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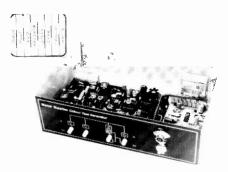
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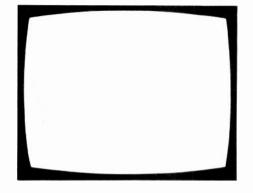
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TELEVISION

June 1989

Vol. 39, No. 8 Issue 464

On sale May 17th

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INDEXES

Indexes to Vols. 36 and 37 are available at 80p each from the Editorial Office (address above).

SUBSCRIPTIONS

An annual subscription costs £20 in the UK, £24 overseas (by surface mail). Send orders with payment to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex, RH16 3DH.

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VK19	Hitachi V18000/8300/8500	J		3 1.05 6 1.50	JVC 23/24
VK20 VK21	Hitachi VT11/33 Hitachi VT11/33 Hitachi 9500 Sony SLC6 Sanyo 5500 Nat Pan. NV300/NV333			3 1.12	JVC HR22
VK21 VK22	HITACHI 9500			6 1.90	JVC 3660
VKZZ	Compa EEOO			3 1.05	Akai VS97 Hitachi VT
VK23 VK24	Mat Don Militannikii/222			6 1.55	Sharp VC6
VK25	Toshiba V7540			5 1.90	Sony T C
VK26	JVC/HR 7700/3V23			2 0.96	1 55,
VK27	Thorn 3V29			4 1.75	
	Amstrad 7000			3 1.45	MOTOR
	Amstrad 4500/900D			3.25	VHS Drun
	Amstrad 4600/5200			5.19	VHS Caps
	Nat Pan, NU777			4 1.00	Sanyo 500
	Sony T9			6 2.20	Sharp Ree
	Toshiba 9600			4 1.20	
VK32	Sanyo 1100-1300-1500			0.75	VIDEO
VK33	Ferguson 3V35-36 Ferguson 3V42-3-4-5-8 Fisher FVHP710-716-722 Panasonic NV370-430			0.69	Video Clea
VK34	Ferguson 3V42-3-4-5-8			0.90	Universal
VK35	Fisher FVHP710-716-722			1.20	Head Clea
VK36	Panasonic NV370-430			1.20	Beta Ecce
VK37	Hitachi 9300			0.85	Chamois

6	25.99 25.99 25.99 25.99 45.00	Philips V2000 Philips 1700	56.00 14.50 35.62 53.00 64.00 71.00 40.00
	VHS (general purpose) Sharp 381/383/386/91/ Sharp 0006/GEZZ VC3 6/496/581/5/85 Sanyo Reel Drive Pulley Hitachi E/F Idler 68869	20 9300/9500 0005/GEZZ 00/387/481/2/3 1 143-0-662 T0202/TD1282 1 (UT116/UT335) 522 203 34 4822 528 784 84 9904 00900 4204 00300/400 4307411 20001 688000)	4.95 2.20 5.10 2.90 3.50 3.95 4.50 1.85 3.20
	PINCH ROLLERS Amstrad 4500/4600.5/ Amstrad 7000 Nat Pan NV7000 Sanyo YIC 9300 VP85/ Sony D77.3/95.1.1 JVC 126.3/20 JVC 146.3/20 JVC 3620/ JVC 3620	000 .	3.75 3.75 3.75 3.75 3.75 3.75 3.75 3.75
	MOTORS VHS Drum Motor VHS Capstan Motor Sanyo 5000 Reel Moto Sharp Reel Motor		25.50 25.50 12.95 19.50
	VIDEO CARE Video Cleaning Tape VI Universal Copying Kit Head Cleaner Beta Eccentricity Gaug Chamois Cleaning Stic	e	8.23 7.50 0.96 57.92 0.25

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1		AMSTRAD SPARES	1
