (d), phase-shifted crosstalk noise. Adding (a) and (d) in the mixer gives us the noise-free signal (c). Prior to the limiter the output from the differential amplifier will contain large amounts of

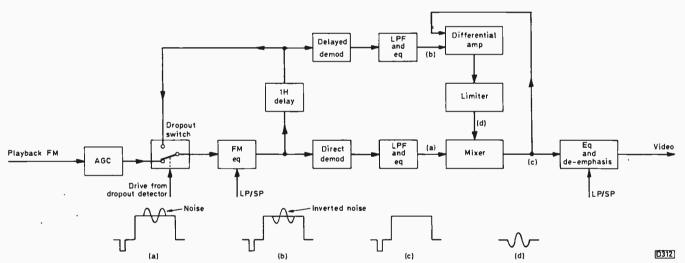


Fig. 5: Typical playback noise reduction system, with the dropout compensation delay line also used in the noise cancelling arrangement.

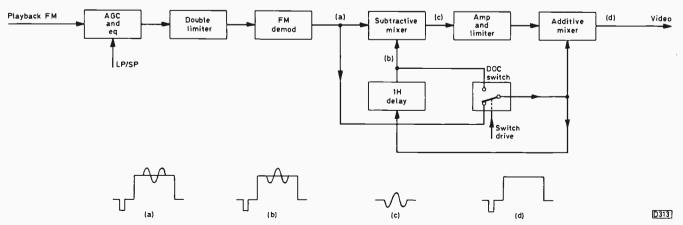


Fig. 6: Playback system used in the JVC HRD725.

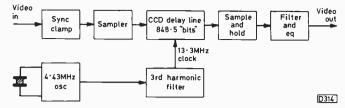


Fig. 7: Operation of the CCD delay line.

unwanted video in addition to the noise. If this was allowed through to the mixer without clipping the result would be impairment of the displayed picture.

Now to the HRD725 where other new concepts are introduced, see Fig. 6. It looks deceptively simple in block diagram form, but the circuitry used is actually very advanced. After a.g.c. and equalisation the f.m. signal passes through a double limiter and is then demodulated. In this case the delay line comes after demodulation – because a CCD (charge-coupled device) delay line is used instead of a glass delay line.

As a result of the action of the delay line the noise in signals (a) and (b) applied to the subtractive mixer is of opposite polarity. The subtractive mixer cancels the video component of the signal to leave just the noise signal (c). This is amplified and limited and applied to the additive mixer along with the direct signal (a). The mixing process this time gives noise instead of video signal cancellation, resulting in the clean signal (d). You will notice that one small licence has been taken. During a dropout the noise will be additive. This happens for only very brief periods however and is not visually perceptible.

The action of the CCD delay line is shown in Fig. 7. The analogue input is sampled and sent along the line as clocked "bits". At the output a sample-and-hold circuit restores the analogue signal. There are 848.5 "bits" within the delay line, clocked at 13.3MHz – this is conveniently obtained as the third harmonic of a 4.43MHz colour crystal oscillator. The clock period is 75nsec, the delay through the line being 63.8µsec (0.075µsec × 848.5). A further delay of 200nsec is gained in the equalisation and filtering circuit, giving 64µsec in all. The use of a delay line at baseband video improves the signal-to-noise perfor-

mance by avoiding the losses inherent in a glass delay line at low carrier levels.

Fig. 8 shows the arrangement used in the HRD725 in greater detail. The playback luminance signal enters IC8, a T8004, at pin 7. It's first clamped and then sent along two paths. The main path is via the dropout (DOC) switch to the noise-canceller section, after which it emerges at pin 2. The other path is to the noise-detector, where one-line delayed video is subtracted. In the subtraction process the video components cancel and the noise components add. The amplified noise emerges at pin 3 and is fed back in at pin 1 where it's limited to reduce high-level video spikes to the level of the noise. The noise is then subtracted from the main path video in the noise-canceller circuit.

The horizontal correlation detector monitors the signal level at the output from the noise amplifier. If there's no horizontal correlation between tracks the noise amplifier's output rises and the detector mutes the noise limiter. The noise cancelling system cannot work without horizontal correlation because the noise component will not change polarity on each line. The system then breaks down – this happens in visual search when tracks are crossed, and in slow motion and still picture when only one field is replayed continuously.

The input to the CCD chip IC9 is taken from pin 4 of IC8. The circuitry around Q30 and Q31 filters out the 13-3MHz clock switching spikes as well as introducing a 200nsec delay. The delayed signal is fed back into IC8 at pin 6 and is then clamped to prevent d.c. drift and ensure that the black levels of the direct and delayed signals are the same. The DOC switch is driven by dropout pulses derived from the f.m. a.g.c. circuit – this is standard practice. It's a cyclic dropout compensator, so that if the dropout is longer than a line the switch stays over and the signal continues to circulate. I've not found the cyclic effect as noticeable as in Grundig machines, where a single line can be repeated down the screen giving a pattern of vertical, wiggly lines.

In the concluding instalment next month we'll look at further luminance signal processing – h.f. noise reduction and picture crispening.

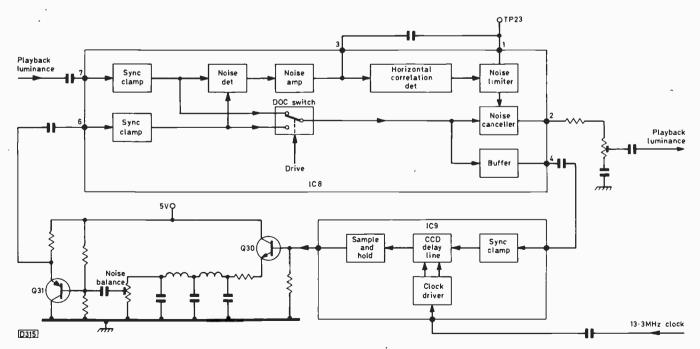


Fig. 8: Crosstalk noise cancelling system used in the JVC HRD725, shown in greater detail.

Teletopics

DBS LATEST

It's understood that the IBA's report to the Home Secretary on the prospects for UK DBS TV services is cautiously optimistic. An announcement from the government giving the IBA the go-ahead to advertise DBS franchises is expected by the end of February. One favourable factor is an assessment made by John Jackson, chairman of Celltech and a member of the British Technology Group, the holding company for the government's investments in new technology. Mr. Jackson believes that a project offering viewers three DBS channels on a subscription basis could be established by 1989 and that it could attract fifteen per cent of viewers within seven years of starting. The cost is estimated as being some £200 million, spread over several years.

A proposal for a joint UK-Irish satellite system has been put forward by James Stafford, chairman of Atlantic Satellites, the company chosen by the Irish government to start a DBS service. Ireland and the UK share the same satellite orbital allocation at 31°W. A six-channel system (three channels controlled by each country) has been suggested in talks between the Department of Trade and Industry and the Irish government – the proposal has also been formally submitted to the IBA.

An independent satellite TV news and information service has been established in London to offer the growing number of European private TV stations an alternative to EBU services. Independent Satellite Network expects to be able to provide between six and twelve hours of transmissions daily by April 1st.

It's understood that an agreement has been reached between Satellite Racing Development, a consortium of large bookmakers, and British Telecom to provide live coverage of horse and greyhound racing for betting shops, using an Intelsat satellite. The signals would be scrambled and the source would be video equipment already installed at racecourses for stewards' use.

Launch of the French TDF-1 DBS satellite has been put back from July to November – the delay is a result of schedule changes following an abortive Arianespace mission last September in which two satellites, including ECS-3, were lost and the failure of the French government to reach a final decision on the financing of the satellite. It's also understood that a final decision on the transmission standard has still to be made. This is delaying plans by European setmakers to start production of satellite TV receiving equipment. Arianespace is due to launch the Luxembourg SES satellite in May 1987.

REVISED DBS PLAN

A revised plan for DBS TV transmissions was approved by the 1985 World Administrative Radio Conference. Under the new plan the 500MHz band between 12·2 and 12·7GHz is to be used for 32 24MHz channels, with left-and right-hand circular polarisation to maximise band use (the previous plan approved at WARC 1977 was for 40 27 MHz channels in the band 11·7-12·5GHz). Satellite orbital position spacing varies from 1° to 11° under the new plan instead of being a regular 6°. The allocation of orbital positions to countries has been changed (several countries in addition to the USSR have been assigned more than

one orbital position) and the previous five channel per country allocation has been dropped. The minimum power flux density at the outer edge of each satellite's service footprint has been reduced from $-103 \mathrm{dBW/m^2}$ to $-107 \mathrm{dBW/m^2}$.

SATELLITE TV RECEIVING EQUIPMENT

The latest issue of the Philips publication *Electronic Components and Applications* contains brief details of an indoor receiver unit designed by the company. A block diagram is shown in Fig. 1. Because of the high gain now achieved with head units the tuner has been designed for minimum intermodulation distortion rather than an optimum noise figure. Surface mounted components are used to minimise parastic inductance and capacitance and reduce the size of the unit – the prototype has a board area of only 70cm².

An input bandpass filter is used to suppress image frequencies and match the input from the head unit to a high-gain, broadband amplifier stage using a BFG67 transistor. This advanced device has a cut-off frequency of 7.5GHz. A filter between the broadband amplifier and the mixer is used to isolate the local oscillator signal from the input. It's tuned by two BBY39 varicap diodes – these devices have an extremely low capacitance. The high i.f. of 479.5MHz has been chosen to reduce the number of tuned circuits required and has the advantage that all image frequencies are outside the input from the head unit. The BFR92A transistor used in the local oscillator stage has very low feedback capacitance. A buffer stage is used to isolate the local oscillator from strong input signals.

Use of a BF990 dual-gate MOSFET in the i.f. amplifier makes it easy to apply a.g.c., which is necessary to prevent the SAWF driver stage being overloaded. The design of the PLL f.m. demodulator, which has excellent threshold performance, depends on the transmission standard used.

Prototype 60-90cm. parabolic dish aerials have been produced in W. Germany using Bayer's Novodur ABS engineering thermoplastic and have been subjected to exhaustive tests. Stability at wind speeds up to 100 m.p.h. has been established by tests carried out in a high-speed wind tunnel and the plastic has been found to have good rigidity, high heat resistance and good dimensional stability. The surface of the plastic dish is covered with a reflective metal layer. This can be done by placing aluminium foil or wire mesh in the injection mould or by applying a conductive coating, either by flame-spraying a metal alloy or by chemical electroplating. The result in an inexpensive dish that meets all design requirements.

AERIAL CATALOGUE

A new catalogue and price list is available from Aerial Techniques, 11 Kent Road, Parkstone, Poole, Dorset BH12 2EH (0202 738 232) for 65p inclusive of postage. The catalogue lists an impressively wide range of aerials and associated equipment, including amplifiers, splitters and combiners, converters, rotors etc.

VISIONHIRE REORGANISATION

The Electronic Rentals Group (Visionhire) has started a major reorganisation following its acquisition of Telefusion last October. The Telefusion headquarters at Blackpool is being closed down and about half the 200 outlets will be closed. Thirty former Telefusion shops are

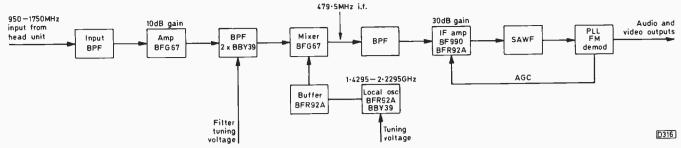


Fig. 1: Block diagram of the Philips indoor unit designed for satellite TV reception.

to become Visionhire outlets, bringing the total to 453. Some seventy former Telefusion Connect outlets will be relaunched. The two companies' cable TV interests are to be merged and run from the Telefusion Westhoughton centre.

ITT's SOPHISTICATED DIGITAL TV SET

The latest model in the ITT Digivision range, the Multicontrol, introduces some interesting features. The picture-in-picture facility enables a second picture to be displayed in a postcard sized area at the top right-hand side of the screen – a sixteenth of the total screen area. Freeze frame can be applied to this smaller picture area, which can also be used to monitor other parts of the house in conjunction with a video camera. The inset image can be interchanged with the main picture: a computer display can be seen on the main area of the screen while viewing a TV channel in the "window", or alternatively a video or TV channel can be monitored while the main screen area is used for teletext.

PERITELEVISION SWITCHING IC FROM MULLARD

The TDA8440 switching chip has been introduced by Mullard for use with a Peritel connector, offering flexibility and low-distortion performance. The i.c. enables signal sources to be selected under microcomputer control, eliminating the need for manual interchanging of cordsets at the rear of a display unit or TV set. The circuit can also be controlled by the d.c. level on the Peritel connector's function switching pin.

The TDA8440 can select one of two video channels together with their stereo/dual sound channels. An off position can also be selected, enabling the input signal to be taken from another TDA 8440. The device incorporates two three-state switches for the audio channels and one three-state video channel switch. A video amplifier with a selectable gain of one or two is incorporated and expansion with up to seven devices is possible. The minimum video switching crosstalk attenuation is 60dB and the total, maximum audio harmonic distortion 0-1 per cent. The chip operates from a supply voltage of 10-13-2V and requires a maximum unloaded supply current of 50mA. It's encapsulated in an 18-pin plastic DIL pack and has static short-circuit proof outputs.

VIDEO NEWS

According to a Keynote report the UK VCR market has now reached saturation level. Over 42 per cent of households now have a VCR and some 8.6 million machines are in use. Annual sales are now running at a level of around 1.5-1.7 million. An increase of some 200,000 is expected when the machines sold during the boom year come to be

replaced but this is not likely to be before 1989/90. It's thought that only about 40 per cent of machines are now rented. The report is available from Keynote, 28-42 Banner Street, London EC1Y 8QE at £79.

Sanyo has introduced a range of three VHS machines (Models VHR1100E, VHR1300E and VHR1500E) in the UK – Sanyo manufactured VHS machines have been on sale under the Fisher brand name since 1982. The new Sanyo models will initially be imported from Japan but assembly at the Lowestoft plant is expected to start in the near future. Sanyo will continue to assemble Betamax machines at Lowestoft. The new VHS models will be promoted under the Proformance (professional performance) label, which is also to be used for TV sets.

BUSINESS NEWS

The latest half-yearly report from Thorn-EMI shows profit reduced from £40.2 million to £11.4m on turnover up from £1,436.9m to £1,533.6m. The Ferguson TV manufacturing operation is now back in profit: increased profits were recorded by the rental and retail sides of the business. Problems at Inmos have been the main cause of the profit shortfall.

Matsushita's profits for the year to November 20th, 1985 increased by ten per cent on turnover increased by five per cent. Sales of video equipment (VCRs and TV sets) increased by eight per cent, with the growth mainly in the US market, but there was a fall of five per cent in audio equipment sales. Virtually static profits are expected for the current year due to appreciation in the value of the Yen and reduced VCR sales.

VCR SOUND RECORDING INTERFACE

The VSR-1 sound recording interface module has been introduced by Video Interface Products Ltd., Charlton House, 32 Charlton Lane, Cheltenham, Gloucestershire GL53 9DX (0242 581 383). At present it's available by mail order only, at £49·99 inclusive of VAT and postage. A free brochure is available.

The VSR-1 comes complete with leads and an instruction manual. Its advantage is that radio programmes (or audio material) can be recorded in the same way as TV programmes on a VCR. So you can make timed recordings running to several hours. The video part of the tape is blacked out and playback is through a TV set. It may be thought that this is rather wasteful of tape, but the point is that lengthy timed recordings can be made without fuss: if the material is to be kept it can be transferred to audio tape. The VST-1 is a compact unit measuring only $120 \times 65 \times 40$ mm and weighing 150g. Two further modules, an f.m. tuner with five preset stations and a preselector, are to be introduced. They will all bolt together.

Servicing Teletext Receivers

Part 3 Mike Phelan

This month we'll look at the TAC – text acquisition and control – i.c., type SAA5040 or SAA5040A (M914A in very early decoders), which is probably the most complicated of the chips in this decoder set. We'll also look at the row/column decoder system.

The TAC Chip

A block diagram of the TAC chip is shown in Fig. 1. The processed data from the VIP chip enters at pin 2 and goes to one of the inputs of an AND gate. The DEW (data entry window) gating signal goes to the other input, via pin 7. Serial data passes through the gate when the DEW signal goes high. The data is required in parallel, not serial, form however, so the next step is to feed the data into a shift register. If this holds eight data bits, the register will make one byte of teletext data available. As the data arrives at the rate of 6.93MHz the shift register must be clocked at this frequency. The clock signal from the VIP chip enters at pin 3.

Before any use can be made of the data checks on its

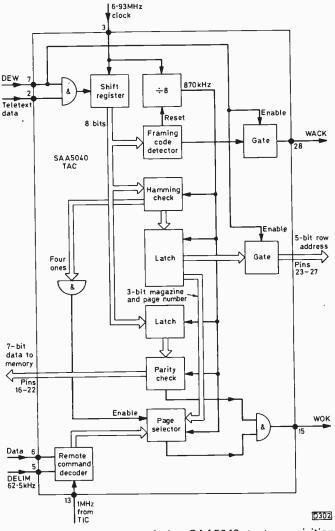


Fig. 1: Block diagram of the SAA5040 text acquisition control (TAC) chip.

integrity must be carried out. And before this can be done the electronics must be synchronised with the data, i.e. the electronics must know which is the first bit of each byte. The "framing code" – see Fig. 2 – is used for this purpose.

When the framing code detector recognises the presence of the framing code (11100100 binary) it provides a reset pulse for the divide-by-eight section of the i.c. This section divides the 6-93MHz clock signal, which has already been synchronised with the data by the VIP chip, by eight, i.e. one "tick" per byte. The reset pulse ensures that the correct groups of eight bits are accepted as bytes. The 870kHz signal is used for various timing functions within the i.c.

There are two forms of error checking – a Hamming check and a parity check. The former, more elaborate, system is used to check the row address information, the latter the display data. Minor display errors are not too important but if the rows of information weren't presented correctly the display would be useless.

The eighth bit of each teletext data byte is a parity bit whose state is made such that the total number of one bits in the byte comes to an odd figure. If the total comes to an even figure there's an error in the byte which can thus be rejected instead of being fed into the page memory.

With the Hamming system four of the bits in each byte are parity bits, the other bits comprising the message: the message and parity bits are interleaved. Error checking consists basically of carrying out four sets of additions of the bits in each byte. If there's no signal corruption the result of each addition check is an odd number. The advantage of doing it this way is that the checks will indicate which bits are in error and the corrective action required. If more than one bit is wrong the byte is rejected. Otherwise correction consists of inverting the incorrect bit – this is accomplished within the TAC.

The display data emerges at pins 16-22 of the TAC – seven bits now instead of eight since the parity bit has been dropped.

Page Selection

The pages are transmitted in numerical sequence (more or less). If we were unable to select the page we required they would all flash before our eyes as transmitted. This would clearly be of no use at all. Page selection is done by keying the appropriate number into the remote handset. The remote control signals from the SAA5010 remote control receiver chip arrive at pins 5 and 6 of the TAC chip. The data at pin 6 is in the form of a serial code at a frequency of 62.5kHz. It's converted to seven bits of parallel code within the i.c., using another shift register. As with the serial teletext data, a clock signal is required to drive this. It comes in from the SAA5010 chip at pin 5 and is referred to as the DLIM (delimiter) signal. The seven data bits comprise two that specify TV/text/mix and five for the text functions, including page numbers.

A page is displayed when the transmitted page number (in the page header line) matches the selected page number. The four ones from the Hamming code parity

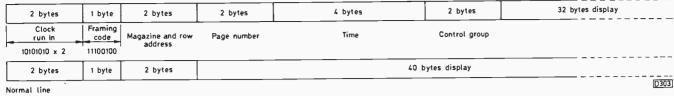


Fig. 2: Data composition of the page header and an ordinary display line.

check go to an AND gate: if all are o.k. the output goes high to enable the page selector. This carries out comparison between the page number in the header and the selected page: when they match the WOK (write OK) signal appears at pin 15. Note the second AND gate: the other input to this is high only when the parity check on each display byte is o.k. – thus corrupt bytes are rejected. The WOK output goes low to write data into the memory during the DEW period, also during the EDIL period (line 40) when status data is transmitted to show which channel is in use.

Addressing the Memory – Row and Column Decoding

We have display data leaving the TAC at the correct times then: where do we put it? We need some sort of clock to keep track of the locations in the memory. The RAM i.c.s used to store the display data have to be told whether to read or write data and the correct addresses.

The seven RAM i.c.s used have a capacity of 1Kbyte each (1,024 bytes). This is unfortunate since 960 bytes (40 columns by 24 rows) are required to store a page of text. The TAC provides a five-bit row address (counting 0-23) but there's no way in which this can be used to address a RAM. Consider for a moment why this should be. Each 1,024 byte RAM stores one bit of the seven-bit character display code. To address each location in the RAM we'd need a ten-bit address – to put it another way, to count up to 1,024 in binary we need ten bits – 1,024 is 10000000000 in binary. We can't use so many bits for rows and the rest for columns as 1,024 won't factorise into anything like 40 × 24. The nearest we can get is 32 × 32, which is of no use to us.

To get round this snag a clever bit of circuitry is used employing three TTL i.c.s (see Figs. 3 and 4). Two of these form a counter which counts up to 39, for which six bits are required. Each 74LS161 four-bit counter will count up to 15, so we pass a carry pulse from the first to the second and use only two bits from the latter. This gives us the six bits to count from 0 to 39.

After a byte from the TAC has been written into the RAMs, WACK (write address clock) sends a pulse to the counter i.c.s to prepare the next address. The GLR (general line reset) pulses reset the two counters at the end of each line. Note that during the display period, when the RAMs are being read, WACK is replaced by the RACK (read address clock) signal from the SAA5020 TIC chip.