	VIDEO RE 1750 1226 1227 1231 7593 1981	RF Clutch	3.75 4.25 10.53 5.80 5.19 1.80
	MD150146 MD150146 MD150293 MD150287 1759 1059	COROER VCR 7000 Dew Sensor Loading Motor. Reel Break Unit Video Head (Genuine) Video Lamp Pinch Roller Idler Bett Kit	1.91 6.02 12.50 40.00 0.45 3.75 1.80 1.45 0.45
	1758 1225 1226 1227	Clutch Gear Holder Cass. Led (also 4500) Belt Kit (also 4500) Drive Belt	10.53
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NV7000/7200/7800 .	1.22
VXP0331 Idler Unit NV3000	. 1.28
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NV370/43ti/730/830/850 .	1.00
VXP0521 Idler Arm Unit	
NV370/431i/830/850	. 4.08
VXP0325 Loading Gear	
NV333/2000/3000/7800	1.83
VXP0520 Load Gear Unit	1.36
VDG0016 Action Gear	0.50
NV333/2000/3000	. 0.58
VDG0017 Interim Gear	0.62
NV333/2000/3000	1.30
Direct Rep. Video Bulb VXP0433 Play Idler Unit NV333/336	. 5.50
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Belt Counter (122) V6354241	0.63
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Belt 313 V6355591 Belt 317 V6357531 Belt 318 V6355581 Capstan Motor V5577355/6 2	0.47 0.40 0.63 0.54 9.94 8.47
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	Belt (302) Vf FF/Rewind A (Gen. Hitach SUNDRIES Vertical Out GEC-C2286 GEC-2067	put Module Hitachi-CPT2	1 .	33E	0.40
	GEC-2069 Y	23/0551			 6.21
	General Purp 3V23 with P 3V29 with P Amstrad 700 Amstrad 450	AS Bulb (also pose VHS Bul	b 0/9000		 1.59 0.45
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	Sony Sony Hitachi Nat Pan Nat Pan. Akai JVC JVC		1.DIA 17.4 18 25 29 25 20 32.8 23.9	4 9 5 1 4.9 3.9 3.9	 0.50 0.50 0.50 0.52 0.56 0.50 0.56 0.56

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GCA 514620/C2089H-C2090H IR8823 23.50 C2290H, C2889	9" Welded 2.41 Gutter Brackets 1.00	CM7082 UHF/VHF Dist. Amp 74.14 CM7080/10 UHF MHA 16.89 CM7271 UHF Wideband 15 db 9.09	74LS132 0.63 74LS260 0.83
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691-17181	Plastic Single 0.68		901225 Cha. Rom Comm 3.37 901226 Bas. Rom Comm 8.71 901227 Ker Rom. Comm. 6.63
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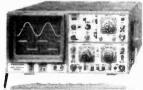
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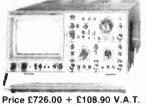
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- SPECIFICATION