We still have the 40 × 24 problem however. Back to the counters, which provide a count of 0-39 in six bits, from WACK or RACK which give one "tick" per byte. The TAC chip provides at pins 23-27 a five-bit row address to count up to 23 (during the display period a five-bit row address comes from pins 19-23 of the TIC i.c. – this was not shown in Fig. 1, Part 1). Note that the two sets of row addresses and the WACK and RACK outputs are directly connected between the i.c.s, so tri-state

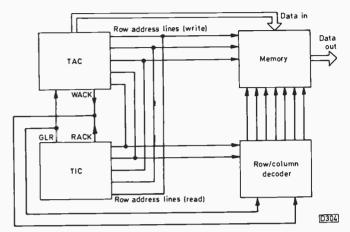


Fig. 3: Way in which the TAC and TIC i.c.s address the memory. This partially corrects Fig. 1 in Part 1.

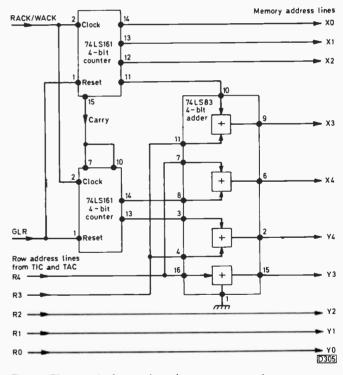


Fig. 4: The row/column decoder arrangement.

outputs are required with the outputs not being used switched to the high-impedance state.

To convert from the six column and five row bits to the ten bits required to address the RAMs we use the lowest four row bits as they are – this counts up to 15. The first four column bits will also count to 15. We add the highest three column bits to the highest two row bits to give two row and two column bits respectively, thus converting the 24×40 matrix to 32×32 (1,024). X0-X4 and Y0-Y4 in Fig. 4 are the RAM address lines.

Next month we'll discuss the final chip in the decoder, the TROM, and servicing aspects of this decoder.

VCR Clinic

Reports from Steve Beeching, T. Eng., Les Harris, Philip Blundell, Eng. Tech., R.S. Narwan and William G. Lockitt

Sanyo VT9300

There was no servo lock on record, but it would play back known good tapes. A quick check through the servo soon showed a distinct lack of monostable output pulses at pins 17 and 19 of the control track record i.c. Q101. Separated field sync pulses were present at pin 15 but were of a suspect, low level. I had to cross check with another VT9300 that the 1.25V p-p field pulses were indeed correct. The faulty component was actually C108, which is part of the monostable timing for dividing the field syncs by two.

Hitachi VT11

This machine would thread up, run for a few seconds and then stop. The dealer who'd sent it in had already changed the capstan motor. The fault was caused by the threading motor not reaching the after loading position however. Changing this motor and the accompanying belts cured the trouble.

S.B.

JVC HR2200/Ferguson 3V24

I was interested in E.T.'s report (December issue) on a problem caused by C11 (3·3F, 1·6V) whose sole purpose is to retain the counter memory when the machine isn't powered. In the case I had the leakage was to the remote control socket print. This brought about permanent rewind by raising the voltage level on control line B2. S.B.

Hitachi VT5500 - No Clock Display

This was difficult to solve, not because the problem was complex but because of Hitachi's aggravating production modifications not being shown in the service manual. The clock i.c. we found in the machine was an HD38845A-36. I thought at first that the dealer who'd sent it in had replaced it with the wrong type. We confirmed that the replacement was of the correct type, but it hadn't cured the fault. After lengthy tests and yet another HD38845A-36 I was getting nowhere fast. The chip just wouldn't run despite checking and double checking everything. One problem was that I was using a VT8500 service manual because the chips and circuits in the machine bore no relation to anything I could find in the VT5500 manual. It appears that there's an updated manual, reference no. 1311, so this was sent for.

It could be deduced from the VT8500 manual that the HD38630A-26 is an earlier equivalent of the HD38845A-36, then from the revised VT5500 manual that it could be an HD38630A-36 (or an HD38630A-06 or HD38630A-26, provided one, both or either sub or sub-2 PCBs are fitted). Confused? Yes, so was I.

Anyway, the i.c.'s internal clock was running but nothing else – no output strobe pulses anywhere. The –30V line was present – actually it was –45V, due to the machine being of NAFFI origin for a 220V mains supply. While I was playing around with the power supply I discovered that a 6V rail was missing, due to R954 being open-circuit. This was repaired – and the clock came on! Now this 6V line goes nowhere near the clock i.c. It just runs through the timer PCB to the programme selector

panel. What's more it doesn't even exist on the VT8500 circuit. It didn't seem possible that the 6V line could affect the clock i.c. but it did, via the programme selector. Q703 in the programme selector circuit is normally off: with the 6V supply missing it turns on via the tuning supply. This held pin 35 of the clock i.c. at chassis potential, which is a permanent interrupt, holding the i.c. off. Unfortunately the service manual incorrectly shows pin 35 as being at 0V, which means that innocent souls fault-finding wouldn't think twice about it.

Grundig 2 × 4 Super

The problem with one of these machines was no modulator output. R25 ($2\cdot 2k\Omega$) which feeds the -22V supply to zener diode Di27 within the modulator was open-circuit. Another fault on one of these machines was no E-to-E audio. The TBA120T chip on the i.f. panel was defective.

Mitsubishi HS330

The complaint with this machine was an intermittently snowy picture on long play. After much panel waggling we found that flexing the top PCB around the head amplifer section caused the fault to appear and a relay could be heard clicking in and out. The head amplifier screening can was shorting to the link by R20.

P.B.

Ferguson 3V29

A loan machine would not record sound though there was playback sound from a prerecorded tape and in the E-E mode. The audio signal was present at the record amplifier output from IC1 (TP2) and the erase oscillator was working, but there was hardly any bias signal at TP3. We found that the voltage at the collector of Q11 in the control circuit was permanently low – it should go high in the record mode. Zener diode D7 in its base circuit was short-circuit.

Toshiba V8600

Poor pictures were obtained with both playback of a prerecorded tape and E-E operation – the pictures were "nasty", with flaring. A scope was used to check the video signal along the E-E path. Everything was o.k. up to the point where the path splits two ways – to the r.f. modulator and to the video output socket. As a quick check I fed the video output to the video input of another machine and obtained a perfect picture on the monitor. The supply to the r.f. modulator was then measured – only 4V. Switch transistor Q661 on the servo logic board was faulty. A meter check on this produced a base-emitter reading of 500Ω both ways – I've had Q661 open-circuit on several occasions but never before has it been half way!

Panasonic NV7200

There was no timer programming on this machine, which had been subject to liquid spillage at some time - the

timer and operation boards were affected and had received a lot of attention. The clock worked so I decided to check the programme switch. It had 5V at one side but when pressed produced only 1.5V at the other side. A replacement programme switch cured the trouble. R.S.N.

Sony SLC9

The problem with this machine was no signal from the tuner, no clock and no programme numbers due to no 38V supply from the d.c.-to-d.c. converter module on board D (check for 38V at pin 3 of the module). W.G.L.

Panasonic NV366

The complaint was intermittently incorrect capstan speed. The machine was put on soak test and after half an hour the capstan speed increased. A scope was used to check the capstan FG signal at TP2007 – it was missing. We

checked back to the motor and found that when this was gently tapped the speed corrected itself. A new motor restored normal results – the capstan FG generator is built into the motor.

R.S.N.

Ferguson 3V31

This machine would work all right for a short time then the drum speed would increase. The trouble was traced to IC13 (μ PC1458). W.G.L.

Sony SLC5

The head drum wouldn't rotate, though turning the drum by hand would get the machine to work until switched off. The fault was eventually traced to D1 (1S1555) on audio/servo board AS6 – it was short-circuit. As a check, pin 18 of the drum servo i.c. (IC1) should be at 10-8V at switch on: D1 short-circuit gives a low reading. W.G.L.

VHS the Philips Way

Harold Peters

When Philips took up the VHS format to improve their share of the VCR market they were reluctant to abandon some of the features of their V2000 system. The result has been something of a compromise: machines that are indisputably VHS but have the Philips philosophy applied to their operation and use. This can be a little confusing to someone who has just got one to replace an early Japanese machine, or to engineers who have to deal with a mixture of the two types. The instruction books don't help, being multilingual (or alingual!) and badly set out with the exception of a limited edition for the VR6462, revised in the UK. Nor does the fact that their authors, following the practice of "positive thinking", don't tell you what the things won't do. Let's try to straighten matters out. We'll look first at the differences between the Japanese and Dutch approaches, then run through the range of Pye/Philips machines released up to the time of going to press.

Different Approaches

The Japanese philosophy, which up to now covers the majority of VHS/Beta machines and means that if you can operate one model you can get by on all the rest, is as follows:

- (1) The user's on/off switch is used to turn the machine on: it remains on until you turn it off again.
- (2) Timed recording programs, once entered, lock the machine so that it cannot subsequently be used or accidentally "dusted to error".
- (3) Tracking errors are compensated by adjusting a control which must be reset after the mistracked tape has been played.

The Philips philosophy, based on the electronics of their V2000 system, is totally different:

- (1) There's no on switch, only a standby button. To start the machine you merely press the button for the required function, e.g. play, wind or eject. If the machine is not used for a few minutes it automatically reverts to standby, i.e. only the clock and infra-red receiver are on.
- (2) Personal use overrides timer settings. Dad can come in with a borrowed tape and watch it despite Mother having

booked the VCR to record Coronation Street. At 7.30 Dad wonders why the display starts flashing.

(3) Tracking should be automatic. The V2000 format uses dynamic track following, with the video heads mounted on bendable arms. Compatibility precludes the use of this arrangement with the VHS system. Instead Philips use a tracking button: push it till the sparklies move out of the picture and it holds that setting while the tape is played, resetting itself at the end.

So much for the basic differences. Now let's see how they have been applied. As you'll see, only partially at first. We'll consider the machines in the order in which they were released: the model number in brackets is the Pye version, which differs only in style and presentation.

Philips VR6520 (65VR20)

To get Philips VHS off the ground the initial basic Models VR6520 (65VR20) were imported from Japan – they are in fact the Panasonic NV370 with restyled fronts. Naturally they conform fully to the Japanese philosophy, with on/off switches, locked timer programming and a tracking knob. They stay on till you turn them off. What you can't do is to watch a broadcast on its own channel while the machine is in the play mode. This is a Panasonic feature introduced to avoid beat patterning in areas where the lower u.h.f. channels are in use: it can be overcome by linking pins 5 and 6 of P1 on the modulator.

The VR6920

The VR6920 (no Pye version) was an adaptation of the Panasonic NV850 stereo hi-fi model. The use of helical audio recording gives sound quality comparable to that from a compact disc. It's "helical stereo only", the lateral sound track on the edge of the tape being mono only in both the record and playback modes. As with the VR6520 the broadcast channels are inhibited during playback, and since the VR6920 can be used purely as a sound recorder – in conjunction with a hi-fi – this feature prevents other members of the family watching TV while someone is using the machine as a sound recorder. If required the

remedy is the same as with the VR6520: link pins 5 and 6 of P1 on the modulator.

The Japanese philosophy of on/off switching, timer lock and a tracking knob is maintained, but Philips replaced the infra-red remote control circuitry with their own RC5 board (see January TV), permitting remote control to be linked to TV handsets of the flat 53 series. The handset supplied, type AV5567, controls all the VCR functions and will also control a restricted range of functions on any Philips group TV set that uses the RC5 code. Two orange buttons on the right of the "calculator" part of the keypad give selection betwen VCR/TV control. A word of warning here. Although it doesn't say anything about it in the instruction leaflet, the act of inserting the batteries in a new handset puts it into the TV mode. The writer, unaware of this, unpacked three samples before a chance encounter with a teletext set in the showroom told him that he hadn't received a batch of duds.

Model VR6560 (65VR60)

The middle range Model VR6560 (65VR60), which is capable of programming up to five items in advance, was the first purely Philips machine. It's a top loader with the lift controlled by touch buttons. The temptation to push it down by hand should be resisted. Much of the cabinet and electronics are derived from the V2000 format Model VR2324 and the machine has the full Philips philosophy: it turns off after eight minutes of non-operation, personal use overrides the timer and tracking is by pushbutton. Setting the clock requires you to enter the date – day, month and year, even though it never asks questions about the latter.

Test Program

Due to its compact size this is not the easiest machine to service. It does however contain a comprehensive test program in its microcomputer, part of which is initiated every time the machine is plugged in. The rest is detailed in the manual, but we'll mention two useful sections.

The first is the ability to read off the number of hours the machine has been used. Press standby once then press store and, while holding it down, press search (not the other way round). If you ignore the decimal point the time display will then show the total number of hours of use, i.e. 2.35 indicates 235 hours' use. To clear, release store and search and press standby once again.

The other feature of the test program useful to the servicing fraternity is a life test mode. Make up a dummy DIN plug to fit the camera socket at the back of the machine, with a diode connected between pin 4 (anode) and pin 5 (cathode). Put a tape in, unplug the machine, fit the plug and reconnect the mains supply. The machine will now play the tape to the end, rewind, replay the tape again and so forth until the mains supply is disconnected. Should an intermittent fault occur the machine will stop and an error indication, which can be looked up in the manual, will appear on the display. This is also a useful feature for display purposes.

The VR6460 (64VR60)

The VR6460 (64VR60) was the first front loader with the Philips philosophy. This is considered to be a basic machine even though two programmes can be entered in the timer. A "one touch recording" counts as one of the

two, i.e. filling both timer "blocks" will prevent a "one touch" recording being made. Manual operation overrides the timer and after eight minutes of idleness the machine automatically goes to standby.

The AV5561 plug-in infra-red unit gives remote control operation: it can be used with the AV5562 handset or with many of the current range of Philips TV handsets that employ the RC5 code (more on this later). There's a builtin test program similar to the one just described, but since the machine uses a Panasonic deck which is similar to that used in the VR6520 the two features specifically mentioned above are not available.

The VR6462 (D464)

The VR6462 (D464) is destined to be the basic model for the coming season and after. This two-program development of the VR6460 differs in having a Philips deck as well as Philips electronics and a built-in remote control receiver unit. This latter feature means that any user of a recently bought Philips TV set which employs the flat 53XX type handset can use this to control the majority of VCR operations. Further details will be given later. Again the full Philips philosophy applies: shutdown after eight minutes of non-operation, manual use overrides the timer and there's pushbutton controlled tracking. Also the "one touch" button requires an empty timer block to function.

A limited number of these machines came complete with an easy-to-read instruction manual printed in the UK. Its illustrations are in blue and black, so you can tell it from the "Euromanual" which is printed in red and black. Unhappily it doesn't have a code number, so if you send for a manual you'll get the Euro version. Neither manual mentions the fact that there are two versions of the machine – "swallowers" and "stoppers". If empty a swallower will accept a cassette, even if in standby, and lower it into the deck, staying in the on state. The stoppers go into the standby mode with the cassette lift down, thus preventing the insertion of a cassette until the machine has been turned on by pressing the eject button.

As with other models a comprehensive test program is built into the microcomputer chip. This is triggered on every POR (plug in) and gives fault indications that can be looked up in the manual. Its "life test" mode is similar to that of the VR6560 but you don't need a diode plug.

Model VR6660

The VR6660 is a full-specification front loader with the mechanics of the VR6462 and the electronics of the VR6560, plus extras. As the shutdown after eight minutes without use and the timer lock are optional the machines can be run following either philosophy.

The most noticeable feature is an alphanumeric display beneath the standard four digit time/counter figures. The function (play, record, wind, search, timer etc.) appears on this in large letters. The second thing you notice is that everything, including setting the timer, can be done from the remote control handset. There's also audio dub and, provided you've entered the type of cassette you're using, e.g. E180, a time remaining readout can replace the conventional counter display. Like the VR6560 the clock setting requires the date with year. Once you've set it, and the TV channels it is to monitor, these details remain in store for up to three months. So there's no need to reset after every power cut and more predelivery work can be

done in the workshop.

You can override the eight minute turn off by selecting a broadcast channel during standby, turning the machine into a high-quality tuner. There's also a tamperproof lock: you open the store, enter any four digits and store them all while the set is in standby - and the word "locked" appears on the display. Only by opening the store again, re-entering the same four digits and closing the store can the machine be unlocked. The machine cannot be used in the locked mode, but any programs booked into the timer before you locked the machine will be carried out. What if you forget the four-figure code? Hard luck! There's obviously a way to restore the machine to normal use but you'll be asked a lot of embarrassing questions (we hope) before anyone will come out and do it. If in normal use you override the timer when it should be recording a programme the machine will emit bleeps to warn you.

The POR test program is similar to the VR6560's, including a "life test" that requires the same diode plug.

VR6860 Matchline

The VR6860 is the Matchline version of the VR6660. It has hi-fi stereo sound recording facilities via helical tracks, as with the VR6920, and all the features mentioned above. It should be noted that the linear track is mono only and that audio dubbing can be carried out only on the linear track.

Remote Control

For the last eighteen months or so most remote control and teletext Pye/Philips TV sets have come with a flat handset that includes some VCR functions. They were originally designed for use with the later V2000 series

VCRs but will also remotely control the VR6560. VR6462, VR6660 and the Pye equivalents for the following functions: play; record; forward search; reverse search; channel change; standby; stop; pause; and a few others depending on the combination of handset/TV. Three functions are available only via the remote control handset - triple forward speed playback, normal speed reverse playback and slow forward. The TV/VCR button at the side of the unit has to be held in when VCR functions are being selected. Fast wind and fast rewind are not available via remote control - due I've been told to no one asking the designer to include them. Finding this hard to believe, I dug a bit deeper. The more plausible explanation is that the system was designed for use with V2000 machines and in this respect doesn't require wind and rewind since all V2000 machines have a "go to" feature which is quicker and more effective.

Service

Hitherto Philips Service have held courses at various regional centres to train dealers' engineering staff on the servicing techniques required for new models. In the case of the VHS machines these courses have been replaced by packages of instructional material that amount to a tidier form of the notes you'd have taken had you gone on a course. In addition to the service manual each package includes a circuit description and fault-finding guide – the latter emanating, thank goodness, from Croydon itself and thus being in a language we all understand.

Issued so far are VR6920, code No. 727 17992; VR6460, code no. 722 17197; and VR6462, code no. 722 17202. Each package comes in a zip-up wallet and, at £25 a time, is a lot cheaper than sending a man on a two-day

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16181 16182 16334	1.04 1.04 0.98	2SC1124 2SC1151A 2SC1152	1.26 4.72 4.68	2SD348 2SD350 2SD350A	16.13 5.20 2.80	AN5435 AN5610 AN5612	3.08 7.43 3.51	BC186 BC187 BC204	0.27 0.28 0.16	BD222 BD225 BD228	0.49 0.49 0.63	BF195 BF196 BF197	0.14 0.17 0.16	BSR59 BSS38 BSTBD140G	1.29 0.59 4.98	BZX79 RANGE BZY88 RANGE	0.10 0.10
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16600 16799	1.38 2.88	2SC1172Y 2SC1195	2.20 3.26	2SD401 2SD551	3.55 2.42	AN6326 AN6342	3.98 1.61	BC212B BC212L	0.26 0.10	BD232 BD234	0.50 0.42	BF200 BF216	0.37 0.36	BSTC0233 BSTC1233	6.12 4.34	CA3044 CA3046	3.50 2.06
16801 16802	0.54 1.27	2SC1213 2SC1226	0.89 1.46	2SD588A 2SD600	1.99 3.25	AN6344 AN6363	5.87 16.00	BC212LB BC213	0.26 0.10	BD237 BD238	0.47 0.45	BF218 BF222	0.36 0.55	BSTC3146 BSTCC0143	0.79 3.07	CA3060 CA3065	1.65 1.29
16803 16905	5.30 0.86	2SC1306 2SC1307	1.98 1.98	2SD621 2SD636	12.67 0.40	AN6551 AN6552	1.35 0.68	BC213L BC213LB	0.10 0.15	BD239 BD240	0.45 0.37	BF224 BF237	0.17 0.65	BSTC0643 BSV57B	3.37 3.49	CA3089 CA3089E	0.83 1.43 2.38
17074 17127 1N4001	9.30 3.51 0.06	2SC1316 2SC1364 2SC1383	4.10 0.49 1.20	2SD657 2SD679 2SD731 ·	2.80 3.35 2.11	AN7115 AN7145 AN7146	2.52 2.80 9.90	BC214 BC214L BC214LB	0.10 0.14 0.26	BD241 BD242	0.39 0.39 0.50	BF240 BF241 BF244	0.17 0.17	BSW68 BSX19	0.60	CA3090 CA3094	2.20
1N4002 1N4003	0.06 0.06	2SC1398 2SC1410	0.84	2SD787E 2SD811	0.62 5.54	AN7150 AN7151	2.45 2.26	BC225 BC237	0.40 0.10	BD243 BD243A BD244	0.37 0.51	BF245A BF255	0.57 0.37 0.20	BSX20 BSX21 BSY52	0.34 0.87 0.50	CA3131EM CAH76023N CBF16848N-07	3.12 6.60 1.56
1N4004 1N4005	0.04 0.08	2SC1413 2SC1505	3.55 1.00	2SD823 2SD856	1.98 6.61	AN7156 AN7158	2.78 6.75	BC238 BC238A	0.10 0.13	BD244A BD245C	0.85 0.99	BF256 BF256LC	0.28 0.42	BSY79 BT100A	0.51 1.61	CD4001 CD4002	0.38 0.27
1N4006 1N4007	0.08 0.07	2SC1578 2SC1617	8.74 3.89	2SD869 2SD898 TR	7.17 5.45	AN7218 AP58076	1.64 4.68	BC239 BC239B	0.12 0.25	BD246C BD253	0.89 1.05	BF257 BF258	0.34 0.36	BT106 BT108	1.55 1.45	CD4008 CD4011	1.06 0.29
1N4148 1N4448 1N5401	0.04 0.05	2SC1670 2SC1678 2SC1810	3.13 1.98 1.70	40408 40594	0.50 1.53 1.53	AS560S AU113	1.58 2.97 2.08	BC251A BC252 BC258	0.12 0.12	BD278A BD317	0.80 2.60	BF259 BF262	0.34 0.57	BT109 BT112	1.45 2.48	CD4012 CD4013	0.24 0.47
1N5402 1N5403	0.14 0.15 0.16	2SC1815 2SC1829	0.66 2.22	40595 40636 40871	1.43 1.53	AY105K AY106 BA130	1.09 0.14	BC261A BC262	0.25 0.22 0.22	BD318 BD375 BD377	2.59 0.42 0.26	BF263 BF264 BF271	0.57 0.37 0.34	BT113 BT116 BT119	2.48 1.20	CD4016 CD4017 CD4020	0.45 0.82
1N5404 1N5408	0.15 0.35	2SC1855 2SC1875	1.88	40872 60857	1.53	BA1310 BA1320	1.98	BC287 BC294	0.50	BD379 BD380	0.76 0.76	BF273 BF274	0.20 0.20	BT120 BT121	1.76 2.17 2.48	CD4021 CD4023	1.23 0.39 0.28
1N914 1S44	0.04 0.09	2SC1891 2SC1893	3.69 3.02	74LS30 7805 TD-220	0.32 0.63	BA1330 BA145	2.75 0.19	BC301 BC302	0.45 0.53	BD410 BD412	0.52 6.27	BF324 BF336	0.23 0.33	BT122 BT123	2.48 1.98	CD4025 CD4028	0.64 0.84
1S5012A 1S921	0.81 0.06	2SC1929 2SC1942	2.25 5.70	7805 TD-3 7806	1.16 0.73	BA148 DIDD BA154	0.33	BC303 BC307	1.04 0.18	BD418 BD433	0.87 0.47	BF337 BF338	0.36 0.40	BT125 BT126	2.48 2.48	CD4047 CD4049	1.06 0.46
2N1302 2N1303 2N2218	0.27 0.38 0.42	2SC1945 2SC1953 2SC1957	4.53 1.93 0.95	7808 7812 TO-3 7812 TD-220	2.39 2.85	BA156 BA157 BA159	0.05 0.22 0.12	BC307A BC308 BC308A	0.14 0.18 0.11	BD434 BD435 BD436	0.49 0.49	BF355 BF362 BF363	0.49 0.66	BT128 BT128P	2.48 3.07	CD4050 CD4052	0.55 0.75
2N2219A 2N2222	0.40 0.38	2SC1959 2SC1962	0.31	7815 7818	1.16 0.64 0.92	BA182 BA222	0.12 1.66	BC309 BC317A	0.17 0.13	BD437 BD438	0.60 0.49 0.40	BF371 BF391	0.60 0.50 0.25	TBA970 BT151-800R BT151 500R	3.06 1.15 1.38	CD4053 CD4069 CD4081	0.80 0.29 0.35
2N2646 2N2904	0.80 0.36	2SC1969 2SC1965	2.92 0.55	7824 AC107	0.64 0.73	BA284/2 BA301	0.17	BC327 BC328	0.15 0.11	BD441 BD442	1.42	BF393 BF417	1.59 0.84	BTT6018 BTT6218	2.42 2.51	CD4093 CD4511	0.72 1.10
2N2905 2N2906	0.43 0.38	2SC1983 TR 2SC2009	7.00 0.34	AC117 AC123K	0.43 0.43	BA302 BA311	1.24	BC337 BC338	0.09 0.12	BD507 BD509	0.60 1.42	BF418 BF422	1.87 0.29	BTT8024 BTT8124	4.43 4.89	CP5521 CV12E	17.83 3.07
2N3053 2N3054 2N3055	0.27 0.99 0.61	2SC2029 2SC2027	2.33 1.42 2.11	AC128 AC138	0.34 0.09 0.29	BA312 BA313 BA317	0.97 0.76	BC360 BC368 BC440	0.34	BD510 BD518	1.07 1.50	BF423 BF435	1.12 0.54	BTT8214 BTT8224	5.99 2.97	CX034 CX095D	11.83 3.14
2N3055H 2N3442	0.85 1.16	2SC2028 2SC2057 2SC2073	1.18 1.54	AC141 AC142K AC151	0.43 0.28	BA318 BA328	0.04 0.09 4.77	BC441 BC454	1.09 0.44 0.36	BD519 BD529 BD530	1.50 1.32 1.10	BF450 BF451 BF457	0.35 0.29 0.41	BU105 BU106 BU108	1.50 2.48 1.50	CX104 CX108 CX109	9.64 9.16
2N3702 2N3703	0.14 0.14	2SC2078 2SC2091	2.39	AC153 AC176	0.34	BA333 BA401	1.37	BC455 BC460	0.36 0.42	BD533 BD534	0.67 0.53	BF458 BF459	0.39 0.52	BU109 BU110	2.25 5.69	CX121 CX130	7.86 11.83 8.76
2N3704 2N3705	0.14 0.14	2SC2122A 2SC2141	5.12 1.86	AC179 AC183	0.28 0.72	BA511 (IC) BA521	2.92 2.02	BC461 BC462	0.47 0.30	BD535 BD536	0.77 0.61	BF460 BF469	1.56 0.31	BU111Y BU124	4.16 1.38	CX131 CX134	11.83 11.04
2N3706 2N3707	0.14 0.16	2SC2166 2SC2216	1.98 0.69	AC187 AC187K	0.39 0.43	BA524 BA526	8.94 7.98	BC463 BC464	0.64	BD537 BD538	0.74 0.67	BF470 BF471	0.55 0.31	BU126 BU134S	0.90 4.57	CX136 CX137	11.49 11.83
2N3711 2N3771 2N3772	0.11 2.04 1.71	2SC2233 2SC2271 2SC2278	2.20 4.01 1.14	AC188 AC188-01 AC188K	0.25 0.49 0.43	BA532 BA536 (IC) BA6304A	2.67 2.95 2.92	BC465 BC477 BC478	0.64 0.32 0.32	BD544B BD580 BD590	0.83 1.17 1.17	BF472 BF479 BF480	0.33 0.61 0.60	BU204 BU205 BU206	1.58 1.08 1.27	CX139 CX157 CX158	11.83 4.84 4.10
2N3773 2N3819	2.29 0.41	2SC2314 2SC2335	0.87 10.41	AC193K AC194K	0.65 0.65	BA843 BAV18	3.96 0.21	BC479 BC532	0.41	BD598 BD677	1.25	BF491 BF495	0.32 0.64	BU207 BU208	1.65 1.12	CX170 CX177	7.62 6.75
2N3823 2N3904	1.17 0.62	2SC2526 2SC2551	1.87 1.26	AD140 AD145	1.06 1.60	BAV19 BAV20	0.11 0.11	BC546 BC547	0.17 0.10	BD679 BD680	0.57 0.76	BF506 BF509	0.43 0.41	BU208/02 BU208A	1.97 1.12	CX506 CX507	9.33 7.62
2N3908 2N4101 2N4240	0.62 1.33 3.30	2SC2570 2SC2570A 2SC2578	2.39 1.05 6.75	AD149 AD161 AD162	0.90 0.56 0.45	BAV21 BAX12 BAX13	0.34 0.11 0.11	BC548 BC549 BC550	0.10	BD695 BD696	1.48 2.30	BF523 BF594 BF595	0.20 0.27	BU208D BU209	1.95	CX755 CX758	12.95 7.62
2N4444 2N4914	0.90 0.72	2SC264A 2SC2671	4.82 1.99	AD262 AF114	1.05 2.47	BAX16 BB119	0.11 0.17	BC556 BC557	0.40 0.16 0.10	BD697 BD698	2.47 3.60 1.85	BP596 BP597	0.27 0.18 0.27	BU226 BU312 BU326	2.95 2.38 2.00	D1693 DEC1 DEC2	2.59 2.20 2.20
2N5064 2N5293	0.71 0.50	2SC2728 2SC2785	0.95 0.75	AF115 AF117	1.24 0.50	BC107 BC107B	0.13 0.11	BC558 BC559	0.10 0.10	BD699 BD700	3.49	BF617 BF618	1.05 1.05	BU326A BU326S	2.20	E1222 E5024	0.40 0.28
2N5294 2N5296	0.50 0.49	2SC372 2SC373	1.40	AF118 AF127	1.20 0.50	BC108 BC108B	0.15 0.15	BC560C BC635	0.14 0.36	BD702 BD707	3.70 1.06	BF694 BF757	0.22 0.59	BU406 BU407	1.49 0.82	E5386 E5529	0.25 0.25
2N5297 2N5298 2N5490	0.50 0.61 1.49	2SC383 2SC388 2SC394V	1.33 0.50 0.81	AF139 AF178 AF179	0.53 1.45 0.55	BC109 BC109B BC113	0.12 0.15 0.14	BC636 BC637 BC638	0.20 0.24 0.20	BD709 BD710 BD807	1.12 0.80 0.34	BF758 BF759 BF760	0.65 0.47 0.65	BU407D BU412	1.00 5.29	E8021 E9003	1.29 0.46
2N5496 2N6107	0.59 0.59	2SC41 2SC458	2.19 0.34	AF180	0.55 0.53	BC116A BC119 BC126	0.25 0.36	BC639 BC640	0.20	BD809 BD810	0.75	BF762 BF870	0.75 0.30	BU426 BU426A BU500	1.90 1.67 1.95	E9005 ESM432C ESM532C ESM632C	0.50 4.60 4.60
2N6109 2N6122	1.58 1.76	2SC495 2SC508	0.92 3.70	AF181 AF182 AF186	0.55 0.53	BC132	0.20 0.14	BC879 BC880	0.39 0.31	BD879 BD880	0.74 0.79	DE071	1.81 0.83	BU508A BU526 BU608D	1.89 2.02	ESM732C	4.60 4.60
2N6130 2N6133 2N6178	0.72 1.25 0.73	2SC515A 2SC536	1.85 0.29	AF239 AF279	0.43 0.88	BC135 BC137	0.14 0.18	BCX32 BCX33	0.42	BD895 BD899 BD901	2.31 2.48	BF900 BF959 BF970 BFR39 BFR52 BFR62	0.42 0.69	BU608D BU807 BU826A	1.57 0.80	ETTR6016 FND500	2.65 5.78
2N6180 2N696	0.73 0.43	2SC537 2SC558 2SC606L	0.54 3.69 1.16	AL100 AL102 AL103	4.03 5.69 2.68	BC138 BC139 BC140	0.34 0.28 0.45	BCX34 BCX37 BCY70	0.40 0.67 0.30	BD902 BDV64B	0.79 0.84 1.26	BFR52 RFR62	0.44 0.50 0.50	BUV46 BUV84	1.76 1.00 1.24	FT3055 GF758 GF759	1.16 0.84 1.13
2N698 2N707	0.43 0.43	2SC620 2SC673	1.46 1.23	AL113 AN115	2.68 1.36 3.98	BC141 BC142	0.34 0.34	BCY71 BCY72	0.21 0.20	BDV65B BDX32	1.26 1.75	BFR81	0.29 0.50	BUW81A BUW84	3.06 1.39	GF761 GH3F	1.20 1.82
2SA10276 2SA1076	1.96	2SC681 2SC684	4.40 1.65	AN155 AN206	1.89 2.58	BC143 BC147	0.33	BD115 BD116	0.36 0.70	BDX53 BDX53A	1.25 4.93	BFR86 BFR89	1.08 1.63	BUX84-TRAN BY126 BY127	1.00 0.13	HA11211 HA11215	2.53 5.06
2SA329 2SA351 2SA489	0.40 1.17 1.17	2SC685A 2SC693 2SC710	2.89 0.63 0.69	AN208 AN210 AN214	3.98 1.89 2.58 3.55 2.28 2.26	BC147A BC148 BC148B	0.12 0.13 0.13	BD124 BD124P+KIT BD131	1.31 0.69 0.42	BDX538 BDX54B BDX62A	3.35 2.61 1.96	BFT41 BFT42 BFT43	0.30 0.43 0.43	BY133 RY164	0.13 0.11 0.47	HA11223W HA11225 HA11226	0.00 4.29
2SA490 2SA493	1.67 1.05	2SC717 2SC734	1.20	AN2140 AN231	2.40 14.89	BC148C BC149	0.11 0.11	BD132 BD133	0.42	BDX63A BDX64A	1.96 2.61	DETRA	0.40	BY176 BY179 BY182	1.52 0.62 1.05	HA11229 HA11235	8.71 2.88 2.48
2SA628 2SA637	1.14 1.46	2SC735 2SC782	1.16 2.47	AN234 AN236	5.92 3.78	BC149B BC153	0.13 0.14	BD135 BD136 BD137	0.36 0.26	BDX65A BDX76	2.61 0.59	BFW10 BFX29 BFX30	0.34 0.65	BY184	0.47	HA1124 HA11244	5.25 2.82
2SA673 2SA683 2SA684	1.27 1.61	2SC790 2SC806 2SC814	1.27 11.29	AN238 AN239 AN240P	6.79 5.88	BC154 BC157 BC159	0.14 0.14	I BD 138	0.36 0.46	BDY20 BDY62/01	1.21 4.62	BFX84 BFX85	0.37 0.41	BY187 BY189 BY198	0.77 1.76 1.62	HA1125 HA11251	4.29 4.47
2SA584 2SA748 2SA818	1.33 1.08 1.82	2SC828 2SC867A	1.39 0.28 3.04	AN240P AN241 AN245	1.52 1.71 4.49	BC158 BC159 BC160	0.10 0.16 0.40	BD139 BD140 BD144	0.34 0.37 1.43	BDY81 BF115 BF117	1.18 0.40 0.66	BFX87 BFX88 BFX89	0.55 0.34 0.44	BY189 BY198 BY201/2 BY203/20 BY206	1.50 0.41	HA1137W HA1138 HΔ1141	2.87 5.03
2SA835 2SA940	2.50 1.81	2SC876 2SC901	0.96	AN247P AN252	4.49 4.22 2.57	BC161 BC167	0.28 0.36	BD150 BD157	0.75 0.67	BF118 BF121	0.67 0.25	BFY50 BFY52	0.32 0.27	BY206 BY207 BY208 BY210-400	0.17 0.22 0.46	HA1141 HA11414 HA1144	5.65 5.65 7.87
2SA951 2SA966-1	1.26 Y 1.16	2SC926A 2SC930 2SC935	4.55 1.42 0.54 4.13	AN253 AN262 AN272	2.57 2.97 1.98 7.92 6.53 5.52 5.55 3.99 4.39	BC168 BC169C	0.36 0.16	BD159 BD160	0.53 1.60	BF123 BF127	0.13 0.13	BFY90 BLY49	0.61 2.20	BY210-400 BY210-600 BY210-800	0.18 0.27	HA1156 HA11580	1.16 9.00
2SB325 2SB375 2SB400	3.87 3.87 0.40	2SC936 2SC937	4.13 5.25 3.58	AN272 AN281 AN295	6.53 5.52	BC170 BC171 BC172	0.16 0.11 0.10	BD163 BD165 BD166	0.71 0.62 0.42	BF137 BF152 BF153	0.29 0.31 0.58	BR100 BR101 BR103	0.22 0.70 0.66	BY210-800 BY223 BY224-400 BY225-100	0.34 0.85 0.99	HA1160 HA1166X HA1166	4.78 5.36 1.55
2SB407 2SB411	3.24 3.30 2.50	2SC940 2SC982	4.68 0.70	AN301 AN302	5.55 3.99	BC172 BC172B BC173	0.27 0.17	BD166 BD168 BD175	0.73 0.43	BF153 BF154 BF157 BF158 BF159 BF160	0.26 0.33	BR88B BRC-M-300	0.64 0.97	RY226	1.13 0.25	HA1167 HA11711	5.36 20.16
2SB511 2SB54	1.39	2SD1051 2SD1128	0.75 2.25	AN303 AN305	9.47	BC174B BC177	0.27 0.20	BD177 BD179	0.43	BF158 BF159	0.18 0.18	BRC116 BRC1330	0.67 1.76	BY227 BY228 BY255 BY298	0.49 0.60	HA11713 HA11714	8.13 7. 7 6
2SB56 2SB618A 2SB681	2.80 2.22 3.96	2SD1138 2SD1265 2SD1398	0.94 0.76 2.25	AN313 AN315 AN316	3.41 2.46 5.53	BC178 BC179 BC182	0.26 0.26 0.09	BD181 BD182 BD183	0.99 0.99 0.99	I BF167	0.31 0.38 0.34	BR88B BRC-M-300 BRC116 BRC1330 BRC300 BRC4443 BRC5296 BRC5296	2.01 1.02	BY255 BY298 BY299	1.07 0.20 0.60	HA11714 HA11715	8.13 8.13
2SB695 2SB75	3.96 1.98 1.04	2SD1396 2SD1453 2SD198	0.75 3.87	AN318 AN320	6.20 5.47	BC182	0.11 0.26	BD184 BD187	1.21 0.53	BF173 BF177 BF178	0.34 0.55 0.40	BRC5296 BRC6109	1.02 0.77 0.83	BYW56 BYX10	0.34 0.29	HA11724 HA11725 HA11738	22.25 18.26 22.25
2SB861 2SC1034	0.85 6.75	2SD234 2SD235	0.49 0.60	AN331 AN337	4.5 9 5.37	BC182B BC182L BC182LB	0.10 0.14	BD189 BD190	0.69 0.69	BF179 BF180	0.36 0.36	BRC82 BRC83	1.08 2.19	BYX55-350 BYX55-600	0.53 0.15	HA1180 HA1192	5.15 0.00
2SC1050 2SC1061	5.06 1.26	2SD257 2SD291	2.94 2.94	AN340P AN355	1.17 5.98	BC183 BC183L BC183LB	0.10 0.11	BD201 BD202	0.53 0.60	BF181 BF182	0.32 0.34	BRX44	2.08 0.60	BYX61 RANGE BYX71-600 BYX71-360	0.18 1.25	HA1196 HA12005 IN	7.43 9.00
2SC1096 2SC1104 2SC1106	1.16 3.98 4.54	2SD292 2SD313 2SD315	2.59 2.59 2.94	AN362 AN5111 AN5132	1.75 2.92 4.39	BC183LB BC184 BC184L	0.26 0.13 0.14	BD203 BD204 BD207	0.50 0.40 1.79	BF183 BF184 BF185	0.39 0.43 0.39	BRX49 BRY39 BRY55	0.53 0.69	BYX71-350 BYX71-600 BYX94	0.72 0.85 0.14	HA1203 HA1306	1.72 2.26
2SC1114	6.75	2SD325D	0.91	AN5250	2.89	BC184LB	0.26	BD208	1.79 1.23 . REMI	I BF194 EMBER TO A	0.14	BRY56	0.67 0.50 & HAN	BYY56	1.20	HA1308 HA1322 VAT TO TO	7.50 2.18 TAI
_ " 10	2 2014 1 3	11 4311	~ 43N	. on doo	, L. GI	IADAGE IAI	JUEL	-CONTION	L	STIDEN TO A	TU 1	JOHN TUST	OL FINAIN	PUI4G. ADL	1070	ANT TO TO	/1AL