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Dn/Off Switch (Remote) Push Button TX90 Tuner	1.75 12.95 14.35 24.95 24.95	FF/Rew Pulley	1.95 85 3.95 22.95 (E) 23.95 (E) 29.95 7.95 (e) 2.50 3.95	Reel Idler (Genuine) Video Head	4.95 SERVIC 7.95 Ferguson TX9 Ferguson TX9 Ferguson TX8 Ferguson TX9 Ferguson TX1 Ferguson TX1 Ferguson TX9 Fidelity AVS26 fidelity AVS26 fidelity TV14	Genuine Complete	Unlock A Video He VC481 Capstan Pinch Ro Reel Idlet Reel Mot Video He Capstan Pinch Ro	Ad	35 / 23.95 122.95 3.95 3.95 3.95 18.50 23.95 27.95	Amstrad VCR9000 erguson 3V0/22/23/39 erguson 3V32/2-erguson 3V32/2-erguson 3V32/3-9-erguson 3V32/44/45/55 issher FVH520/615/720 inari VXL2/4 irlachi 8000/3300/9500 irlachi VT11/33E Witsubishi 303/31 0. Panasonic NV330 Panasonic NV333 Panasonic NV336 Panasonic NV366 Panasonic NV368 Panasonic NV368 Panasonic NV430 Panasonic NV440 Pana	24.9 17.9 47.5 26.9 24.9 22.9 22.9 27.5 29.9 17.5 39.5 24.9
On/Off Switch (Remote) Push Button TX90 FERGUSON VIDEO SPARES 3000/16/22 Capstan Motor Drum Motor Pinch Roller Lake-Up Clutch (Small)	1.75 12.95 14.35 24.95 24.95 3.95 5.65	FF/Rew Pulley Pinch Roller Play Idler Video Head V4100/VT11E/VT33E Capstan Motor (VT1 Capstan Motor (VT3 Clutch Assy FF/Rew Idler (Benuir Pinch Roller Video Head	1.95 85 3.95 22.95 (E) 23.95 (E) 29.95 7.95 (e) 2.50 3.95	Reel Idler (Genuine)	4.95 SERVIC 1.25 (All Ferguson TX9 Ferguson TX9 Ferguson TX9 Ferguson TX9 Ferguson TX9 Ferguson TX9 Ferguson TX9 Ferguson TX9 Fidelity AVS16 Fidelity AVS26 Fidelity AVS26 Fidelity CTV14 Fidelity CTV14	Genuine Complete	Unlock A Video He VC481 Capstan Pinch Ro Reel Idler Reel Mot Video He Capstan Finch Ro Pinch Ro	Add	35 / 23.95 1 22.95 3.95 3.95 1 8.50 23.95 1 27.95 3.95	Amstrad VCR9000 erguson 3V32 erguson 3V42/44/45/55 erguson 3V42/46/46/46/46/46/46/46/46/46/46/46/46/46/	24.9 17.9 47.5 26.9 24.9 22.9 22.9 27.5 29.5 39.9 24.9
Dn/Off Switch (Remote) Push Button TX90 Tuner FERGUSON VIDEO SPARES 3V00/16/22 Capstan Motor Drum Motor Pinch Roller Take-Up Clutch (Small) Take-Up Clutch (Large)	1.75 12.95 14.35 24.95 24.95 3.95 3.95	FF.Rew Pulley Pinch Roller Play Idler Video Head V4100VT11E/VT33E Capstan Motor (VT1 Capstan Motor (VT3 Clutch Assy. FF.Rew Idler (Genuir Pinch Roller Video Head V4005/VT63E	1.95 85 3.95 3.95 22.95 (E) 23.95 (E) 29.95 7.95 (e) 2.50 3.95 22.95	Reel Idler (Genuine) Video Head	4.95 7.95 Ferguson TX9 Ferguson TX8 Ferguson TX8 Ferguson TX8 Ferguson TX1 Fidelity AVS2 Fidelity CTV2 Fidelity CTV2 Philips CF1	Genuine Complete	Unlock A Video He VC481 Capstani Pinch Ro Reel Idler Reel Mot Video He Capstan Pinch Ro Pinch Ro Rewind I	ad	35 / 23.95 1 22.95 1 33.95 1 33.95 1 33.95 1 33.95 1 33.95 1 33.95 1 33.95 1 4.65 1	Amstrad VCR9000 erguson 3V0/22/23/9 erguson 3V32/erguson 3V310 erguson 3V310 ergu	24.9 17.9 47.5 26.9 24.9 22.9 22.9 27.9 29.9 21.9 24.9 24.9 24.9 24.9 24.9 24.9 24.9 24