The content of the	E	CO	NON	ЛIC	: DE	VI	CES.	PO) B(OX	228.	TE	ELF(DRE) TF	2 80	P	
Angle	HA1338 HA1339	7.50 2.33	M1130 M191	5.35 6.32	NE646N NE650N	2.98 4.34	SAS560 SAS560S	1.85 2.26	SN76620 SN76622	2.59 1.65	TA7109 TA7120P	3.71 0.64	TC4053BP TCA150	1.79	IDA2611AQ IDA2612Q	2.98 IIP3L 4.68 TIP31	IA	0.34
March Marc	HA1350	3.75	M51102L M5115P	6.35 5.24	NP1106 0A200	5.61 0.11	SAS570 SAS570S	1.78 2.61	SN76630 SN76640	2.55 4.24	TA7124P TA7130P	2.34 1.27	TCA270Q TCA270S	1.71 2.15	TDA2630 TDA2631	1.96 TIP3: 2.73 TIP3:	1C 2B	0.69
Section	HA1367	4.32	M5124P	4.82 4.13	OA47 OA90	0.14 0.08	SAS580 SAS5800	2.85 2.89	SN76660N SN76665N	2.48 1.49	TA7137P TA7141AP	0.98 3.87	TCA290A TCA420A	2.39	TDA2643 TDA2651	12.12 TIP3 4.65 TIP3	3C 4	0.80 1.18
March Marc	HA1368R	2.45	M5142P	5.49	0A95	0.09	SAS5900	2.56	SN76705N	1.34	TA7148P	1.67	TCA4500A	2.15 2.16	TDA2653 TDA2654	5.65 TIP4	1B .	0.65
Section Color	HA1377	4.80 3.96	M5144P M51513L	3.77 2.55	0C29 0C35	1.06	SAS6600 SAS660S	1.33	SN76709N	5.45	TA7162P	2.59	TCA650	2.04	TDA2660	2.47 TIP4:	2A 2B	0.49 0.79
Section 1.5 Section 1.	HA1392	3.90	M51516L M51517L	2.95 3.71	0C44 0C45	0.35 0.18	SAS670 SAS6700	3.96 1.33	SN76810N SN76920N	0.60 2.90	TA7171P TA7172P	2.79 1.41	TCA730 TCA740	3.81 2.48	TDA2670 TDA2670A	1.94 TIP4 3.20 TIP4	7 8	0.65 0.92
MARCE 15 Missing 15 Missin	HA1397 HA1398	3.76 3.98	M51522 M5191P	4.77 4.94	ON188 ON236	1.87 1.06	SAS6710 SAS6800	1.33 2.53	SN94042 SP8385	4.35 0.55	TA7193AP TA7193P	6.67 5.50	TCA800 TCA8000	5.95 5.95	TDA2690A TDA2780A0	2.65 TIP4 5.14 TIP5	5A	3.65
MARCH 10 Price 1 Pri	HA1452 HA17723	1.63 5.94	M5194AP M53273P	5.74 1.02	OT121	1.32 2.24	SBA550B SBA750	4.50 1.61	STK0029 STK0039	5.54 5.35	TA7202P TA7203P	2.47 2.18	TCA900 TCA910	2.04 1.65	TDA2791 TDA2795	2.50 TIS9 2.78 TIS9	1	0.29
## ## ## ## ## ## ## #	HD38750A53 HD4480	8.71 17.16	MA06	1.07	PT5006	2.48	SC9503	1.65 1.95	STK0059 STK0080	7.13 9.16	TA7205 TA7206P	1.38 6.25	TCE330 TCE527	3.89 1.86	TDA3030A TDA3190	11.49 TMS 2.68 TMS	3748NS 34116	14.95 2.06
Heading 1.5	HEF4001P	0.67	MB3712	1.85	R1039	2.19	SCR957	1.33	STK013	9.25	TA7208P	2.15 3.58	TCE83	1.08	TDA3500 TDA3501	4.25 TY60 7.25 U050)10B G	2.97 1.14
Header 1965	HEF4528	0.29	MB3730 MC13002	3.25 6.22	R2009 R2001B	1.98 1.33	SG608 SG613	1.75	STK016	6.91	TA7215P	2.58	TCEP100	9.61	TDA3510	6.55 U370 9.71 UA7	003 23CA	0.49 5.53
Miles 1.50	HM6232 HM9102	3.22	MC1307P MC1310P	1.92 1.30	R2030 R2257	1.33 2.38	SG6533 SI-1125HD	10.31 13.86	STK025 STK040	12.50 8.70	TA7222 TA7227P	1.95 2.81	TD3F700H TD3F800H	4.86	TDA3540	2.98 UA7	83P3C 1170	3.38 2.31
Story	HM9105 HT4207	3.24 17.16	MC1330P MC1349P	1.69 0.99	R2305 R2306	1.18 1.36	SKE2F 1/04 SKE2G 2/04	1.39 0.95	STK054 STK070	7.13 22.31	TA7233P TA7240AP	5.32 7.83	TD3F900H TDA1003A	4.16 1.79	TDA3561 TDA3561A	7.50 ULN	2165 12204	1.49 7.70
SCHOOL 157 WICHSHIP 128 SCHOOL 128 SC	K174YP KA2101	3.46 2.92	MC1351P	1.33	R2323 R2348	0.76 2.01	SKE4F 1/02 SKE4F 1/06	1.39 0.73	STK078 STK082	8.52 11.86	TA7314 TA7325P	5.94 1.15	TDA1006A TDA1010	1.69 1.15	TDA35710 TDA3576	2.83 UPC 7.09 UPC	1009C 1001H	6.32 2.75
LIDY	KC582C KC583C	3.97 5.54	MC1358P	1.30	R2354B	2.01	SKE4F 2/08	0.86	STK2101	6.32 7.33	1A7676P 1AA300	2.81 2.97	TDA1028 TDA1029	2.45 4.89	TDA3590B . TDA4050A	1.54 UPC 3.47 UPC	1028H	2.00 2.77
Author 144	L200CV	1.69 0.88	MC14013 MC14016CP	0.84	R2461	1.50	SKE5F 3/10	1.60	STK415	7.70	TAA320A	1.27	TDA1034B	2.42 1.98	TDA4260 TDA4280	1.54 UPC 7.20 UPC	1032H 1030H	0.62 2.27
ALISS 1.4	LA1210	1.56 2.87	MC14025 MC14049UBC	0.60 0.58	R2501 R2540	1.28 1.98	SL1430	1.39	STK436	7.21	TAA550	0.37	TDA1041	2.16	TDA440	4.90 UPC 2.27 UPC	:1031H2 :1154H	6.00 1.93
August Color Col	LA1352	1.54 11.07	MC14493P MC14556BCP	2.82 3.47	R2615 RC4195NB	0.67 2.16	SL1432 SL414	2.25 3.69	STK439 STK441	8.31 11.28	TAA611B12 TAA621AX1	1.30 2.00	TDA1047 TDA1054M	1.21	TDA4422	8.32 UPC	1185H	2.94 1.82
ALTONO	LA1364	3.02	MC7724CP MC7818C	3.49 2.18	RCA16029 RCA16334	2.01 1.02	SL437 SL439	2.48	STK459 STK460	9.40 10.75	TAA661B TAA700	1.00 2.59	TDA1060 TDA1082	2.59 3.06	TDA4431 TDA4432	2.27 UPC 2.27 UPC	C1181H	1.25
ASSISTANCE 1.5 MCRISTON 0.8 RACK 0.8 SISSISSAN 0.9 SISSISSAN 0.9	LA1385	1.94	MC78M12 MC78M24	0.83 0.94	RCA16600 RCA16799	1.38 2.38	SL490 SL901B	2.37 8.32	STK463 STK465	11.53 10.31	TAA930 TAA970	4.87 2.83	TDA1151 TDA117#	1.17 2.37	TDA4600 TDA4610	2.84 UPC 3.11 UPC	C1217C C1212C	1.72
LASSID 1.05 MCROWN 1.07 MCROWN 1.0	LA3155 LA3300	1.25 1.54	MCR101	0.67	RCA16802	1.08	SL918A SN16861N-07	9.07 2.72	STR441 STR453	9.45 8.16	TAG232-600 TAG626-600	0.73 1.06	TDA1180 TDA1190	3.25 2.11	TDA5500 TDA5700	2.73 UPC 2.73 UPC 2.31 UPC	C1353 C1350C	7.85 1.07
LAMOSP 22	LA3350 LA3361	1.43 1.23	MCR220/7 ME0402	2.28 0.17	RCA17074 RCA17376	1.58	SN16965 SN16966N	8.95 10.25	T6007V	0.95	TBA120A	1.05	TDA1200A	1.43 1.95	TDA9403 TDA9503	3.15 UPC 3.15 UPC 2.92 UPC	C1362 C1365	7.75 7.10
LAMES 1.79	LA4031P LA4032P	3.20 2.35	ME0404/2 ME0411	0.47 0.28	RT402	1.58	SN29716N SN29717N	3.66 7.19	T6017	0.72	TBA120SB	1.05	TDA1235	3.88	TE527	5.44 UPC	C1360C C1458	4.51 8.66
LAHI2	LA4051P LA4100	1.79 1.25	ME4102 ME545B	0.50 10.02	S0280 S0281	214 214	SN29723AN SN29744N	7.65 2.29	T6021 T6022V	0.40 3.92	TBA120U TBA1440	2.03	TDA1327B	1.82	TEA1002	1.49 UPC 3.47 UPC	30C 32C	2.51 4.94
LAH490	LA4102 LA4112	2.81 4.83	ME6102 ME8001	0.28 0.29	S175 S2062D	31.48 2.07	SN29767 SN29770BN	4.98 4.24	T6027 T6028V	0.81 0.39	TBA1441 TBA240A	3.99	TDA1412	1.05	TEA1087	8.21 UPO 0.51 UPO	C554C C558C	4.04
LAM20 122	LA4138 LA4140	3.38 1.15	MJ2501 MJ2955	3.30 0.99	S28000 S2802	5.54 3.47	SN29772BN SN29773	4.91 2.51	T6032V T6033V	0.98 0.60	TBA395Q TBA396	1.10 0.80	TDA1470 TDA1512	2.90 2.89	TIC106M TIC116	9.77 UPO 2.07 UPO	C572 C575C2	3.87 2.40
LAMS0	LA4220 LA4400	1.62	MJ3001 MJ3028	1.69 2.65	S3703F S3707	5.21 4.32	SN29791 SN29845	1.67 2.36	T6036 T6037	0.67 2.11	TBA440P TBA480	2.45 1.57	TDA1770 TDA1905	6.85 1.76	TIC45 TIC47	0.77 UPO 0.35 UPO	C577H	0.76 4.13
LAMS20	LA4422 LA4430	1.72 1.47	MJ802 MJE2955	5.45 1.89	S551 S552	4.54 4.54	SN29861 SN29862	2.29 2.29	T6044V T6045	0.95 1.20	TBA510 TBA520	1.37 1.84	TDA1940 TDA1950	1.95 3.80	TIP110 TIP112	0.53 UPO 0.88 UPO	C592H D1514C	8.32
A7000 7.33 MILZ2B 2.15 SAA1004 2.29 SA76013NO 2.26 B8050V 1.20 BBA50Q 1.15 DA2010 1.25 Th227 1.20 S00055C: 4.79 A7007 3.25 MILZ3B 5.77 SAA1050 4.16 SA76013NO 8.90 F9005V 2.36 TBA550Q 4.50 TDA2020 2.77 TP275 A8065C: 4.29 TP278 A8	LA4461 LA4520	2.95 2.15	MJE340 MJE520	0.49 0.49	S6087AR SAA1020	4.90 4.76	SN75110N SN76001ANQ	0.83 1.65	T6052V T6058	0.87 0.59	TBA530 TBA5300	1.30 1.30	TDA2003 TDA2004	1.75 2.27	TIP120 TIP121	0.55 X00 0.87 X00	i35TA 156CE	5.11 5.11
LA7800 2.65 ML741CS 1.29 SAA105 5.16 SNF622ND 3.25 T9010V 0.62 TBA560C 1.60 TDA2150 6.20 TDA215	LA7020 LA7025	7.33 8.05	ML232B ML237B	2.15 2.51	SAA1024 SAA1025	2.81 4.40	SN76013N0 SN76013N	3.99	T8001V T9003V	1.20 0.95	TBA540Q TBA550	1.15 4.50	TDA2010 TDA2020	1.85 2.77	TIP127 TIP2955	1.43 X00 0.86 X00	165CE 196CE	4.78 4.29
LOSIZIO 1.53 MMSSIBN 425 SAA1102 435 SAVESION 255 SAVESI	LA7800 LA7801	2.65 4.15	ML741CS ML923	0.59 3.30	SAA1051 SAA1061	5. 83 3.61	SN76023N SN76023ND	3.96 3.50	T9010V T9011V	0.62 0.49	TBA560C TBA560CQ	1.40 1.60	TDA2140 TDA2150	1.59 6.20	TIP29B TIP29C	0.63 X10)74AF 9494P	7.00 1.33
MMS389N 201 MMS389N 201 MMS389N 201 MMS389N 201 MMS387AAN 16.20	LC4011B LD3120	1.24 1.13	MM5314N MM5316N	4.02 4.25	SAA1082 SAA1121	8.85 4.43	SN76105N SN76110N	0.90	T9014V T9016	1.68 1.02	TBA570A TBA5700	1.71 1.35	TDA2760 TDA2161	4.01 1.85	TIP30A	0.41 Y96	10 19	
MISSID M	LM1017N IC LM1111	4.29 4.29	MM5369N	2.01	SAA1130	4.99	SN76131 SN76226DN	1.92 1.98	T9035V T9038V	1.39 9.42	TBA625B TBA625C	2.17 2.17	TDA2520 TDA2521	2.37 3.71				
MRSIA MRSI	LM1310P/N LM1877	1.38 10.92	MP8112	1.49	SAA1251	5.75	SN76228N SN76231	3.27 2.55	T9053V T9054V	1.41 0.75	TBA641A12 TBA651	4.13 1.76	TDA2523 TDA2524	3.13 4.50		•		
LM340T5	LM317CKC LM339N	1.38 0.80	MP8512 MPF256C	1.57 0.60	SAA5010 SAA5012	4.15 5.78	SN76243 SN76322	5.23 5.23 2.77	T9063V TA5814	3.24 1.49	TBA7000. TBA720	2.00	TDA2530 TDA2532	2.70 2.50		chine av	ailable	J
LM342P 12V 1.62 LM342P 13V 1.62 LM342P 15V 1.62 LM34	LM340T5 LM340T12	0.83 0.64	MPSA42 MPSA56	0.65 0.27	SAA5030 SAA5040A	8.25 16.23	SN76360 SN76390	2.17 3.08 2.90	TA7020P TA7027 TA7050	4.86 1.74	TBA7500 TBA760	2.90 1.71	TDA2540 TDA2541	2.15 2.48	0902 - 712083			
LM342P 15V	LM342N LM342P 12V	0.62 1.62	MPSU05 MPSU10	0.86 1.56	SAA661B SAA700	1.98 3.30	SN76510N SN76532N	1.05 0.91	TA7051 TA7060AP TA7061AP	1.74 0.71 1.27	TBA800 TBA810AS	1.08 1.00	TDA2560 TDA2571A	2.17 3.66				
LM384N01 3.25 MR812 0.21 SAB3013 5.61 SN76540N 1.98 TA7072P 2.57 TBA900 2.48 TDA2581 1.89 TDA2582 2.18 MR914 0.51 SAB3021 7.90 SN76544 2.99 TA7073P 5.86 TBA9200 1.89 TDA2582 2.18 TDA2580 2.50 TDA2580	LM342P 5V LM348N	1.62 2.15	MPSU56 MPSU60	0.80 1.33	SAB1046P SAB3011	4.03 7.34	SN76530P SN76546N SN76540N	1.57 3.47 1.98	TA7069 TA7070P TA7071	3.13 1.68 3.69	TBA810S TBA820M TBA890	0.82 1.61	TDA2576A TDA2577	2.85 3.70	customers			
MVS460 3.22 MVS460 0.34 SA830238 12.30 SV76549 2.59 TA7076P 7.50 IBA940 1.37 IDA2591 2.50 IDA2591 0.35 For quantities of 100+ per line -	LM380N LM384N01	2.80 3.25	MR812 MR914	0.21 0.51	SAB3013 SAB3021	5.61 7.90	SN76540N SN76544	1.98 2.89	TA7072P TA7073P	2.57 5.86 1.98	TBA900 TBA920 TBA9200	2.48 1.89 2.31	TDA2581 TDA2582 TDA2590	1.69 2.18 2.50	post only			
LM8361 3.57 NE566 0.95 SAB3210 3.49 SN76570 3.08 TA7092P 6.94 TBA9700 3.28 TDA2594 3.08 Orders from Govt. Institutions, M1024 2.81 NE560N 3.48 SAF1031 2.53 SN7660N 0.02 TA7093P 3.39 TBA990 1.82 TDA2600 5.50 Schools, Nationals etc., accepted M1025 5.17 NE565N 1.33 SAF1039 3.35 SN7660N 0.02 TA7102P 5.88 TBA9900 1.88 TDA2610 2.79 with official order M1124 2.80 NE645BN 3.35 SAS5010 8.39 SN76611 2.59 TA7108P 1.61 TBA231 2.57 TDA2611A 1.25 All goods should be delivered	LIM8360	1.82 3.22	MVS460 MVS460-02	0.34 0.61	SAB3023B SAB3024	12.30 6.36	SN76549 SN76550	2.59 0.37	TA7076P TA7089M	7.50 1.56	TBA940 TBA950	1.87 1.55	TDA2591 TDA2591Q TDA2593	2.50 0.83 2.47	For quantities of 100+ per line - Please ask for special quote.			
M1124 2.80 NE6456N 3.35 SASS010 8.39 SN/5611 2.59 TA7108P 1.61 TBA231 2.57 TDA2611A 1.25 All goods should be delivered	LM8361 M1024	3.57 2.81	NE556 NE5560N	0.95 3.48	SAB3210 SAF1031	3.49 2.53	SN76570 SN76600	3.08 1.21	TA7092P TA7093P	6.84 3.99	TBA970Q TBA990	3.28 1.82	TDA2594 TDA2600	3.08 5.50	Schools	, Nationals	etc., acce	
REGISTERED OFFICE: THE COACH HOUSE, MUXTON LANE, TELFORD	M1124	2.80	NE645BN	3.35	SAS5010	8.39	SN76611	2.59	TA7108P	1.01	TBA231			1.25		All goods s	should be deli	ivered rs.

The Network EMS System

Denis Mott

Network NWC1402 series colour receivers employ an electronic programme memory system (EMS). It's a voltage-synthesis tuning arrangement based on the SGS M193 i.c. Inevitably faults can occur and the service engineer then has to try to cope. The service manual will probably be consulted but it's seldom obvious from a circuit diagram how things are supposed to work. It's about this time that my phone goes . . .

The M193 incorporates a non-volatile memory, i.e. the memory retains the information stored in it when the power supply is interrupted – SGS quote the memory storage time as being ten years. With a volatile memory, i.e. one using RAMs as in the earlier Network NWC1401 series, a back-up battery is required to ensure that the stored information is not lost when the main power supply is switched off.

Fig. 1 shows a simplified block diagram of the M193. It's been simplified because some of the facilities incorporated in this i.c. are not used in the NWC1402 – data display control and band switching for example. The memory is organised as 17 bits of information, 12 to provide the varicap tuning voltage, three for fine tuning and two for band selection. A digital-to-analogue converter (DAC) provides the tuning output at pin 15: the output depends on the twelve bits of information obtained from the memory.

The four input lines PA-PD receive a binary-coded input to address the memory. Pulses are applied to pin 9 when a new programme is to be stored. The timing of these pulses depends on the store output at pin 14: the pulse trains differ for memory erase and memory store – during a store cycle the previously stored programme is first cancelled then the new one is written in. The band select, a.f.c. and auto-tune facilities incorporated in the i.c. are not used.

Fig. 2 shows a basic block diagram of the EMS system. The EMS panel is used in both remote and non-remote control versions of these sets. For remote control the preamplifier unit is added.

The EMS system is shown in rather more detail in Fig. 3 to enable its operation to be understood. The μPD1937C remote control receiver/decoder i.c. (IC1301) receives both the remote control commands and the programme/volume up/down signals from the touch board. The i.c. is clocked by a 455kHz resonator (X1301) connected between pins 10 and 11. Pin 13 receives the remote control input signals from the preamplifier while pins 1-5 receive the local commands – pin 1 power on/off, pin 2 channel up, pin 3 channel down, pin 4 volume up, pin 5 volume down. The outputs are at pins 6, 7, 14 and 15. Pin 6 goes high when an on command is received. Pin 7 provides an 18msec pulse output for volume control: the

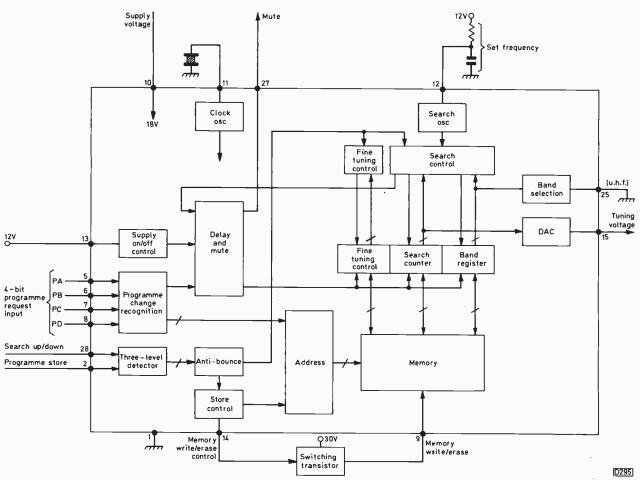


Fig. 1: Simplified block diagram of the M193 programme memory chip.

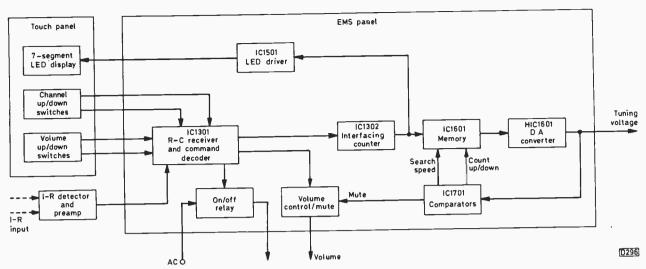


Fig. 2: Block diagram of the EMS system used in the Network NWC1402 series.

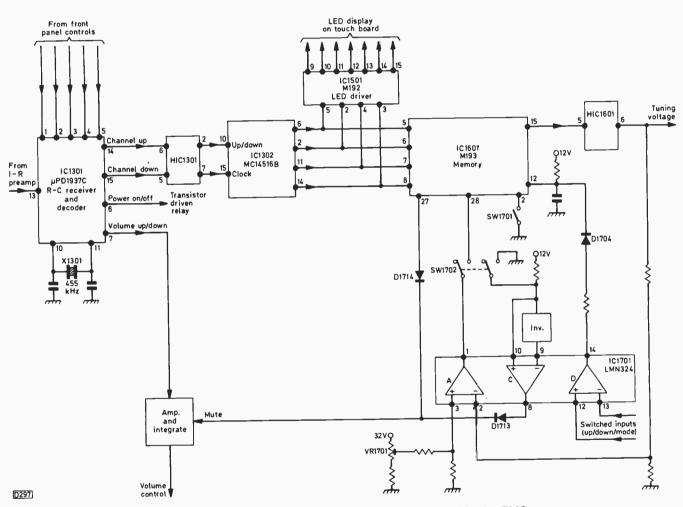


Fig. 3: Interconnections between the various i.c.s used in the EMS system.

mark-space ratio is short for low volume, long for high volume. Pins 14 and 15 both provide 18msec pulses, pin 14 when channel up is selected, pin 15 when channel down is selected. There should be a 20V peak-peak 455kHz sinewave at pin 10.

The up/down pulses from IC1301 go to pins 5 and 6 of the thick-film hybrid i.c. HIC1301 whose job is to gate the up/down signal on to a single line – the output is at pin 2. In addition it provides a clock signal at pin 7. The up/down and clock outputs pass to IC1302 which provides an interface with the M193 memory chip. This is an

MC14516B 4-bit bi-directional counter whose outputs are taken from pins 2, 6, 11 and 14. These outputs go to the M192 LED driver i.c. IC1501 as well as the memory chip.

When a data input is applied to pins 5-8 of the memory chip IC1601 an output will be obtained at pin 15. This comes via a digital-to-analogue converter, but since this is clocked the output at pin 15 consists of pulses rather than d.c. The mark-space ratio of these pulses alters to provide the tuning voltage required. The following thick-film hybrid i.c. HIC1601 inverts and integrates the pulses from pin 15 of IC1601, producing the tuning voltage at pin 6. It

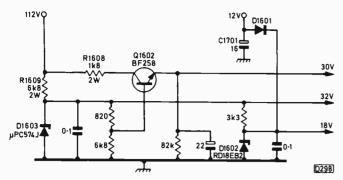


Fig. 4: Power supply arrangement for the M193.

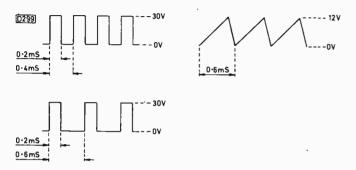


Fig. 5 (top left): Memory erase signal at pin 9 of the M193. Fig. 6 (lower left): Memory write signal at pin 9. Fig. 7 (top right): Ramp waveform at pin 12 of the M193.

can also be used for band changing on v.h.f./u.h.f. sets. When data stored in the memory is to be changed, i.e. a channel location is to be retuned, pin 28 (search up/down) of the M193 is connected to a comparator i.c. (IC1701) via the mode switch SW1702 – an indicator LED then lights.

The power supply arrangements for the M193 chip are a bit ticklish. It requires 12V at pin 13, 18V at pin 10 and a 30V supply for memory write/erase. The 12V supply must arrive first (D1601 provides the initial supply for pin 10). The 18V supply is derived from the set's 112V h.t. supply, which is delayed slightly. The 32V tuning voltage supply is also derived from the 112V line, in the usual manner. Fig. 4 shows the main items in the power supply system.

M193 Pinning

The M193 is a 28-pin device but not all pins are used in this application. Useful pin information to note is as follows:

Pin 2: Voltage falls to 0V when the memory switch is operated.

Pins 5-8: Data address signals from IC1302 at 12V logic levels. A low on all inputs gives programme one, a high on all inputs programme 16. Programmes 2-15 are given by different combinations of 1 and 0 on the four lines.

Pin 9: 30V peak-peak pulses are applied to this pin for memory erase/write. For the erase part of the cycle the pulse duty cycle is 0-4msec (see Fig. 5). For the write part of the store cycle the pulse duty cycle is 0-6msec (Fig. 6).

Pin 11: Clock oscillator pin. A 3.58MHz crystal is connected to this pin. If you suspect that the crystal is faulty, connect a X10 scope probe to this pin via a $1M\Omega$ resistor. A 150mV p-p sinewave should be displayed. If the $1M\Omega$ resistor isn't included the oscillator will stop.

Pin 12: An RC network is connected to this pin to set the frequency of an internal oscillator which produces the

scan ramp in the search mode. The ramp is normally of 0.6msec duration (Fig. 7) but shortens to 0.2msec initially (see later).

Pin 14: Pulses as at pin 9.

Pin 15: 5V p-p pulse train. A small mark, wide space will eventually tune in channel 68: for channel 21 a wide mark and small space are required.

Pin 27: Sound muting. Goes high (5V) when changing channel.

Pin 28: Memory data up/down selection. When low the data clock counts down, when high the data clock counts up. At 6V the data clock is inhibited.

The Comparator Chip

The final i.c. on the EMS panel, IC1701 (LMN324), is a quad comparator of which three sections are used.

Comparator A provides the up/down information for pin 28 of the memory i.c. The non-inverting input of this comparator is fed by VR1701. The inverting input is supplied with a potted down portion of the tuning voltage. If the non-inverting input is positive with respect to the inverting input the output will go high and the memory data will scan up to provide a new channel. The opposite applies with reversed inputs.

Comparator C provides sound muting for approximately one second when the channel up or down button is pressed.

Comparator D alters the search speed at pin 12 of IC1601 for approximately one second after the up, down or mode switch is operated.

Fault Finding and Modifications

The two most common failures are no output from pin 15 of the M193 memory i.c. and failure of some memory locations to store data.

When there's no output from pin 15 of the M193 the device usually gets very hot due to an internal short.

Failure to store data at some memory locations is caused by an internal problem which can be checked by monitoring the waveform shown in Fig. 6. New data will not be entered if the memory erase waveform (Fig. 5) is seen.

Tuning drift has been a problem with some of these sets. There are two possible reasons for this: (1) temperature drift; (2) a.f.c. locking range.

When the temperature within the set reaches 40° C the varicap tuning voltage starts to drop. This is caused by the inverter transistor in thick-film module HIC1601 not turning on fast enough. Eventually, the changed output voltage will be too much for the a.f.c. to handle and the set will go off tune. To eliminate this effect remove the thick-film module HIC1601 from the EMS panel and add a tantalum bead capacitor as shown in Fig. 8: any value between $0.22\mu\text{F}$ and $2.2\mu\text{F}$ will do.

The other problem arises from the fact that on one

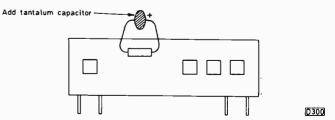


Fig. 8: Temperature drift modification.

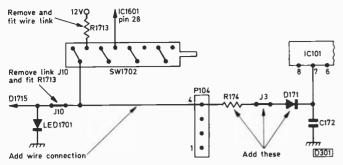


Fig. 9: A.F.C. disable modification.

version of the chassis there's no a.f.c. disable when programming the memory. This may cause the set to appear to have drifted off tune when changing channel – it usually happens when going from a higher to a lower frequency. To overcome the problem add diode D171 (1N914 or 1N4148) in the vision i.f. screening can, add R174 (22k Ω) near P104, add link J3 and add a connection wire from P104/4 to SW1702. See Fig. 9.

There's a version of the EMS panel which is electrically correct but R1713 (820Ω) is incorrectly sited so that the a.f.c., disable doesn't operate. To correct this, remove R1713 from the panel and replace with a wire link. Fit R1713, with extended leads, in place of link J10 (see Fig. 9).

To ensure correct operation, check as follows:

- (1) The voltage at P104/4 should be 11-12V when the mode switch is pressed.
- (2) The voltage at TP14 should be $5.5V \pm 0.5V$ when the mode switched is pressed.
- (3) The voltage at TP14 should remain as at (2) when the mode switch is released after tuning.

If the voltage at TP14 is incorrect or tuning drift still occurs the a.f.c. coil L171 may be incorrectly tuned. The following procedure is suggested:

- (1) Desolder the a.f.c. pin of the tuner from the PCB pad.
- (2) Connect a variable bias supply to the a.f.c. pin. A PP9 battery and $10k\Omega$ potentiometer can be used.
- (3) Set the bias at 5.5V with respect to chassis and tune the set to a good signal.
- (4) Alter the a.f.c. bias and note the effect. The tuning should shift visibly. If not, suspect the a.f.c. varicap circuit in the tuner.
- (5) Reset the bias to 5.5V.
- (6) With the set correctly tuned, monitor TP14 with a meter. The reading should be $5.5V \pm 0.5V$. If the voltage is incorrect, retune L171 slightly to bring the voltage back to 5.5V.
- (7) Disconnect the a.f.c. bias and reconnect to the PCB.

I hope the information provided in this article will be of help to engineers who come across the NWC1402 and its variants. Hopefully my telephone will cool down a bit! My thanks to Network Industries for permission to publish these service notes.

TV Fault Finding

Reports from Mick Dutton, P.A. Smith, Bob McClenning and Maurice Kerry

Rediffusion Mk. 4 Chassis

We've had several chopper transistors fail in this chassis. In every case the cause of the problem has been poor soldered joints on the chopper transformer. It's a good idea to remove the transformer, clean the legs then resolder it.

M.D.

Philips CTX Chassis

A portable set fitted with this chassis was brought in because it was tripping. It was fairly new and we were surprised to see the rust marks on the chassis – it must have been kept in very damp conditions. To cure the tripping we had to change the tube (cracked glass), the TDA2577 sync/timebase generator/chopper control i.c., the TDA3651 field output chip and the 26V rectifier D6590.

Another of these sets had an intermittently dark picture. Flexing the PCB would produce the fault but we could find no cracks or dry-joints. After a lot of probing around we found that C2656 $(0.039\mu\text{F})$ on the earthy side of the e.h.t. circuit had never been soldered through the panel – the beam limiter line is linked to this capacitor.

M.D.

Panasonic U3W Chassis (TC2211)

The complaint with this set was line tearing. We found that the supply lines were low which led us to check the h.t. reservoir capacitor C853 ($100\mu F$). It had gone rotten, dropping to pieces when we removed it from the panel. The h.t. smoothing capacitor C854 ($47\mu F$) also had to be

replaced. These blue high-voltage capacitors used by Panasonic often seem to give trouble, causing all manner of weird effects

M.D.

Thorn 9000 Chassis

Fuse blowing in this set was caused by a shorting chopper transformer. We've never had that one before though the sets have been around for a long time now.

M.D.

NordMende 3602 (F8 Chassis)

This colour portable, fitted with the F8 chassis, had no luminance with red flyback lines showing. The set employs a TDA3300 colour decoder chip, which we first suspected, but the problem turned out to be due to the TDA1170 field timebase i.c.

The problem with another set fitted with this chassis was blue smearing that looked like a low-emission tube. RV43 (47k Ω) in the blue output stage had gone high in value. M.D.

Philips G8 Chassis

The owner of one of these sets complained of picture jitter. We were short of time so we swopped the power panel, but the owner phoned back to say that he still had a problem. The cause of the trouble was the $600\mu F$ h.t. smoothing capacitor C5536, which is mounted on the line output panel – it had gone open-circuit. A clue is given by the fact that the power supply won't set up correctly, with jitter at 200V or less and no jitter at 205V.

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Another of these sets, fitted with the combined i.f./chroma panel, suffered from loss of colour. This led us a merry dance until we found that the voltage at pin 7 of IC3540 (TBA560C), the burst output, was low while the voltage at pin 5 of IC3550 (TBA540), the input to the burst detector, was high. The two pins are connected by a filter, U3008, which contains a series 220pF capacitor. It turned out that this capacitor was leaky.

M.D.

Hitachi CPT1471

This 14in. colour set was tripping. When switched on the e.h.t. came up then the power supply shut down. On two previous occasions we've had faulty chopper chips in these sets, IC901 (STR6020), but with both these cases the power supply would shut down intermittently when warm. We changed IC901 just in case but this made no difference.

No shorts etc. could be found in the line output stage so we decided to try disconnecting the various rectifiers fed from the transformer. When we lifted D771 the set came to life. This diode provides the main 12V line so we started to disconnect the various sections of the set this feeds. When R604 was lifted the set ran with sound but no raster. At this point we took a closer look at the circuit. R604 feeds IC701 (LA7801) which contains the sync circuitry, the line oscillator and the field oscillator and driver stages. It's in two "halves" with separate supplies, 12V via R604 to pin 12 for the field circuits and a supply from the emitter of the line driver transistor to pin 15 where an internal zener diode provides the supply for the rest of the chip – the line driver transistor is fed from the main 115V h.t. rail so there's no need for a start-up

supply. Replacing IC701, also the STA441C field output chip IC681, cured the problem. If the line output stage in these sets is unloaded the power supply doesn't regulate properly, so it's essential to reduce the mains input, preferably by using a variac, to prevent damage to the line output transistor whilst testing. With the sort of fault we had (field timebase) Hitachi recommend replacing the flyback switching transistor Q681 (2SC1213A) as well.

M.D.

Zanussi 22ZT505

This was an oddball – we'd never seen one of these sets before. The complaint was intermittent no results. After a long soak test and much prodding around we found that the collector of the chopper transistor was dry-jointed, causing the set to go into standby.

M.D.

Philips G11 Chassis

We came across an unusual fault recently on a G11 power panel. The screen symptom was a small picture and a check on the h.t. voltage at fuse F4037 revealed that this was low at 130V instead of 153V. After much scratching about we discovered that zener diode D4048 in the trigger pulse phase control circuit had decided to become a 6·1V zener instead of a 7·5V zener. Replacing this item cured the trouble – a large brandy settled my nerves.

P.A.S.

ITT CVC1100/CVC1200 Chassis

These sets incorporate the CMR800/1 r.f./i.f. module. When the problem is low volume with distortion, before leaping to change the TDA1035T sound i.c. replace C228 ($100\mu F$, 16V) which stabilises the audio feedback. The symptom sounds like a very badly stuck speech coil. This module is used in a wide range of ITT models. **B.McC.**

Hitachi NP83CQ Mk. II Chassis

This set produced a bright, high-contrast picture and loud sound, with the sound, brightness, colour and contrast controls inoperative. A PCD8571 memory i.c. mounted on a panel (difficult to get at) under the c.r.t. stores the digital level codes for the above controls. These are fed to the SAB3037 chip on the main panel, where they are converted to analogue signals. The memory chip (IC1502) proved to be at fault.

Hitachi NP81CQ Chassis

An STR441 chopper chip (IC901) had been ordered by another engineer but when I fitted it the set remained dead. There was a supply of 345V at pin 1, which is connected to the collector of the chopper transistor in the i.c., but no voltage at its base (pin 4). Apart from feedback and bias components a standby switching transistor (Q901) is connected to this pin. There's a zener diode (ZD901) between the base and collector of this transistor and a check revealed that it was leaky (150 Ω). The set remained dead when a replacement was fitted and it then seemed that Q901 had a base-emitter short-circuit, though it checked all right out of circuit. The apparent short was due to link J907 touching IC901's heatsink – this link goes to the base of Q901. After removing the short and switching on the set was still dead, due to R905/6 in the chopper feedback path being open-circuit. Replacing these restored normal results with a good picture.

Letters

MICROCOMPUTER FAULT FINDING

Now that TV engineers are being asked to take on home computers your readers may be interested in some of the more common faults I've encountered whilst servicing these beasties.

The BBC Model B has proved to be an excellent and reliable machine with only a few common faults. The keyboards on later versions tend to have one or two characters that are either over or under sensitive: contact cleaner spray seems to have little effect and the only cure is to replace the offending switch. The screen filling with rubbish after an hour or so of use is usually caused by the video ULA (IC6) which is sometimes fitted with a clip-on heatsink to relieve the problem. Later versions of this chip don't seem to suffer from this problem however – they are available from advertisers in the magazine *BBC Micro User*. Failure to load or save programs on cassette can be due to incorrect cassette recorder volume setting or failure of the LM324 chip which is located next to the cassette socket at the rear of the machine.

The early Dragon 32 microcomputer suffered from loss of colour. This can be easily corrected by adjusting a preset inside, towards the rear of the PCB. These machines are quite critical about cassette recorder volume level and care must be taken to ensure that it's correct. The Dragon's mains transformer is prone to developing shorted turns – a replacement is available from advertisers in the magazine *Dragon User*.

The Commodore VIC 20 has two recurrent faults. First blowing of the 1A l.t. fuse for no apparent reason: I replace it with an anti-surge type and have had no returns. Secondly no picture and/or no sound due to the lead from the computer to the modulator unit developing internal breaks. A Commodore 64 that came in recently had a blown l.t. fuse but it seemed that the cause was the flying earth lead on the cassette plug having come into contact with the expansion edge connector at the back of the computer. As there doesn't seem to be anywhere to fasten this I taped it to its own lead. Commodore cassette recorders give few faults and head cleaning is usually enough to get them working. I have however had cases where the head is slightly out of alignment, giving occasional data errors. With one head the attached tape guide was out of alignment with the head itself.

The Sinclair Spectrum seems to produce a blank or rubbish-filled screen in response to faults, the most common of which is failure of the ZTX450 transistor that forms part of the power supply circuit. It produces -5V from the 9V supplied to it and is mounted near a small coil on the right-hand side of the board. This coil forms part of an oscillator circuit with the transistor – a buzzing noise is heard from the coil when the oscillator is working correctly. Replace the transistor with a ZTX650 or ZTX651.

Beware of add-ons that are plugged into the back of these machines: always ask the customer to bring *all* the bits in. A poorly locating joystick controller can short out the pins on the expansion port and blow the transistor again. Check that the index locating peg is correctly positioned and not bent.

The 48K memory is built up using eight 16K chips and eight 32K chips. The 32K chips are prone to internal shorts – an oscilloscope is required to determine which chip has developed the fault.

A keyboard that doesn't respond properly may be due to the connectors linking the board and the keyboard being split. They are made of thin, flexible plastic on which tracks are laid. If the break is at the board end it's possible to cut a little off the connector and remake the end. If the connector has been creased or broken along its path a repair is possible using stiffening pieces made from cardboard and conductive paint – don't put a soldering iron near these connectors as they disintegrate.

Finally, test the whole machine – add-ons as well. It'll save a lot of hassle later.

G. Jackson, Hyde, Cheshire.

SPECTRUM PROGRAM CORRECTION

There were a couple of errors in the Spectrum 48K colour bar program of mine you published on the letters page last month (page 241). The last number in line 130 should be 175, not 178; the last number in line 260 should be 116, not 16.

M. J. Edis, G4RPT, Broughton, Nr. Kett, Northants.

THE PHILIPS T8E CHASSIS

A bit of a problem arose recently with a Pye monochrome portable fitted with the Philips T8E chassis. The initial fault was poor line sync. Naturally the video/a.g.c./sync chip IC607 was suspected. It's shown as a TBA690 on the circuit diagram, so a couple of these were obtained. When tried, both died instantly. It wasn't until another of these sets came in for a different video fault that a clue was obtained. This set was unmistakably fitted with a TBA890. Fitting one of these put matters right. A further check with the manual showed that a TBA890 is specified in the semiconductor list at the front and in the parts list at the back, so presumably the circuit is wrong.

The fault in the second set was an overbright picture with flyback lines and very weak contrast due to the BF422 video output transistor being leaky.

These sets are not all that simple to service – they might be worth an article in *Television*.

Laurie Watkinson, Telesonic Services, Holsworthy, Devon.

Editor's note: Thanks for the tip! Anyone want to contribute any notes etc. on the T8E and the similar T8?

TELETEXT DECODING FAULTS

With reference to G. Beard's letter in the January issue on degraded text decoding with a Tifax XM11 module the following notes may be of assistance.

The XM11 was designed to accept more data lines when they became available, so it's more likely that Mr. Beard's fault is due to either short-term echoes (ghosting) because of an aerial problem or misadjustment of the video signal amplitude fed to the module. The make of receiver being used isn't mentioned but the three makes using the XM11 that I'm familiar with, i.e. ITT, Rank and Thorn, all have provision for adjusting the amplitude of the video input to the XM11 module (plug 2, pin 16).

Texas specify a p-p value of 2-3V. This however needs to be adjusted to compensate for differing power supply voltages and the characteristics of the video and i.f. circuits in the receiver and the module itself.

The video interface circuit usually consists of an emitter-follower. ITT suggest that adjustment is done as follows. Reduce the signal strength progressively, using an aerial attenuator, until errors start to appear in the display. Adjust the video input level to the XM11 for fewest errors, using the preset provided. Progressively increase the attenuation, adjusting the preset for fewest errors with greatest attenuation.

This will correct faulty decoding only if the aerial and the i.f. circuits are o.k. of course. The data bit rate with the teletext system is 6.9MHz, which means that a delay of only 140nsec is sufficient to cause errors. My company still has some of these decoders in the field: we've had no similar complaints from our customers.

It's also possible that the transmissions are at fault. At the time of writing the data bridge at Leeds is causing decoding problems from Leeds northwards. This sometimes results in missing rows of text, but the most annoying fault (on Ch. 4 only) is that the next page in the magazine appears instead of the one you call up, i.e. if

you call up 597 you get 598. The IBA engineers are aware of the fault but because it's very intermittent a solution hasn't been found.

During regional opt out on BBC-1 from my local transmitter (Emley Moor) the clockcracker page displays errors. The engineers at Leeds say the signal leaving there is o.k. and blame the fault on local reception conditions. I've checked the clockcracker page at a number of customers' premises throughout our service area however and all show the same fault, so there must be a problem at the transmitter. There are no problems when network programmes are on.

In conclusion, Mr. Beard is not suffering from the effects of an early design – though modern decoders are much improved. My first decoder was an XM11. I now have an XM12, which has background colour, double height and four pages of memory. I think it's a lot better than the Mullard decoders. Unfortunately Texas no longer make any teletext or viewdata decoders and I'm unable to obtain circuit diagrams etc. for the XM12. Can anyone help with this information?

L.D. Sears, Chief Engineer, Hepworth and England Ltd., Mirfield, W. Yorks.

Vintage TV: The Vidor CN377

Vivian Capel

To start with, Vidor was a name associated solely with batteries and torches. Then other things came along such as boiling rings and grillers, and like their rivals Ever Ready they started to produce a range of portable radio sets. It was something of a surprise when the first television sets were announced in the late forties, and some people felt that the firm might be overreaching itself. The manufacture of Vidor television sets continued until 1956 however. By that time a number of models had been released and the sets had become quite popular.

One of the first sets to appear was the CN377, a twochannel, 9in. table model that was very like a table radio receiver in appearance. There was a large, fabric-covered speaker baffle at the front left and to the right of this, where you'd expect to find the station scale, there was the screen. Four knobs were arranged along the bottom of the cabinet – contrast, volume-on/off, focus and brightness.

To further increase the resemblance to a radio set there was a wavechange switch with wafers similar to those used in the radio counterparts. It was mounted at the back of the r.f. subchassis however, and operated with a screwdriver as a preset channel selector – the two channels were London and Birmingham of course.

The Receiver Unit

Being of superhet design, the receiver unit was more advanced than its many t.r.f. contemporaries. It used what would later have been considered rather low i.f.s however – 9·75MHz vision and 6·25MHz sound. There were nine valves on this compact subchassis, seven EF42s, a couple of EB91s and the EL41 audio output valve. The first three EF42s were used as the r.f. amplifier, local oscillator and mixer. There were two vision only i.f. stages using EF42s and a single EF42 sound i.f. amplifier stage. The final EF42 was used as the video amplifier. The two

EB91s acted as detectors and interference suppressors in the vision and sound channels. The use of the largish, eight-pin EF42 was an odd choice – the contemporary console Model CN370 used seven-pin EF91s in the same positions (this difference led to surprisingly few circuit or even component value changes). A sensitivity control was provided in one corner of the subchassis: it set the cathode bias applied to the r.f. amplifier valve.