Dn/Off Switch (Remote) Push Button TX90 Tuner FERGUSON VIDEO SPARES 3Y00/16/22 Capstan Motor Drum Motor Pinch Roller Take-Up Clutch (Small) Take-Up Clutch (Large) Video Head	1.75 12.95 14.35 24.95 24.95 3.95 3.95	FF.Rew Pulley Pinch Roller Play Idler Video Head V4100/VT11E/VT33E Capstan Motor (VT1 Capstan Motor (VT3 Clutch Assy FF.Rew Idler (Genuir Pinch Roller Video Head V4005/VT63E Capstan Motor	1.95 86 3.95 22.95 (E) 23.95 (E) 29.95 7.95 (e) 2.50 3.95 22.95	Reel Idler (Genuine) Video Head	4.95 4.95 4.95 4.96 4.97 4.97 4.97 4.97 4.97 4.97 4.97 4.97	Genuine Complete	Unlock A Video He VC481 Capstan I Pinch Ro Reel Idle Reel Mot Video He Capstan Pinch Ro Pinch Ro Rewind M Rewind M	Add	23.95 12.95 13.95	Amstrad VCR9000 - erguson 3V32 - erguson 3V32 - erguson 3V42/44/45/55 - issher FVH520015/720 - (finari VXL2/4 - (finari VXL2/4 - (finari VXL2/4 - (finari VXL2/3 - (finari VXL2/	24.9 17.9 47.5 26.9 24.9 22.9 22.9 27.5 29.5 21.5 24.6 24.6 24.6 24.6 24.6 24.6 24.6 24.6
On/Off Switch (Remote) Push Button TX90 FUNET FERGUSON VIDEO SPARES 3000/16/22 Capstan Motor Drum Motor Pinch Roller Lake-Up Clutch (Small) Lake-Up Clutch (Large) Video Head	24.95 24.95 24.95 24.95 395 5.65 5.95 17.95	FF.Rew Pulley Pinch Roller Play Idler Video Head V4100VT11E/VT33E Capstan Motor (VT1 Capstan Motor (VT3 Clutch Assy. FF.Rew Idler (Genuir Pinch Roller Video Head V4005/VT63E	1.95 .86 .3.95 .22.95 .22.95 .23.95 .29.95 .7.95 .2.90 .2.90 .2.90 .2.90 .2.90 .2.90 .2.90 .2.95	Reel Idler (Genuine) Video Head 1	4.95 SERVIC 7.95 Ferguson TX9 Ferguson TX9 Ferguson TX8 Ferguson TX8 Ferguson TX8 Ferguson TX1 Ferguson TX9 Ferguson TX9 Fidelity AVS2 Fidelity CTV2 Fidelit	Genuine Complete	Unlock A Video He VC481 Capstan I Pinch Ro Reel Idle Reel Mot Video He Capstan Pinch Ro Pinch Ro Rewind M Rewind M	ad	22.95 1 1 1 1 1 1 1 1 1	Amstrad VCR9000 erguson 3V32 erguson 3V42/44/45/55 erguson 3V42/46 erguson 3V42/46 erguson 3V42/46 erguson 3V47/48/46 erguson 3V47/48/48/46 erguson 3V47/48/48/48/48/48/48/48/48/48/48/48/48/48/	24.9 17.9 47.5 26.9 24.9 22.9 22.9 27.5 39.9 24.9 29.9 17.9 24.9 24.9 24.9 24.9 24.9 25.9 27.9 27.9 27.9 27.9 27.9 27.9 27.9 27
On/Off Switch (Remote) Push Button TX90 FERGUSON VIDEO SPARES SY00/16/22 Capstan Motor Drum Motor Pinch Roller Take-Up Clutch (Small) Take-Up Clutch (Large) Video Head SY29/30 Capstan Motor Capstan Motor	24.95 24.95 3.95 3.95 5.65 5.95 17.95	FF/Rew Pulley Pinch Roller Play Idler Video Head V4100/VT11E/VT33E Capstan Motor (VT1 Capstan Motor (VT1 Capstan Motor (VT3 Clutch Assy FF/Rew Idler (I Genuir Pinch Roller Video Head V4005/VT63E Capstan