Video and Sync Circuitry

The video and sync separator circuits are shown in Fig. 1 – V7 and V8 were on the main chassis. The negative-going detected video developed across the load resistor R25 was applied to the video output valve's control grid. Series and shunt peaking coils, L9 and L10 respectively, were included in the valve's anode circuit, R27/8 being the load resistors. C23 coupled the positive-going video signal to the c.r.t.'s grid – the voltage at the c.r.t.'s cathode was set by the brightness control. The coupling to V7, which acted as the sync separator, was via C22.

As so often in those early days the sync circuit was a little unusual. The video signal, with negative-going sync pulses, was fed to the cathode of the first section of the EB91 sync separator. It's anode was biased by the voltage developed across R38. This section of the valve remained cut off during the positive-going section of the video waveform, conducting when a negative-going sync pulse appeared at its cathode. The pulse output was d.c. restored by the second section of the EB91 and applied to the control grid of V8, which acted as a sync pulse amplifier. Note that the d.c. restoration action also affected the c.r.t. drive, via R31. The line sync pulses developed across R36 were differentiated by C28 and R39 and fed to the line oscillator. The field sync pulses were integrated by R34 and C26 and coupled to the field

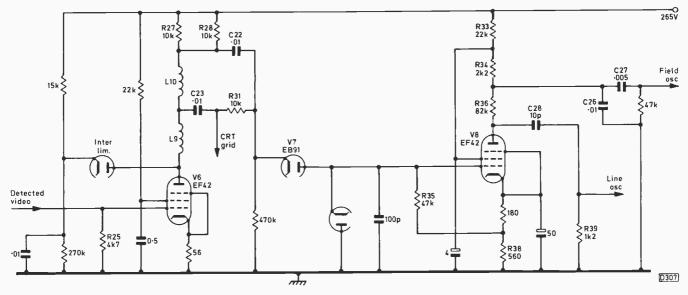


Fig. 1: The video amplifier and sync separator circuits used in the Vidor CN377.

oscillator by C27. In the absence of a sync pulse input V8 was conductive since its control grid and cathode were linked via R35.

Timebase Circuits

Thus positive-going sync pulses were developed at the anode of V8. These were applied to the control grids of the T41 gas-filled triodes (thyratrons) used in the line and field oscillator circuits. While it was quite common to use a thyratron as the field oscillator it was not so common to used one as the line oscillator - a hard-valve oscillator was generally preferred here. The use of the same type of valve in each timebase is an advantage from the servicing point of view however, since the valves can be swapped over to provide a quick check. Thyratrons tend to be temperamental, and it could well be that one is more effective at line than field frequency or vice versa.

The two timebase oscillator and output stages were very similar, and it was easy to get them mixed up from a brief glance at the circuit. Even the two sets of deflection coils were both series connected. An EL33 was used in the field output stage and an EL38 in the line output stage easily distinguishable by its top cap connection. Both output stages used transformer coupling - in the otherwise similar CN370 RC coupling was used in the field output

stage.

The main presets were situated at the rear of the main chassis and consisted of four linear sliders with locking control knobs. From the top to bottom they were field hold, line hold, height and width. The last two functioned by varying the h.t. applied to the appropriate output valve. They were in the cathode rather than the anode circuits: since the control grids were returned to the positive ends of these controls they did not affect the bias applied to the valves.

Each timebase also incorporated a linearity control. These were mounted on the main chassis alongside the respective output valves - they were screwdriver operated rotary presets. The field linearity control was part of an RC network in the output valve's control grid circuit: as it varied the amplitude of the waveform it also affected the height. The line linearity control was part of an RC damping network across the line scan coils: it controlled the left-hand part of the screen. The line output valve was operated as a class A amplifier, the damping network being used to remove the post-flyback overshoot.

The Power Supply

Perhaps the most significant feature of this receiver was the transformer power supply, complete with mainsderived e.h.t. - never a very popular feature with service engineers! A 6.4V winding on the transformer supplied the parallel connected valve heaters, a separate 4V winding being used for the thyratrons. A third heater winding was used for the h.t. rectifier, a GZ32 in a full-wave circuit. This produced 360V across its 16µF reservoir capacitor. There was choke smoothing with the choke tuned to a minimum frequency of 100Hz by a parallel capacitor combination $(0.2\mu F)$ plus $0.5\mu F$ in parallel). The focus coil also formed part of the smoothing circuit. Further RC smoothing was incorporated in the feeds to the anode of the field output valve and to the receiver subchassis.

An HVR2 rectifier produced some 5kV across its 0.1μ F reservoir capacitor. A point to note here is that the earthy end of the e.h.t. winding on the mains transformer was connected to chassis via a $270k\Omega$ resistor. If this went open-circuit it could be wrongly assumed that the winding itself was open-circuit - if a check was made from the hot end to chassis.

Switch-off Spot Suppression

A form of switch-off spot suppression was incorporated: a switch opened to add a $10M\Omega$ resistor in the c.r.t.'s cathode circuit to ensure that the cathode bias didn't fall too rapidly.

The CN390 Series

The following CN390 series was similar in many respects but in some ways moved to what was to become standard practice - it used cathode c.r.t. drive and a conventional pentode sync separator for example. The EL38 line output valve was used in a self-oscillating arrangement, with feedback to its control grid from the line output transformer's secondary winding: an overwinding and an EY51 rectifier produced the e.h.t.

Long-distance Television

Roger Bunney

From the DX-TV viewpoint a major event during the past year was the end of 405-line transmissions in Band I. It left the band wide open for DXing, clear of local TV signals. The problem of the 49MHz cordless phone continued, though the situation has become no worse now that legal 47MHz versions are available - the kiddies' 49MHz walkie-talkies seem to have disappeared from the market stalls. We have still to see what the effects of the amateur 50-50-5MHz allocation will be: ch. R1 vision will suffer to some extent, and the use of horizontal polarisation by amateurs won't help. For over two decades now I've advocated reduced i.f. bandwidth operation for DX reception. This does help to reduce interference and improve weak signal performance. Those who use the full i.f. bandwidth will suffer most from interference problems perhaps this is the time to consider adding an in-board i.f. preamplifier with integral i.f. notch tuning by means of a simple varicap system. Interference from microcomputers has declined now that interest in them has fallen and types with improved suppression have been introduced - at one time in my town centre location three Spectrums and an upmarket word processor were producing visible interference in Band I! It's unlikely that we shall see any official PMR activity in Band I during 1986.

Looking forward to the prospects for 1986, since we are in the early stages of sunspot cycle 22 there's no chance of enhanced F2 or early evening transequatorial skip reception – we shall have to wait another two-three years for these rather more exciting Band I signals. I'm hoping for a good year for Sporadic E reception, perhaps slightly better than 1985 when we all received signals from the Middle East. Pirate TV activity at u.h.f. is likely to be minimal and confined to the London area – transmissions on ch. E36 were expected over Christmas, from the Crystal Palace area, but there have been no reports of reception. Look out for the first independent French TV stations from February onwards, and the Munich "TV Weiss Blau" station on ch. E59 from around May/June.

December 1985 was a quiet month. There was a sudden tropospheric opening on the 15/16th, giving really strong W. German Band III and RTL ch. E7 reception across the south east and south, spreading as far as Cornwall, with noise-free reception until close downs. Meteor scatter/shower reception was disappointing. The Ursids just before Christmas gave only a small lift to the residual pings and the quadrantids similarly had little effect – the peak for the latter was at midnight on January 4th when most European TV stations were off air. The mornings during this period, traditionally a good time to watch, proved disappointing.

The minimal SpE signal log is as follows:

13/12/85 TVP (Poland) chs. R1, 2 from 2100 onwards. 14/12/85 +PTT (Switzerland) E2; ORF (Austria) E2a from 1500 onwards.

15/12/85 NRK (Norway) E2, 3 from 2140 onwards.

21/12/85 TSS (USSR) R1-5 (ch. R5 heard on scanner only); ARD (W. Germany) E3; MTV (Hungary) R1; NRK E2, 3 from 1200 onwards.

25/12/85 RUV (Iceland) E3 (at midnight).

26/12/85 SR (Sweden) E2; TVP R1; ARD E2; TVE (Spain) E2 from 0730-0930.

1/1/86 TVE E3 at 0830.

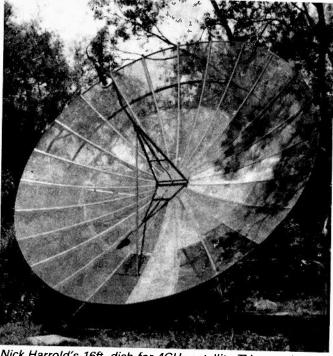
As usual then there was the characteristic mid-December opening. A thin month – my thanks to Iain Menzies (Aberdeen), Simon Hamer (Powys) and Reg Roper (Torpoint) for supplementing my meagre loggings.

The 50MHz Amateur Band

As mentioned in Teletopics last month (page 223) the band 50-50-5MHz has been allocated to class A licensed radio operators from February 1st, running in any transmission mode but limited to e.r.p.s of 14dBW carrier and 20dBW peak envelope power (for SSB). The transmitting aerial should not be more than 20m above the local terrain and must be horizontally polarised. No repeaters will be allowed. The situation will be reviewed after a year with a view to allowing class B operators use of the band. All precautions must be taken to avoid interference to Band I broadcasters elsewhere in Europe – should interference prove to be troublesome the allocation will be cancelled. There's every possibility of extending the band at a later date if no problems arise.

Another Threat to Band I

A recently received leaflet illustrating a new portable radiophone system being marketed under the Bohsei brand name, available through a telephone retailer in Brentford (though the leaflet is marked "export only"), represents another threat to Band I. The base station transmits in the 48.9-50.99MHz spectrum, using f.m. at 10W (into 50Ω). The portable unit, housed in a black brief case, features a push-button telephone, cassette recorder and transmitter/receiver system: it transmits in the 146-152MHz spectrum, at 10W. Both units are crystal controlled with a claimed range, subject to local terrain,



Nick Harrold's 16ft. dish for 4GHz satellite TV reception.

of 18-25 miles. The base and mobile unit can both be operated with a type 50/70 linear amplifier which provides up to 70W output with 10W input: ranges of up to 75 miles are claimed. The 48MHz output could be a problem for DX-TV enthusiasts but perhaps of more concern is the mobile 146-152MHz coverage since this is allocated to police communications following Band II re-engineering. The information has been passed to the appropriate authorities and hopefully problems will not arise.

From our Correspondents . . .

Hugh Cocks, formerlly resident in East Sussex, has moved to the Algarve, Portugal where he's busy producing and installing TVRO equipment for the 11GHz band. The Eutelsat and Intelsat signals there are some 6dB down on UK levels - 2.8m dishes are used to compensate for this. He comments that Moroccan Band III TV stations are well received during the evenings.

Nick Harrold has sent us a photograph of his homemade 16ft. diameter dish. It's fitted to a polar mount and is used in conjunction with a 110°K LNA and a Sat-Tec 5000 receiver unit. Sparkle-free reception across the 4GHz band is obtained down to 26dBW on half transpon-

der signals.

Terrestrial Interference Shield

Continental Satellite Systems, a US company, has introduced what it calls a terrestrial interference shield for fitting to dishes of its own manufacture. The shield consists of a sectional lip that fits to the rim of the dish. So far as terrestrial interference is concerned it reduces the focal length to 0.3 - the focal length for satellite signals remains at 0.36. This changed focal length reduces terrestrial interference by up to 12dB.

A Decade of Satellite TV

Satellite TV reception in 1986 usually means signals at around 11GHz - and for a few the lower 3.675-4.2GHz international telecommunications band. Yet ten years ago in 1975/6 a few enthusiasts were having their first experience of the joys and frustrations of satellite TV - at u.h.f.! These were the pre-Ekran (714MHz) days as well.

NASA launched ATS-1 in 1966. It was the first in a series of "application technology satellites" that featured on-board experiments covering solar measurement, telecommunications/propagation and other diverse packages. Of interest to TV enthusiasts was the sixth in the series (ATS-6) since this carried a high-power TV transmitter with f.m. video, the purpose being to establish the feasibility of low-cost receiving terminals and obtain general technical data. If you recall the beam was directed at India, whose government wanted to know whether a satellite broadcasting system for general entertainment and instructional programmes was a practical proposition. The craft had a thirty food parabolic aerial with ribs supporting a mesh, giving an f/d of 0.44. The equipment for uplink reception and downlink transmission was housed in a 54in. cube. The experiment was called SITE (satellite instructional television experiment) and was to last a full year from August 1975 to July 1976. The satellite was initially at 94°W where it carried out various communications experiments for a year. Moving it to 35°E for the SITE experiment took nearly three months. It arrived in the new orbital position in early July 1975. The TV uplink from Delhi or Ahmedabad was at 5.950GHz

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with the downlinks at 860MHz and 3.750GHz, using a 30MHz bandwidth. The Indian government installed some 2,500 direct receiving terminals and 2,700 receivers adjacent to existing v.h.f. transmitters for rebroadcast throughout the country. The broad objectives of the experiment were successful in establishing that transmission of wideband f.m. signals from a satellite at u.h.f. worked well. On the ground there were certain problems - where terminals were installed in remote areas without mains electricity for example. The experiment came to an end when the satellite was moved to 105°W for further research purposes.

Details were given in this column up to two years before the start of the SITE experiment. It was generally felt in UK DX circles that there was little chance of receiving the signals in the UK. How wrong we were! On Christmas Eve 1975 I received a Christmas card from Steve Birkill in Barnsley enclosing some dramatic shots of Indian TV which he'd received using a five foot dish, a head amplifier feeding a conventional u.h.f. tuner and an f.m. video demodulator. This started a flurry of activity. Various dishes were constructed from chicken wire, using a dipole/reflector arrangement at the focal point, with domestic preamplifiers. Before long reports of reception began to trickle in - some enthusiasts were using standard TV sets with slope detection of the f.m. signals. Perhaps the excitement was that it could be done, with poor to fair results, using normal DX-TV equipment with the addition of a simple dish. The cost was minimal and signals were received daily.

Professional broadcasters took an interest, including RTE, TDF, IBA (Israel) and RAI, but it was the

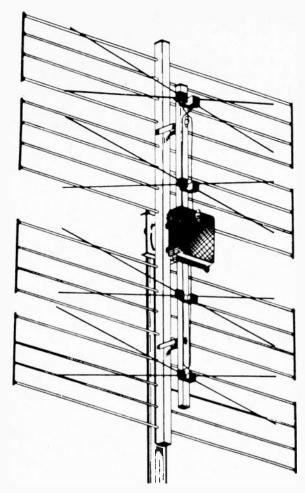


Fig. 1: The Jaybeam Model JBB/4 stacked bowtie array.

amateurs who proved that it was possible – Steve Birkill, Ian Beckett, Hugh Cocks, Clive Athowe, Reg Roper, Peter Jaansen, myself and a few others. All that was ten years ago and since then satellite TV for Europe has moved to 11GHz. This is much more demanding and amateur interest seems to have declined, presumably due to the cost and complexity. Where, I wonder, will we be ten years from now?

Bowtie UHF Aerials

The new Jaybeam "Aluminium Billboard" wideband u.h.f. bowtie array, Model JBB/4, was briefly mentioned in this column last month. This type of array has been popular for DX use for some years now because of its wide bandwidth, relatively level gain across the band (compared to a Yagi type array), minimal wind resistance and visual impact and the fact that it's relatively inexpensive. Such arrays are available from several manufacturers including Jaybeam, Triax, Wolsey, Fuba, Hirschmann and Wisi – some of these manufacturers supply other firms who market the aerials under their own names. Wolsey also have a two-bay version (the Colour Prince) which is mainly sold as a caravan aerial. Stacked colinear and broadside are other names for the stacked bowtie system. The Jaybeam JBB/4 is 80 cm high, 60cm wide and weighs 1.5kg. It has easy adjustment for vertical or horizontal polarisation.

There's some confusion about the performance of this type of array, particularly with respect to gain. The gain figures quoted by Wolsey for their Colour King are some 2dB or more up on a standard array, though no reference

standard is given. Aerial gain is normally in dB relative to a half-wave dipole (dBd). It's known for manufacturers to quote dBi figures (dB power gain with reference to an isotropic source) which add another 2·1dB with respect to the half-wave dipole standard. Wolsey quote neither dBd nor dBi. For the record we quote the following figures for the Hirschmann Fesa 805 Alu array:

Channels	21-31	32-41	42-50	51-60	61-68
Gain (dBd)	10dB	11dB	12dB	13dB	12dB
Front-back ratio	20dB	22dB	22dB	23dB	20dB
Horizontal beamwidth	50°	47°	42°	39°	37°
Vertical beamwidth	40°	35°	31°	29°	28°

The beamwidths are at the -3dB (half power) points. The vertical beamwidths are smaller because of the phase cancellation produced by stacking the dipoles side by side.

Early versions of this type of array used solid aluminium bowties. It was subsequently found that an equivalent bandwidth product could still be obtained after cutting away the central part of the bowtie to leave a skeleton outline – stiff rods normally subtending an angle of 30°. The four-bay, full-wave dipoles are stacked with half-wave spacing between each bay, the spacing between the dipoles and the rear reflector screens normally being between 0.15 and 0.2 wave - at mid-band. To ensure inphase coupling of the bays and a predictable main lobe the feed lines between the outer and inner dipoles are reversed. The reflector screens are usually at least 0.25 wave greater than the bowties all round to give a good front-back ratio figure: some imported versions have the reflector screens bent round at the edges for optimum front-back performance.

The full-wave stacked bowtie system is coupled with balanced line and the nominal output impedance at the centre point is 300Ω (the dipole stack/reflector screen spacing is set to give the desired impedance). Where balanced ribbon feeder is used the downlead connection is at this point. Where coaxial downleads are used – in the UK for example – a balun is used at the centre point to get correct wideband matching to the feeder. Imported W. German/Dutch arrays are normally supplied with details for either type of connection.

A stacked bowtie array works well for DX/weak signal use, the wide vertical capture area producing an even response from a transmitter over its four channels. Aerial riggers often find that a Yagi array at a difficult location gives two good channels, one not so good and the fourth awful: moving the Yagi shuffles the combination about but you inevitably end up with unequal signal levels. The bowtie array will often overcome this problem. The relatively wide forward beamwidth with horizontal polarisation is a problem for DX use, but stacking two arrays in close proximity, coupled using a wideband coupler such as the Triax stripline 720/U, will substantially reduce the beamwidth and increase the power gain by almost 3dB.

I've used twin Triax grids for some two years at my location, which is pretty poor for reception, and have found that the results are good compared to those achieved with a multi-director Yagi array. The Triax grids work well down to the ATV 435MHz band and have even given useful reception at 1,300MHz (ATV again), the arrays still maintaining their directional characteristics!

My thanks to Jaybeam and Hirschmann for information provided. For further reading I suggest the ARRL Antenna Book and the aerial section of the RSGB's VHF/UHF Manual.

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £1-50 cheque or postal order (made out to IPC Magazines Ltd.), the query coupon and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.

SONY KV2062UB

There's bowing at the sides with bent verticals. Adjusting the pincushion amplitude control won't correct the problem without bending at the top and bottom edges. The set seems to have had the fault from new.

If the set is an early one (serial number below 561100) try replacing R808 with a series combination consisting of a $1.8 k\Omega$ fixed resistor and a $3.3 k\Omega$ preset. If adjustment of this preset doesn't improve the situation it's likely that T802 has insufficient inductance. Replace it (part no. 1-421-610-00).

NATIONAL TC261G

This set gives a very snowy picture at switch on. If the aerial plug is disconnected then replaced the picture usually returns to normal and stays all right until the set is switched off and on or there's a break in the transmission. We've tried replacing the aerial socket, also the three i.f. amplifier transistors.

The problem could well be due to a fault in the a.g.c. circuit. Try putting a fixed potential of 5V on the tuner's a.g.c. pin, i.e. across C1003. If normal operation is obtained, check the AN331 "jungle" i.c. (IC301) and R102 (68k Ω) in the i.f. a.g.c. feed network. If the fault persists the tuner itself is suspect.

GEC HYBRID CTV

This set still has a good tube and I'd like to use it with a VHS VCR. The trouble is jitter on playback and occasional loss of line hold on picture search. Are there any recommended modifications to this chassis for VCR use?

Normally these sets don't require any modification for VCR use. We suggest you check the flywheel line sync filter capacitor C505 (0·01 μ F), the discriminator block D500 (FSY41A) and C69 (150 μ F) which smooths the HT3 line used by the sync separator transistor, then if necessary try reducing the values of the anti-hunt components R508 (33k Ω) and C506 (0·1 μ F) by up to fifty per cent. Ensure that any such modification doesn't impair normal off-air reception. It may be worth checking with another VCR to ensure that the one being used is not faulty or in need of a service.

RANK T22 CHASSIS

After replacing the line output transformer and line generator chip and carrying out repairs to the scan board this set is now running nicely except for no colour. The three decoder chips have been replaced and shorting test points TP9/10 to override the colour killer produces unlocked, horizontal colour bars.

The fact that unlocked, floating colour bars are produced when the colour killer is overridden indicates that the reference oscillator is way off lock. This will give the no-colour symptom. Try replacing the 8-8MHz crystal X1 then if necessary check the trimmer VC1.

ITT FT110

The problem with this set is jitter that affects the top of the picture more than the bottom. It's intermittent in that the fault is not present every time the set is used. Switching off and on again sometimes clears the fault.

This could be a nasty one, involving tedious component substitution checks. Start with C719 $(100\mu\text{F})$ which smooths the supply to the line oscillator, then check the following items in the flywheel line sync circuit: diodes D701/2, C714 $(0.47\mu\text{F})$ electrolytic) and R713/4 (both $2.7M\Omega$). If necessary check the sync separator and line oscillator bias resistors R702 $(3.3M\Omega)$ and R721 $(1M\Omega)$ respectively, also for smooth operation of the line hold and horizontal shift potentiometers.

GRUNDIG 8635GB

This set works all right on BBC-1 but the other channels appear to be unstable, with line jitter: there's also very unstable video from a VCR. The contrast seems to be low on the poor channels – I suspect the i.f. amplifier chip. The aerial installation has been checked.

This sort of thing is very often due to an a.g.c. fault. It would be as well to check the a.g.c. smoothing/decoupling capacitors before replacing the chip – indeed replacing all the electrolytics in this area should help.

FINLUX PEACOCK 67990

There's colour only when the tuning is right at one end of the channel, i.e. almost off tune. The colour then obtained is locked and steady but rather weak.

The a.c.c. control range is not very great with this model. It can be improved by interchanging R03 $(1.2k\Omega)$ in the chrominance module with R01 $(12k\Omega)$ in the colour sync module. Set the a.f.c. by carefully adjusting L1 on the a.f.c. module for correct tuning: leave the tuning door shut when you do this.

ITT VC300 CHASSIS

The problem is field collapse. T12 (BC140/10) in the field output stage was found to be open-circuit but a replacement has failed to cure the fault. The other transistors in the amplifier/driver/output stages have also been tried. The voltages are only slightly different from those quoted in the manual and there are no obvious faults such as print breaks or dry-joints. The flyback diode and the electrolytics in the output stage have also been checked.

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TELEVISION MARCH 1986

It's difficult to fault find in this d.c. coupled circuit without a scope. Use of a scope to check the waveforms would quickly indicate whether the failure is in the oscillator or amplifier sections of the timebase. As you've checked the most likely culprits in the amplifier/output section it could well be that the oscillator is at fault. If the two transistors here (T6/7) are o.k. check the components in the timing circuit, R77 $(100k\Omega)$ and C65 $(0.33\mu F)$ – these have been known to stop the oscillator.



279

Each month we provide an interesting case of TV/video servicing to exercise your ingenuity. These are not trick questions but are based on actual practical faults.

For several years now most GEC sets have been fitted with Hitachi chassis. The reliability of these chassis is excellent – none more so than the NP8CQ, which was the subject of a servicing article in our June 1985 issue. It's rare to find one of these in the workshop, rarer still to have to struggle with it!

The set we had was in fact an Expert Model C2261H, which is basically the GEC C2255H. The symptoms were complete lack of sound and vision: there was no e.h.t. and the tube's heaters were not lighting up – their supply comes from the line output transformer. Since it was a Saturday morning and the workshop radio was tuned to one of those "remember the sixties" pop programmes your scribe's mind went back to the TV sets he used to repair in the days of the Beatles and the Rolling Stones. No i.c.s, no choppers – and no faults like this one! Lashing Radiospares' dropper sections into pre-BEAB sets, diagnosing open-circuit heaters with a flick of the neon screwdriver, cleaning system switches – no-go sets were easy to sort out then. But we digress.

The e.h.t. could be heard to rustle up at switch on, and some minutes were lost in finding out that the e.h.t. voltage appeared fleetingly at switch on then disappeared, as did the 108V h.t. supply from the chopper circuit. Some sort of power supply problem then.

Investigation of the power supply revealed that there was virtually no voltage on the 108V and 54V lines while a low-pitched squeal was coming from the chopper transformer (T901). An oscilloscope check at the collector of the chopper transistor (Q901) produced a display of very narrow needle pulses at a low repetition rate. Knowing that the thick-film module CP901 (HM9102) which supplies the error amplifier with reference and feedback voltages can misbehave we fitted a replacement. This didn't have the slightest effect. Cold ohmmeter checks

were carried out on the error amplifier (Q902) and driver (Q903) transistors in circuit. There were no obvious shorts or open-circuits. Each time the set was switched off however the squeal would continue for a second or two after which there would be a brief burst of energy, with a clear line whistle and the momentary appearance of the e.h.t. and first anode voltages, and presumably scanning energy as well.

If every stage in the set seemed to be capable of working, even if only for a second or two at switch on and switch off, there was little point in looking for the sort of excessive-loading faults one might otherwise have suspected. Instead we hooked up a variac and slowly wound up the mains input to the set. This was much more rewarding! At about 32 per cent of the mains supply the set would perk up and produce about 80V across the h.t. reservoir capacitor C909 on the output side of the chopper transformer. When the tube's heaters had had time to warm up a raster of sorts could be seen, with blurred snow. As the variac was wound up to give 40 per cent of the mains input the raster filled out and a good, locked picture could be tuned in. Further increments of the variac pushed the 108V h.t. line beyond its normal voltage, and at around 120V the set shut down, reverting to the lowpitched squeal condition previously described.

The experiment was repeated with a voltmeter connected to the collector of the error amplifier transistor. This showed that the voltage here rose dramatically as the 108V h.t. line reached and then passed its correct level. At this point the diagnosis was almost complete. What more was required? See next month.

SOLUTION TO TEST CASE 278 - page 260 last month -

Last month's test case was not quite the horror it sounded – in fact it was quite a simple one, the answer being summed up in the last few sentences of the story. You'll recall that the set, a Decca receiver fitted with the 70 series chassis, had an intermittent fault: the supply lines would rise in voltage during the second or two before the chopper transistor blew up.

The main possibility in a circuit of this type, with separate secondary windings on the chopper transformer feeding half-wave rectifiers, is a chopper drive waveform whose duty cycle is incorrect. This implies that the control i.c. is failing to give the required regulating action. In addition the over-voltage facility was inoperative, and the only discrete component likely to have been responsible for this (the voltage sensing zener diode) had been eliminated from the search. Both these factors pointed the finger of suspicion at the TDA2581 chip. And so it was: fitting a replacement restored correct operation on a permanent (we hope!) basis.

We had a similar situation with a Ferguson Model 37340 (TX10 chassis). In this case the chip is a TDA2582 which is presumably a later version: it was blowing chopper transistors as quickly as they could be fitted.

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BA157	6р 12р	BD204 BD222	31p	BF461 BF462	60p	BU500 BU526	110p 80p	TIS44 TIS61	40p	2N.3905 2N.3906	11p 11p	1.3W Zener	s	ECC85 ECH81	40p 49p	CA3240E HA-1156W	90p	T2800D 52p TA-7120 55p	UPC-1182H 15 UPC-1185H2	74LS125	85p 36p
BB101 BB103	13p 16p	BD225 BD232	31p 31p	BF469	62p 30p	BU801 BU806	95p 120p	TIS88A TIS90	45p 15p	2N.4031 2N.4036	25p 25p	8ZX61 Ran 2V7 to 39V	12p	ECH84 ECL80	52p 57p	HA-1197 HA-1306W	150p	TA-7137P 83p TA-7146P 400p	UPC-1350C 15	P 74LS132	42p 44p
BB105E BB205E	18p 24p	BD234 BD235	32p 28p	BF470 BF471	28p 28p	BU807	95p	TIS91 TIS93	18p 20p	2N.4037 2N.4058	25p 13p	JAPANES! TRANSIST		ECL82	59p 57p	HA-1319 HA-1339	250p	TA-7193P 400p TA-7200 200p	74LS SERIES	74LS133 74LS136	34p 35p
BC107 BC108	7p 7p	BD236 BD237	30p 21p	BF479 BF493	30p 18p	C106D MJ2500	23p 100p	VK1010	88p	2N.4443 2N.4444	76p 76p	2SB324	55p	ECL84 ECL85	57p	HA-1342	170p	TA-7201 200 p TA-7203 180 p	74LS00 1	7p 74LS138 7p 74LS139	38p 40p
BC109 BC115	7p 10p	BD238 BD244	24p 50p	BF494 BF595	16p 16p	MJ2501	110p	VN.10KM VN.46AF	60p 88p	2N.5061 2N.5294	20p 30p	2SB507 2SB754	68p 80p	ECL86 EF80	49p 31p	HA-1366W	160p	TA-7204 110p TA-7205 80p	74LS02 1		83p 120p
BC118 BC140	11p 19p	BD245 BD433	50p 28p	BF596 BF597	16p	MJ2955 MJ3000	55p 115p	VN.66AF VN.88AF	100p 115p	2N.5296 2N.6106	30p 40p	2SC495 2SC1060	6Ср 99р	EF85 EF89	34p 43p	HA-1368 HA-1377	160p 220p	TA-7210 200p TA-72222AP	74LS04 1	7p 74LS148 7p 74LS151	110p 38p
BC141 BC142	19p 19p	BD434 BD435	30p 31p	BF615 BF758	30p 41p	MJ3001 MJE29A	115p 30p	VN.89AF	110p	2N,6107	40p	2SC1061 2SC1096	200p 78p	EF183 EF184	45p 53p	HA-1389 HA 1392	140p 230p	120p TA-7310P 100p	74LS08 1	7p 74LS153 7p 74LS154	42p 100p
BC143 BC147	19p 6p	BD437 BD438	28p 36p	BF869 BF870	22p 22p	MJE30A MJE340	30p 25p	ZTX107 ZTX108	11p	2N.6109 3N.128	40p 55p	2SC1161 2SC1172	110p 150p	EL34 EL36	190p 60p	HA-1397 HA-1398	250p 240p	TA-7609 270p	74LS10 1	7p 74LS155	51p 49p
BC148 BC149	6p	BD439 BD440	40p	BF872 BF960	23p 38p	MJE350 MJE520	80p 30p	ZTX109 ZTX212	12p 27p	3N.143 DIODES	6 5 p	2SC1306 2SC1307	90p	EL84 EL95	50p	LA-1201 LA-1352	85p	TAA550 16p TBA120S 45p	74S12 1	7p 74LS157	35p
BC157 BC159	6р	BD441 BD442	40p 40p	BF963 BF964	40p 38p	MJE2955F OC28	90p	ZTX300 ZTX301	13p 16p	AA119 BY100	9p 40p	2SC1678 2SC1969	120p 130p	EL500 EL504	80p	LA-1365 LA-3301	140p	TBA395 60p TBA396 80p	74S14 3	Вр 74LS158 Ор 74LS160	47p 52p
BC182	6р 6р	BD533	50p	BF966	40p 25p	OC29	80p	ZTX302 ZTX303	16p 24p	BY103 BY126	32p	2SC2028 2SC2029	75p 120p	EY86 EY87	31p 31p	LA-3350 LA-3361	120p	TBA520 100p TBA530 100p	74LS20 1	7p 74LS161 7p 74LS162	56p 50p
BC182L BC183	6р 6р	BD534 BD535	38p 38p	BFR40 BFR51	21p	OC35 OC36	100p 120p	ZTX304 ZTX320	17p 29p	BY127 BY133	8p	2SC2078	120p	EY88 EZ35	42p 45p	LA-4030 LA-4031	200p 140p	TBA540 100p	1	7p 74LS163	50p
BC183L BC184	6р 6р	BD536 BD537	38p 40p	BFR62 BFR79	21p 25p	OC45 OC71	50p 30p	ZTX326 ZTX500	29p 13p	BY164	8p	SOCKETS	FILE	EZ80 EZ81	50p	LA-4032 LA-4050	140p	WE ARE HOLD	US FOR TYPE I	AND QUOTAT	
BC184L BC212	6p	BD538 BD675	40p 40p	BFR90 BFR91	52p 99p	OC72 OC200	50p 180p	ZTX501 ZTX502	13p 18p	BY176 BY179	85p 35p	8pin 14pin	5p 3p	GZ34	180p	LA-4051 LA-4100	160p	Please send 50p	EN FOR LARGE P&P and VAt at	15%. Govt, Co	
BC212L BC213	6р 6р	BD676 BD677	40p 38p	BFX29 BFX84	20p 20p	R2008B R2010B	100p	ZTX503 ZTX504	18p 25p	BY182 BY184	32p	16pin 18pin	9p 12p	PC97 PCC85	100p 42p	LA-4101	100p	quantities. Pleas	epted. Quotation allow 7 days for	r delivery. All	brand-
BC213L BC214	бр 6р	BD678 BD679	40p 40p	BFX85 BFX87	20p 15p	TAG4443	76p	ZTX550	24p	BY187 BY196	32p 20p	20pin 22pin	14p 13p	PCF80 PCF200	58p 135p	LA-4102S LA-4112	250p	new Componen	s. All valves are	new and boxe	d.
BC214L BC237	6p 7p	BD680 BD681	40p 45p	BFX88 BFX89	15p 60p	TAG4444 TIP29	76p 15p	2N.696 2N.697	26p 22p	BY206 BY207	11p	24pin 28pin	18p 20p	PCF801 PCF802	110p 57p	LA-4125 LA-4140	210p 70p	GRA	NDA.	ΓΑ L	TD!
BC238 BC300	7p 16p	BD682 BDX32	45p 100p	BFY17 BFY18	30p 40p	TIP29A TIP29C	22p 25p	2N.698 2N.699	40p 45p	BY208 BY210	18p 22p	40pin	25p	PCF806 PCH200	115p 100p	LA-4201 LA-4220	120p		ADWAY, P		ROAD.
BC301 BC302	18p	BDX65 BDY92	80p	BFY41 BFY50	28p 14p	TIP30 TIP30C	25p 30p	2N.706A 2N.708	22p 22p	BY223 BY225	72p 120p	VOLTAGE	ORS	PCL81 PCL82	54p 63p	LA-4400 LA-4420	190p 140p	WEMBLE	Y, MIDDLES	EX, ENGL	AND
BC303	18p	BF180	16p	BFY51	14p	TIP31A	24p 30p	2N.914	28p 36p	BY226 BY227	18p 19p	7805 7812	35p 35p	PCL84 PCL85	50p 55p	LA-4422 LA-4430	130p		01-904 20		
BC327 BC328	6р 6р	BF181 BF183	18p 20p	BFY52 BFY56	14p 25p	TIP31C TIP32	24p	2N.918 2N.930	18p	BY228	32p	7815	35p	PCL86	55p	LA-4460	170p	Telex	No: 932 88	5 (Sunmi	t)

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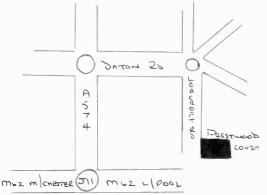
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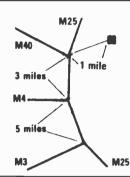
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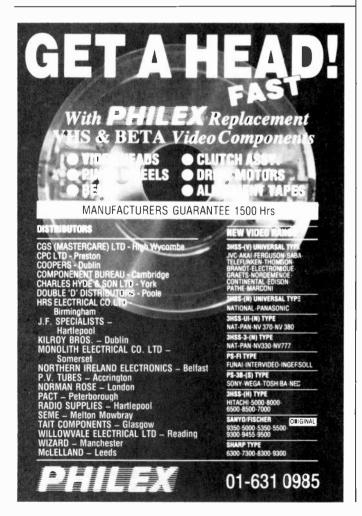
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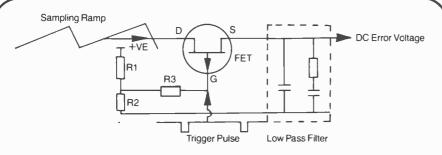
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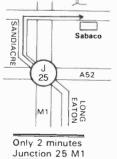
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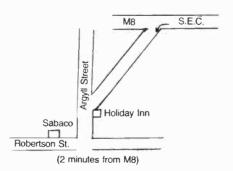
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TA 4145 £1	TIP 41B TIP 41D	40p 70p 30p	15K-20 turn pots 20p Thorn panel 6×100 pot +	Texas Viewdata Decoder VI Issue 3 with all IC's	OP 12/80 £10,00	TO	Mixed Packs
HA 11710 £1 TA 4188 £1	TIP 42/BRC 6109 TIP 48	40p	changeover switch (Irish) 50p Battery converter TA 75 for	Quantity Reductio	ns	Replacemen	ower Trans RCA 16182 NPN nt for BD124 and Mounting
TA 4197 £1 TA 4183 £1	TIP 49 TIP 57	30p	colour TV, 12/24v Thorn 3787 £6 Thorn 3500 2A cut out 50p	BY204/4 BY206	25 for £1.00 25 for £1.00	Kits 50 Mixed A	AC series Transistor £4.50
TA 4197 TA 4183	TIP 100 TIP 102	30p 30p 30p	Stereo GEC amp 20 watt + pre-	W005 bridge KT3 touch button black	20 for £2 6 for £1		ount rocker switch 250V/
TA 4195 £1	TIP 115 TIP 117	50p	anip with 4 pots + mains power unit with circuit £6	G11 touch button red K30 full remote Dawer Ass	6 for £1	25 Panel M	lount Bulbs & Neons £1.50
TA 4177 £1	TTP 120 TTP 125	50p 50p 35p 35p 30p 25p 30p	SPECIAL OFFER Decca-TTT etc.	I.C.	£7.00		£1.50 d/yellow/green £1.50
TA 4192 £1 TA 4146 £1	TIP 130	30p	FEO4/1/250AC/4	K30 VHF. UHF Dawer Ass BY298 3 amp/fast/R	20 for £1.50	201/C Hold 20 Large L	
The Service Engineers Guide to Teletex £1.50	TTP 131 TTP 136	30p	Mains filters (grey type) × 4	BU126 BU205	10 for £6.00 10 for £8.00	20 Small L	
Teletex Colour Training Manual £3	TIP 140 TIP 640	50p 50p	80p BRIDGES	BU105 2SC2122A	10 for £6,00 10 for £8,00	100 Transis	stor £2.50
Mains Trans C. Core 240v 4v+4v	TIP 2955 T 6032	50p 35p 30p	SKB 2/08 L5A 30p KBL 005 30p	BF458	10 for £1.00	20 Converg 10 Thermis	tors 50p
4v04v 2AMP 12v lamp £2	T 6036 T 6040	40p 40p	KBL 02 30p	BD136 BF224	10 for £1.25 20 for £1.40	20 Slider P 30 Presets	ots £1.00 50p
Mullard split diode AT2076/80 £6	T 6047 T 6049	40p 40p 40p	KBP 04 30p W02 15p	OA90 BYXI0	40 for £1.00 100 for £4.00		thermistors, degaussing, HT, £1.00
4 Types Fedility front	T 6051 T 6052	40p	W004 15p W005 20p	KT3 multicaps 50 Ceramic Condensers	10 for £7.50 £1.50	40 glass rec	ed switch £1
panels with i.e. & pats £2 each	T 9004 T 9005	40n	AT 2076/35 £7 AT 2076/55 GEC split diode	Mixed Mounting Kit for Pov	ver	40 Pots	make switch 70p £1.50
Amstrad TV chassis Complete damaged	ZTX 107 ZTX 108c	40p 10p 10p	transformer £10	Transistors 300 Condensers	50p £1.50	5 Tube Bas 1,000 Diod	ses £1.00 es, Condensers, Resistors on
print £5 + £5 post BB 103 10n	ZTX 109k	5p	AT 2048/11 LOPTI Mullard £2.50	300 Resistors 150 Electrolytics	£1.50 £2.00	Bandolier Lucky Dip	£2.00
BB 105A×12 £1 BB 105B×12 £1	ZTX 213 ZTX 341 ZTX 342	5p 5p 10p 10p	H1520 Multimeter 20,000 Ohms per volt. Fuse & Diode protected £17.50	15 Bulbs Antistatic Discloth	40p 5 for £1	Jungle Bag	5Kg £5.00
BB 105G×12 £1 BB 121a 10p	ZTX 384	10p	Huachi Split Diode 2433752 £6 K35 Split Diode £6	100 Diodes	£1.50	20 Knobs 20mm Fuse	
47 10p each	ZTX 451 ZTX 550	10p 10p	Z918 Front Panel with Mains Switch &	OFNIBE C		Chassis Mo IN4001/6 I	ount 20 for £1
A 823A chassis Scan drive £5 IF £3	MJ 2253 MJE 3040	60p 60p	Thorn Chass 13916D Compleat £10	SENUZ Co	MPONENTS	EHT Diod	
Scan control panel £3 NEW A31/510 tubes	MJE 2209 SP 8385 SA B 2206	10p 50p	K3-K30 Hand Set Repaired £8 Thorn TX9 Remote Panels with	TO ORDER SEE BA	ACK PAGE	20 Mixed 5	Switches £1
NEW A31/510 tubes with s/coil £6 + £2 post	SAB 3205 SAB 4209	00.13 00.13	I.C s £2.50 Thorn 9000 4 Slider Front Panel £4				-