Motor End Sensors (Pair)	1.95 85 3.95 3.95 22.95 [E] 23.95 8E] 29.95 2.95 2.95 2.95 1.95 1.95 4.95	Reel Idler (Genuine) Video Head	4.95 Ferguson TX9 Ferguson TX9 Ferguson TX9 Ferguson TX9 Ferguson TX1 Ferguson TX9 Ferguson TX1 Ferguson TX9 Fidelity AVS26 Fidelity CTV20 Fidelity CTV20 Philips CTX-E Philips CTX-E Philips CTX-S Philips C11	Genuine Complete	Unlock A Video He VC481 Capstan Pinch Ro Reel Idler Reel Mot Video He S Capstan Pinch Ro Pinch Ro Pinch Ro Rewind H Video He	Add 2 Motor 2 Iler 2 Iler 3 Iler 4 Iler 4 Iler 4 Iler 5 ONY SPARES Motor C7 2 Iler CS/6/7 Iler C9 Int CS/7 Iler C9 Int CS/7 Int CS/	35 / 23.95 12.95 13.95 13.95 13.95 13.95 13.95 14.65 14.65 15.96 15.96 16.96 16.96	Amstrad VCR9000 erguson 3V322 erguson 3V322 erguson 3V322 erguson 3V3244/45/55 issher FVH520/615/720 -finari VXL2/4 -fittachi 8000/3300/9500 -fitachi VT11/33E -fittachi 8000/3300/9500 -panasonic NV230 -panasonic NV330 -panasonic NV330 -panasonic NV366 -panasonic NV370/380 -panasonic NV370 -panasonic NV370 -panasonic NV370 -panasonic NV370 -panasonic NV730 -panasonic NV730 -panasonic NV730 -panasonic NV777 -panasonic NV679 -panasonic NV6791/1715	24.9 17.9 47.5 26.9 24.9 22.9 27.9 27.9 27.9 21.9 21.9 24.9 24.9 24.9 24.9 24.9 25.9 27.9 27.9 27.9 27.9 27.9 27.9 27.9 27
On/Off Switch (Remote) Push Button TX90	24.95 24.95 24.95 24.95 3.95 5.65 5.95 17.95	FF.Rew Pulley Pinch Roller Play Idler Video Head V4100/VT11E/VT32E Capstan Motor (VT1 Capstan Motor (VT3 Clutch Assy FF.Rew Idler (Genuir Pinch Roller Video Head V4005/VT63E Capstan Motor End Sensors (Pair) Pinch Roller Video Head	1.95 85 3.95 3.95 22.95 [E] 23.95 8E] 29.95 7.95 22.95 1.595 1.95 4.95	Reel Idler (Genuine) Video Head	4.95 SERVIC 7.95 Ferguson TX9 Ferguson TX9 Ferguson TX8 Ferguson TX8 Ferguson TX1 Fidelity CTV2 195 Fidelity CTV14 Fidelity CTV2 Philips CF1 Philips CTX-E 19.95 Philips CTX	Genuine Complete	Unlock A Video He VC481 Pinch Ro Reel Idler Reel Mot Video He S Capstan Pinch Ro Pinch Ro Pinch Ro Rewind I Rewind I Video He	Add	35 / 23.95 122.95 33.95 88.50 23.95 23.95 23.95 23.95 4.65 3.45 9.50	Amstrad VCR9000 erguson 3V02/22/39 erguson 3V32/24/4/45/55 issher FVH520/615/720 -tinari VXL2/4 -tinari VXL2/4 -titachi 800/3300/9500 -titachi VX12/3 -titachi 800/3300/9500 -titachi VX11/33E -titachi 800/3300/9500 -panasonic NV230 -panasonic NV330 -panasonic NV330 -panasonic NV360 -panasonic NV370/380 -panasonic NV300 -panasonic NV370/380 -panasonic NV777 -panasonic NV777 -panasonic NV777 -panasonic NV777 -panasonic NV67/9	24.9 17.9 26.9 24.9 22.9 22.9 27.5 29.5 17.9 39.9 24.9 24.9 29.9 29.9 21.9 24.9 29.9 29.9 29.9 29.9 29.9 29.9 29