SENDZ	COMPONENTS EE BACK PAGE	NEW Pack THORN 17 off Manual NEW 1617 THORN Chasses with ICs & Al 30V Power Supply 500M A 4×21/4 Pvc 731 Power Panel (Dayled Universal Thisland	H13	£5.00 £5.00 £2.50 £13	Tube Thermpath 167 £1.00 Rank Secam Decoder Panel UHF & VIIF T115A £13.00
TO ORDER SE Thorn Spares New 9000 Decoder \$8.50 9000 Frame panel £8	K35 Decoder £8 K35 Sound OP £4	6 Drode Universal Triplers NEW PYE 725 line O/P panel with L O P 1 NEW GEC 20AX Power Supply Switch M Complete new GEC portable chassis M120 v.cap/LOPT1	:xde	£4.00 £10.00 £12.00	Multi-Caps 4,7(0)/75 6 amp Rip £2,00 350V 300M + 300M £1,00
9000 Cyclops panel £1.50 8000/8500 timebase panel £8 8800 convergence panel £6	£10.00 Hitachi 2A/1500V metal case wire end	Field + Jungle panel for GEC 3133/3135 GEC 2110 line panel with transformer GEC 2110 tuner unit + IF Panel		£1.50 £7.00 £12.00	400V 400M 60p 350V 400M 60p
8500 convergence panel £6 4000 Power supply £3 1600 Mains lead, switch	FARST/REC 10p Fidelity Tube Base with transitor & focus pot £1.50	Pye/Chelsea Line op panel Pye 205 T/unit Pye 205 Line op panel		£12.00 £3.90 £7.50	Thom 3500 175/100/100/350v £1.00 KT3/200/25/25/385v £1.00
3500 6 push button + cable form£1.50 T605 IvNPN T066 80v/6A 10p	Bush Tube Base on panel £1.00 Line Transformers	Pye 713 IF panel and tuner Pve 713 Chroma Pye/Chelsea Timebase panel with I OPTI		£7.00 £10.00 £10.00	300+300+150+100+50MFD 350V £2 47/220/350v 60p
9000 Sound output panel £1 3500 Focus unit £1.50 3500 Mains Trans £4	1984 £13	Pye 731 Frame Panel Pve 731 Convergence Panel Pye 731 Chroma		£5.00 £5.00 £10.00	150/150/100/100/100/320v £2,00 2500/2500/63v 50p
3500 eut outs 10 for £4 3500 H- panel £2 3500 Frame panel £3	G8 Symmetry Coil £2.00	Pye 731 IF panel + tuner Pye CDA/205 panel GEC portable chassis + LOPTI 2114 New		£10.00 £6.00	150/200/200/300\v 70\v 400/400/200\v £1.70 300/100/100/16/275\v £1.50
3500 Line panel £3 3500 A1 Diode 20p Export 3500 IF panel £2	G11 Split Diode £12,00 CVC820 Split Diode IT1 £10,00 Thom B W AD5308F + Stik +	The photoic classis + EOF 11 2114 New Thorn 1613/1713 chassis G9 Power Panel Mono RANK Chassis 127A NEW		£4.00 9.75 £6.00	100/209/325v 40p 150/150/100/375v £1.50 300/300/100/32/32/300v 2.00
IC board with set of SN74LS £1 4000 Tube base £4 3500 A1 pots 50p	1690 Thorn EHT over-wind with diode lead & anode cap £2,50	NFW G9 Frame Panel NEW G11 IF Panel	110070	£10.00 £10.00 £7.00	1500/2000/30v 50p Jelly pot Thorn (0)D4/013 £3
Beam limiter panel £1.50 3500 Power panel with Y969 £1 3 Way regulated adaptor 240V 6V/	GEC 2040 £3.00 GFC 2110 £7.00 Mullard A l' 2036 £1.50	NEW MULLARD TELETEX	3300/70 1/100 1/100 × 10	50p 5p 30p	100/350 + 300/200/100/15/275v £2.00 225+25/380 GEC 70p
7.5/9V/300mA £3.50 Rank/Toshiba preh unit 0354 £9.50 2 banks of 3 PB unit. Pve 731 £2	Pye 169 Line Trans £3.00 Pye mono £3.00	G8 Power Supply	22/100 4.7M/100 470/100	10p 5p 20p	200/100/100/350\ £1. 50 500/500/25\ 50p 150/150/100/300\ 75p
4 Push button unit preh 6 Push button VHF/UHF for v/cap. GEC-Decca type £7.00	Split Diode Trans £7.00 GEC 20 AX Rank Z522 £3	G8 Chroma £3.00	2000/100 4700/100 47/160	70p 75p 10p	200/150/150/300v 1.00
7 Push button for CVC5 IT1	CVC 5-8-9 £3.00 CVC 20 FIT £3.50	G11 IF Detector £3,00 G11 Selector gain module £3 Complete CVC 825 Chassis (both	300 300/300V 800/160 1/250 Pulse	80p 50p 5p	FTT 8 and 6 Push Button £1.00
KT3 (Export) 12 P.B.u £2 6 Push button Unit Thorn £1.00	CVC30 ITT £5,00 CVC32 Line Tran £4.75	panels) £40.00 AEC V/Cap Resistor Unit UHF with IC SAS660 SAS670 £3.00	2.2 250v 3n3/250 A.C. 33/250V	10p 10p 20p	CMD 800 Chassis. No tuner £20,00
6 Push button Unit fits GFC & Decca etc. Hearing aid unit Rank 2718 4 P/B/Unit MFCH £4	CVC 40 Slip/Diode £12.00 CVC 45 £5.00	Z714 RANK IF Panels 6MHz 1 LC SL437F £3.00 Z909B RANK IF Panels	.39/250V 4n7/250 tested 5KV .91/250	15p 25p 35p	
7 Button Unit GEC with Lamps £7 Bush T515A 6 button unit with Pos &	GEC Portable G10T2041 £3:00 GEC Portable G10T2046 £3:00 E1f1 Split Diode Leads ITT £1:00	Export 5.5MHz 2 L.C.'s FBA1205B TCA2705Q £2.50 K35 II- £6.00	.91/4(0) 22/250 47/250	30p 15p	FAG 226/600 50p BD 650 50p UPC 574 30p
mains lead. 6 bush buttons. Bush£6.00 697 Push Button Unit £6.00 Mains Droppers	3500 LOPT & HTT Frans each £2 LOPT Rank Z763 £5	Z743 RANK IF Panel Export 5.5MHz 3 LC's 1BA750+SC9504P+	100/250 G11 470/250V	10p 20p £1.75	BSS 38 30p
G8 2R2+68R £1.25 G8 47R 15 watt 75p Pye 731 3+56+27R 50p	KT3-30 BG 20043 £6.00 ITT CVC 5-8-9 £3.50 Rank F251 E Tripler £2.00 Rank IHCP A823 £3.50	SC9503P £1.50 Pye G11 Front panel with transducer,	GEC'600/250 7(0)/250 3(0)+3(0) MFD 350v	60p £1 £1.00	WT 456 £1.00
Pyc 3R5/15R/45R 50p Thorn 50/17/1K5 £1.00 120/20/20/48/117 £1.00 270/10/6 for Thorn 4000 50p	Rank 111CP A823 £3.50 TU 25 30K Rank £3.00 11 TEZ Rank £3.00 G9 Philips £4.00	pots, tuner pots, 6 pb switch+lead £5.00 Pye 6 button switch portable £1.00 GEC V/cap VHF/UHF tuner and HF+ sound O/P PC 7(6B3 (Export) £12.00	800/250 32/300 4/350 8/350	40p 20p 5p 8p	1.M 317T 30p
18/320/70/39 £1.10 Thorn 50-40R-1K5 50p Ac Socket & Lead GEC, ITT. Philips, Pyc 25p	GFC 2110 £4.00 3500 Thorn £3.00 9000 Thorn £5	## 2110 GEC Power Panel ## 28,00 GEC Power Supply (Export) ## 10,00 GH dynamic correction panel ## 26,00 GH dynamic correction panel ## 26,000 GH dynamic sorrection panel ## 26,000 GH	4.7M/350v 33/350 220/350 300/350	10p 20p 30p 40p	AF 114 50p
7×3 ³ / ₄ Thorn £1 Thorn 1600-1700 £1.50 Rank Toshiba Tube Bases 30p		CVC 20 Front panel with sliders + mains input panel CVC 40 PUSH BUTTON ASSY with sliders, complete with lamp assy +	400/350 10/375 22/375 220/385	50p 10p 15p	FET Power VN88AF 50p
Speakers Pair 25 watt 4Ω speaker & tweeter in cabinet £15.00	TVK 76/9 £3,00 G8 £4.00 CVC 825 ITT CVC 20/25/30/32 £3.50	pots £14 CVC9 slider pots panel 50p CVC 5 Mains on/off + 5 pots £2	330/385 CVC 820HT 0 1/400 KT3 E/W .39/400	15/6	PHILIPS SBC 469 Stereo Microphone £23.00
6×4 G11 25 ohm £1.00 5½×2½ 3 ohm £1.00 5×3 80 ohm 70p	Decea 80 100 £4.50 Grundig FVK 52 £2.50 11 FBQ Pye 731 £3.00	Universal Focus, Fits Pye, Thorn and Decca Units. T147 Rank tube base on panel £1,00	56K/400k 47(N)pf/400 22/400	20p 20p 10p	Meters Hills 5 £17,00 Meters Hills 420 £15,00 Infra-red Tester Handset £12,00
5×3 50 ohm 50p 5×3 35 ohm 70p 6×4 15 ohm £1.00	11 THY £4.00 D22 for Pye 18" colour portable £4.00 LP 1193/63 £4.00	Z718 Focus Unit	8-400 3-34-40 4-40-40	10p 15p 20p 40p	Titla-red Tester Francisco
7×3 70 ohm £1.00 8×5 8 ohm 15 watt £2 8×5 8 ohm £1	BG 100/41 £3.25 I'/text ultrasonic rec'r panel Video cassette lamps on lead,	Decca Small 75p KT3 Focus Unit 75p K30 Focus Pot 75p	394K/400V 220/450 47/500	20p 40p	Repaired Handsets Philips K4-K35, RC535#-RC5300, RC5370, RC5375, repaired same day
5×3 8 ohm 70p 7×3 16 ohm £1.00 5" dia 16 ohm £1.00	12-14V. 50p or 3 for £1,00 20 for £5,00 200 for £25,00 GEC 8 touch unit assy complete with	K30 Fube base on panel £1.00 TX10 Focus Units £7.00	0.1/600 0 1/1200V wire end	15p 20p	£10.00 KT3-30 repaired same day £8.00
5" dia 8 ohm £1.50 6 ¹ / ₂ " dia 4 ohm £1.50 6 ¹ / ₂ " dia 3 ohm £1.50	all I C's + pots £4.00 GH E W Transformer 50p GH E W coils £1.00	CVC 32 Focus Unit 75p Fedility Focus Unit 14R-14S 30p 3500 Thorn Focus Unit £1.00	0.1/450 A/C wire end .047/600 0.047/1000	20p 15p 10p	GFC Full Remote Infra-red, 1983 models
23/4" dia	G11 Transient Suppressors 245V 10 for £1.00 G11 Scan Coils £5.00	Z718 Bush Focus £2.00 Diode 50p	0.01/1000 0.1/1000 47/1000v	10p 65p	£15.00
K13 speaker K30 75p 3" dia 15 olim 60p 1690 5×3 12 olim £1	G11 100K tuner pots 12 for £1 KT3 II- panel £6.00 KT3 line OSC transformer £1	Remo IVI2SP 50p 1600 Thorn EHI Rec and Lead 50p	.47/250V A.C 001K/1250 0.0047/1500	10p	Timers, 60 mins, small £1.00
K45 Philip 15 ohm 75p K30 15 watt £1	K I 3/K 30 infra-red receiver head £1 K 30 drawer unit with IC's	TV13 S0p TV14 S0p TV18 60p TV18	005/1500 0105/1500 In8/1500		G11 Ultrasonic Teletext Handset £24.00
OI-550 E.W. 10p OF-513 correction 10p OF-557 50p	(home) £10 K30 drawer unit with IC's (export) £10	TV20 £1.06 50p Thorn 14/1500 rec stick 5p	2n0/1500 2n2/1500 .01/1600	15p 15p	8 C.H. Ultrasonic GEC Full Remote C2014H/C2219H £15.00 New Replacement for G11 Ultrasonic
BY 126 BY 127 10p	KT3 AE Sockets 50p KT3 receiver panel £8 KT3 line driver transformer 50p	G11 drawer ASS 3 pots Mains switch and lead £2.00	G11.8200/2KV 0.1/2KV 10n/2KV	20p 15p	Full Remote £12.00 Thorn 4000 insert with 7 buttons Decea RC 11 £5.00 £14.00
BY 133 10p BY 134 10p BY 164 50p	Pve, K30, GEC, etc. Pre-mains stand- by switch £1 Decea 80/100 IF panel £5	K30 Drawer Ass with pots cable	3n9/2KV 0 0015/2KV 5n2/2KV	10p 10p	Decca RC 12 £14.00 G11 Infra-red full teletext £24.00 Rank, Infra-red £10.00
BY 176 25p BY 179 40p BY 184 25p	NPN PNP 80V 6 Amp TO66 O.P. Trans pair 25p 5 button touch tuner BBC1/2 ITV1/2	forme £1.00	6n2/2KV 2n0/2KV 2n2/2KV	15p 15p	Dynatron-Full remote CTV 62, 63, 64 £19.00
BY 187 10p BY 190 40p BY 196 30p	video with ic SAS 56/TI/570T £7.00 Control panel 5 sliders + mains lead £1.50	Line O/P panel GEC 2217/2218/2213/ 2214/2226/2227/2228 £10	7500pf/2KV 3000PF/3000V 4n7/2KV	10p 15p	Hitachi infra red handset £18 Philips full remote KT3, 16C928/20C934; 7228/7324; K12 26C 797/IST 66K
BY 198 t0p BY 204/4 8p BY 206 8p	G11 8 touch button unit replaces old 6 P.B U. Tube base + base unit for 820 Euro	DISPLAYS £1.00	8n2/2KV 0.0082/2500 150/3500	15p 15p 10p	1826 £12.00 G11. Full remote top button assy. £12.00 G11, Full remote repair service (exchange
BY 208/800 8p BY 210/400 5p BY 210/800 t0p	chassis £4.00 GEC Line O/P Trans. & Rec Stick for	7 Seg Red LED 50p 2 digit LED 8.8 50p 2 digit LED ÷ I 8 with panel +	1800/4KV 4.7nf/5KV 170/8KV	5p 10p	unit) £12.00 Philips infra red full remote 9 channel for
BY 223 60p BY 224/600: 4.8A/600v bridge 50p BY 226 15p	Portable £3.00 CVC 20/25/30/35/40 decoder panel £10 -CVC 20/25/30/35/40 decoder panel (untested) £5	MC¥4511 £1.00 4700/63 £1.50	180/8KV 210/8KV 1000/10KV	10p 10p 10p	60 CP260S £6.00 Philips infra red full remote 12 channel for 60 CP260S £12.00
BY 227 L5p BY 229/4(x) 30p BY 237 5p	CVC 40/45 IF panel £5 40K Transducer 50p	CVC 20-25-30 Mains Switches Infra Red and Ultrasonic G11 Teletext Dec	.47/100V	75p £30	K35 KT3/K30 T/Text £15.00 KT3/K30 Full remote £15.00
BY 254 10p BY 255 30p BY 298 10p	PHILIPS NE511N £1.20 LM337M Reg. 30p 20 GEC Black Spark Gaps £1.00	RANK & ITT Mains Remote On-Off Switch RANK & ITT Mains Remote Switch 2865 of RANK & ITT Remote Switch 2800 ohm	r (720R)	£1.50 £1.50	KT3 Power supply £4.00 Hitachi 8 button unit with resistor unit. Last year mod. £7.00
BY 299 10p BY 406 8p BY 527 20p	G11 Line Driver Transformer KT3 Front Panel Control Assy. £2.50	G11 Mains Switch 4 amp Mains Switch GEC Mains Switch 4 amp		50p 25p	GEC infra-red 2236-2026 £4.00 GEC push pad hand set button blobs 10p
BY 407a 10p BY 602 10p F 247 10p	B FW 30/50 S0p TELETEX DECODER 1.C. SAA 5051 K30	KT3 Mainswitch THORN Rotary Mains Switch G8 Mains Switch		£1.00 50p 75p	each Pye & Philips handset KT3-K30 chassis. No RC5150-RC5176-RC5171-RC5177.
XX 3102 50p BYV 28/2(x) 20p 8/00v/2.75 amps 10p	LC, SAA 5042 LC, SAA 5030 LC, SAA 5020 etc.	Thyristor 600/4 amp C106/2 G11 Preh Red LED P/Button for C.H. Cha RANK TOSHIBA Transductors TPC-2011	nge	24p 20p	Special Price £13.00 ITT Hand Set with TV-Teletex- VCR £12.00
International Rectifier EHT Diodes G7 6A/600V Stud Diodes 20p	70/HV34 6KV 3 for 8p BTW 92/800R £3	Mains Switch ITT Long Type Print Mains Switch Philip Long Type TAG Mains Switch GEC Long Type TAG		75p 75p	RC4001 KT3 £14.00 Philips Tops for Teletext & Full Remote
6A/1000V Stud Diodes 20p	25A473 PNP C/P 10p	Thorn 12 or 24 volt battery convertor for po	ortable colour T/V	£6.00	KT3-K30 £9.75

£2,50 £13	T115A	£13.00
£4.00 £10.00		
£12.00	Multi-Caps 4,700/75 6 amp Rip	£2.00
£10 £1.50 £7.00	350V 300M + 300M 400V 400M	£1,00 60p
£12,00 £12,00	350V 400M Thorn 3500	60p
£3.90 £7.50	175/100/100/350v KT3/200/25/25/385v	£1.00 £1.00
£7,00 £10.00	300+300+150+100+50MFD 350V	£2
£10.00 £5.00	47/220/350v 150/150/100/100/100/320v	60p £2.00
£5.00 £10.00	2500/2500/63v 150/200/200/300v	50թ 70թ
£10.00 £6.00 £4.00	400/400/200v 300/100/100/16/275v	£1.70 £1.50
9.75 £6.00	100/200/325v 150/150/100/375v	40p £1.50
£10.00	300/300/100/32/32/300v 1500/2900/30v	2.00 50p
£7.00 50p	Jelly pot Thorn (0)D4/013 150/150/100/100/320v	£3 £2.00
30p	100/350 + 300/200/100/15/275v 225+25/380 GEC	£2.00 70p
10p 5p 20p	200/100/100/350s 500/500/25v	£1,50 50p
70p 75p	150/150/100/300v 200/150/150/300v	75p 1.00
10p 80n		
50p 5p	FT1 8 and 6 Push Button	£1.00
10p 10p	CMD 800 Chassis. No tuner	£20.00
20p 15p 25p	S 1997 S Huasis, 1307 (URE)	120.00
35p 30p	FAG 226/600 BD 650	50p
15p 10p	BD 650 UPC 574 BSS 38	50p 30p
£1.75	100 00	30p
60p £1 £1.00	WT 456	£1.00
40p 20p	114 2175	
5p 8p 10p	LM 317T	30р
20p 30p 40p	AF 114	50p
50p 10p	FET Power VN88AF	50p
75p 60p 15p	PHILIPS SBC 469 Stereo Microph	ione
20p 20p	Meters Hills 5	£23.00 £17.00
10p	Meters Hills 420 Infra-red Tester Handset	£15.00 £12.00
15p 20p 40p		
20p 40p	Repaired Handsets Philips K4-K35, RC5350-RC5300, DC5370, DC5376	
25p 15p	RC5370, RC5375, repaired same of	£10.00
20p 20p 15p	KT3-30 repaired same day	£8.00
10p 10p	GFC Full Remote Infra-red, 1983	models
10p 65p	_	£15.00
10p 10p 10p	Timers, 60 mins, small	£1.00
10p 10p		
15p 10p	G11 Ultrasonic Teletext Handset 8 C.H. Ultrasonic GEC Full Remo	
15p 15p	C2014H/C2219H New Replacement for G11 Ultrasc	
15p 20p 15p	Full Remote Thorn 4000 insert with 7 buttons	£12.00 £5.00
15p 10p	Decca RC 11 Decca RC 12 C11 Infra red full teletavi	£14.00 £14.00
10p 15p	G11 Infra-red full teletext Rank, Infra-red Dynatron-Full remote (TIV 62, 63	£24.00 £10.00
15p 15p	Dynatron-Full remote CTV 62, 63 Hitachi infra red bandset	£19.00
10p 10p 15p	Hitachi infra red handset Philips full remote KT3, 16C928/20 7228/7324; K12 26C 797/IST 66K	£18 (X934;
15p 15p	1826 G11. Full remote top button assy.	£12.00 £12.00
10p 5p	G11, Full remote repair service (er unit)	change £12.00
10p 10p	Philips infra red full remote 9 chan 60 CP2605	
10p 10p 10p	Philips infra red full remote 12 cha for 60 CP2605	
80p 75p	K35 KT3/K30 T/Text	£15.00
£1.50	KT3/K30 Full remote KT3 Power supply	£15,00 £4,00
£1.50 £1.50	Hitachi 8 button unit with resistor Last year mod.	unit. £7.00
50p 25p 30p	GEC push pad hand set button ble	£4.00 obs 10p
£1.00	each Pve & Philips handset KT3-K30 ch	iassis.
75p 24p	No RC5150-RC5176-RC5171-RC5 Special Price	177. £13.00
20p 50p	ITT Hand Set with TV-Teletex- VCR	£12.00
75p 75p 75p	RC4001 KT3 Philips Tops for Teletext & Full 1	
£6.00	KT3-K30	£9.75

Tuner Units V/Cap Rank VHF Z773/T/Unit £5 V/Cap Rank VHF Z773/T/Unit £5 NEW G8 Tuner V/Cap £2.50 GEC 6 Push Button Unit £6 GEC 6 Push Button Unit £6 DECCA 6 Push Button Unit £6 DECCA 6 Push Button Unit £6 GEC or Hatach 6 push button unit 2110 Conversion £8 GEC 1110 V/Cap £3.75 ELC 1042 (Ex Panel) £4.00 FLC 2000 £4.00 FLC 2000 £4.00 FLC 2000 £4.00 FLC 2001 £5.48 ASTT-C UMI 183 £10.00 V312 (UIII) £5.00 V314 (VIII) £5.00 FLC 1043/05 fhorm £5.00 Mullir £7.00 UV 411 Tuner £10.00 UV 415 £7.00 UV 417 FL £5.00 FLC 1043/05 fhorm £5.00 Mullir £7.00 FLC 1043/05 fhorm £5.00 Mullir £7.00 UV 418 £5.00 Mullir Vap Mitsum £6.00 Harrie Mitsum £10.00 Har	10p BFR79 15p 10p BFR81 15p 10p BFR87 10p 20n BFS60 10p	Reignton, SSEX SS 38 AF SSEX SS 38 AF SSERVICE to availability. December 20 December 2	6MHz 3 6MHz 3 6MHz 3 6MHz 4 6 5 6 7 6 7 6 7 6 7 6 7 6 8 6 8 6 8	SN76516 SN76550 SN76550 SN76550 SN76550 SN76550 SN76620 SN76620 SN76620 SN76620 SN76620 SN76620 SN76620 SN76666 SN76600N SN76620N SN76670N SN76670N SN76708AN SN76708AN SN76720 SN76708AN SN76720 SN76708AN SN76720 SN76708AN SN76720 SN76708A SN76720 SN76708A SN76720 SN76708A SN76720 SN76708A SN76720 SN76708A SN76720 SN76708A SN76720 SN76606 SN76620 SN76820 SN	£3.00 BF470 20p Case BF480 50p BF494 30p 10p BF594 10p
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