Jan/Olf Switch (Remote) Push Button TX90 FERGUSON VIDEO SPARES VVOOR6/22 Capstan Motor John Moto	1.75 12.95 14.35 24.95 24.95 3.95 5.65 5.95 17.95 37.95 870 450	FF.Rew Pulley Pinch Roller Play Idler Video Head Valou/VT1E/VT33E Capstan Motor (VT1 Capstan Motor (VT3 Clutch Assy FF./Rew Idler (Genuir Pinch Roller Video Head V4005/VT63E Capstan Motor End Sensors (Pair) Pinch Roller Video Head	1.95	Reel Idler (Genuine) Video Head 1	4.95 4.95 4.95 4.96 4.97 4.97 4.97 4.97 4.97 4.97 4.97 4.97	Genuine Complete	Unlock A Video He VC481 Capstan i Pinch Ro Reel Idei Reel Mot Video He S Capstan Pinch Ro Pinch Ro Rewind N Video He Video He Akai VS1 Amstrad	Add 2 Motor 2 Iler 2 Iler (Genuine) 7 or (Genuine) 1 ad 2 ONY SPARES Motor C7 2 Iler C5567 1 Iler C9 cit C65 3 cit C65 3 ad C5767 1 DEO BELT KITS 7/3755 7/3756	35 /	Amstrad VCR9000 erguson 3V02/22/39 erguson 3V32/24/4/45/55 issher FVH520/615/720 -tinari VXL2/4 -tinari VXL2/4 -titachi 8000/3300/9500 -titachi VT11/33E -titachi 8000/3300/9500 -titachi VT13/33B -titachi 800/333B -titachi 800/33B -titachi	24.9 17.9 26.9 24.9 22.9 27.5 29.9 21.9 24.9 24.9 24.9 24.9 24.9 24.9 24.9 24
Jan/Olf Switch (Remote) Push Button TX90 "Uner FERGUSON VIDEO SPARES W00/16/22 Japstan Motor Pinch Roller [ake-Up Clutch (Small) 'ake-Up Clutch (Large) '(rideo Head W29/30 Japstan Motor Japstan Motor Japstan Motor Japstan Motor Jake-Up Clutch (Large) Jake-Up Clutch (Large) Jake-Up Clutch (Large) Jake-Up Clutch (Small) Jake-Up Clutch (Small) Jake-Up Clutch (Small) Jake-Up Clutch (Large) Jake-Up Clutch (Small) Jake-Up Clutch (Smal	1.75 12.95 14.35 24.95 3.95 5.65 5.95 17.95 37.95 80 450 80	FF.Rew Pulley Pinch Roller Play Idler Video Head V4100/VT11E/VT32E Capstan Motor (VT1 Capstan Motor (VT3 Clutch Assy FF.Rew Idler (Genuir Pinch Roller Video Head V4005/VT63E Capstan Motor End Sensors (Pair) Pinch Roller Video Head	1.95	Reel Idler (Genume) Video Head 1	4.95 4.95 4.95 4.95 4.95 4.95 4.95 4.95	Genuine Complete	Unlock A Video He VC481 Capstan i Pinch Ro Reel Idei Reel Mot Video He S Capstan Pinch Ro Pinch Ro Rewind N Video He Video He Akai VS1 Amstrad	Add 2 Motor 2 Iler 2 Iler (Genuine) 7 or (Genuine) 1 ad 2 ONY SPARES Motor C7 2 Iler C5567 1 Iler C9 cit C65 3 cit C65 3 ad C5767 1 DEO BELT KITS 7/3755 7/3756	35 /35 /35 /35 /35 /35 /35 /395 /	Amstrad VCR9000 - erguson 3V0/22/29/39 - erguson 3V0/22/29/39 - erguson 3V0/22/29/39 - erguson 3V42/44/45/55 - erguson 3V42/44/45/55 - erguson 3V42/44/45/55 - erguson 3V42/44/45/55 - erguson 3V42/44 - erguson 3V42/49 - erguson 6 V42/30 - erguson 6 V42/30 - erguson 6 V42/49 - erguson 7 V42/44/44/44/44 - erguson 7 V42/44/44/44/44 - erguson 7 V42/44/44/44/44/44 - erguson 7 V42/44/44/44/44/44/44/44/44/44 - erguson 7 V42/44/44/44/44/44/44/44/44/44/44/44/44/4	24.9 17.9 26.9 24.9 22.9 22.9 22.9 27.5 39.9 29.9 29.9 29.9 29.9 29.9 29.9 29.9
Jan/Olf Switch (Remote) Push Button TX90 Juner FERGUSON VIDEO SPARES VV00/16/22 Japstan Motor Juner Mo	24.95 24.95 24.95 3.95 5.65 5.95 17.95 870 450 85	FF.Rew Pulley Pinch Roller Play Idler Video Head Valou/VT1E/VT33E Capstan Motor (VT1 Capstan Motor (VT3 Clutch Assy FF./Rew Idler (Genuir Pinch Roller Video Head V4005/VT63E Capstan Motor End Sensors (Pair) Pinch Roller Video Head PANASONIC SPARI NV333/366 Complete Maintena	1.95 85 3.95 3.95 22.95 (E) 23.95 (E) 29.95 7.95 (e) 2.50 3.95 22.95 1.595 4.95 4.95 C VIDEO	Reel Idler (Genune) Video Head	4.95	Genuine Complete	Unlock A Video He VC481 Pinch Ro Reel Iddie Reel Mot Video He S Capstan i Pinch Ro Rewind I Video He VII Akai VS1 Amstrad Amstrad Fergusor Fergusor Fergusor	ad	35 /35 /35 /35 /35 /35 /35 /395 /	Amstrad VCR9000 erguson 3V02/22/39 erguson 3V32/24/4/45/55 erguson 3V32/30 Panasonic NV330 Panasonic NV730 Panasonic NV730 Panasonic NV707 Panasonic NV6101/1/15 Panasonic NV6101/1/1/15 Panasonic NV6101/1/15 Panasonic NV6101/1/1/15 Panasonic NV6101/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1	24.9.9.2 24.9.9.2 24.9.9.2 24.9.9.2 22.9.2 22.9.2 22.9.2 23.9.3 23.9.3 29.9.3 29.9.2 29.9.2 29.9.2 29.9.3
Jar/Off Switch (Remote) Push Button TX90 FERGUSON VIDEO SPARES VVOOR622 Capstan Motor Drum Motor Princh Rolle Fake-Up Clutch (Small) Fake-Up Clutch (Large) Video Head VX2930 Capstan Motor Princh Rolle Fake-Up Clutch (Large) Fideo Head Video Head Video Head Video Head Video Head Fideo Head Fideo Head Video Head Fideo Head Video H	24.95 24.95 24.95 3.95 5.95 5.95 17.95 80 285 80	FF/Rew Pulley Pinch Roller Pinch Roller Pinch Roller Video Head V4100/VT11E/VT33E Capstan Motor (VT1 Capstan Motor (VT3 Clutch Assy FF/Rew Idler (Genuir Pinch Roller Video Head V4005/VT63E Capstan Motor End Sensors (Pair) Pinch Roller Video Head PANASONIC SPARI NV333/366 Complete Mainten Ent (Genuire)	1.95 85 3.95 3.95 22.95 [E] 23.95 7.95 99 2.50 3.95 22.95 1.95 4.95 4.95 4.95 C VIDEO	Reel Idler (Genume) Video Head	4.95	Genuine Complete	Unlock A Video He VC481 Capstan Pinch Ro Reel Idle Reel Mot Video He Capstan Pinch Ro Rewind Rewind Video He Video He VII Akai VSI Amstrad Amstrad Amstrad Fergusor Fergusor Fergusor	Add 2 Motor 2 Iler 2 Iler 3 Iler 4 Iler 4 Iler 4 Iler 5 ONY SPARES Motor C7 2 Iler CS/6/7 Iler C9 I	35 /	Amstrad VCR9000 - erguson 3V0/22/29/39 - erguson 3V0/22/29/39 - erguson 3V0/22/29/39 - erguson 3V42/44/45/55 - erguson 3V42/44/45/55 - erguson 3V42/44/45/55 - erguson 3V42/44/45/55 - erguson 3V42/44 - erguson 3V42/49 - erguson 6 V42/30 - erguson 6 V42/30 - erguson 6 V42/49 - erguson 7 V42/44/44/44/44 - erguson 7 V42/44/44/44/44 - erguson 7 V42/44/44/44/44/44 - erguson 7 V42/44/44/44/44/44/44/44/44/44 - erguson 7 V42/44/44/44/44/44/44/44/44/44/44/44/44/4	24.9.2 (2
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Jan/Olf Switch (Remote) Push Button TX90 FERGUSON VIDEO SPARES VVOOE(22 Capstan Motor Jrum Mo		FF/Rew Pulley Pinch Roller Pinch Roller Pinch Roller Video Head V4100/VT11E/VT33E Capstan Motor (VT1 Capstan Motor (VT3 Clutch Assy FF/Rew Idler (Genuir Pinch Roller Video Head V4005/VT63E Capstan Motor End Sensors (Pair) Pinch Roller Video Head PANASONIC SPARI NV333/366 Complete Mainten Ent (Genuire)	1.95 86 3.95 3.95 22.95 86 22.95 87 96 196 25.90 3.95 22.95 15.95 4.95 4.95 C VIDEO ES	Reel Idler (Genume) Video Head 1	4.95 4.95 4.95 4.95 4.95 4.95 4.95 4.95	Genuine Complete	Unlock A Video He VC481 Pinch Ro Reel Iddie Reel Mot Video He S Capstan Pinch Ro Pin	ad 2 Motor 2 Iler		Amstrad VCR9000 erguson 3V322 erguson 3V322 erguson 3V322 erguson 3V323 erguson 3V3244/4/555 :issher FVH520/6157/20 -ifinari VXL2/4 -ifinari VX-300 -ifinari V	24.9.4 17.9.9 24.9.1 17.9.9 24.9.1 17.9.9 24.9.1 24
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Please call if your model is not listed.

GENUINE	BELT	KITS
Panasonic		Panas
NV2000. NV2010	£6.50	NV2000
NV7000, NV7200		NV7000
NV333. NV366		NV333.
NV370, NV830, NV850	£2.80	NV8600
NV688	€6.50	Fergu.
NV777, NV788	£4.70	3V00.3
NV8600, NV8610		3V23
NV730	£1.90	3V29.3
NV730 NV230, NV430, NV870	£2.80	3V35, 3
NV870, NV810	£2.80	Sanyo
Ferguson		VTC500
3V00, 3V16, 3V22	£6.50	VTC530
3V23	£3.90	VTC93
3V29, 3V30	£4.90	Sony
3V29, 3V30 3V35, 3V36, 3V38, 3V39	£2.90	SLC5, S
Sanyo		SLC6
VTC5000, VTC5150		SL8000
VTC5300, VTC5400		Sharp
VTC9300	£6.50	VC7300
Sony		VC8300
SLC5, SLC7	£6.50	VC910
SLC6	£7.50	VC381,
SL8000, SL8080	£6.50	Hitach
Sharp		VT5000
VC7300, VC7700, VC7750	£6.50	VT8000
VC8300	£6.50	VT9300
VC9100, VC9300, VC9500		VT11E
VC381, VC383, VC38€	£6.50	VT33E
Hitachi		Akai
VT5000, VT5500	£6.50	VS9700
VT8000, VT8300, VT8500	£2.90	VS2, VS
VT9300, VT9500, VT9700		VS9300
VT11E, VT14E, VT17E, VT19		Many c
VT33E	£6.50	
Akai VS9700	00.50	All Pana
		All Ferg
VS2, VS3, VS4, VS5 VS9300, VS9500, VS9700	£4.90 £6.50	Sharp V
VS9300, VS9500, VS9700 Many others available	£6.50	Sharp V
wany owers available		Amstra
		All Hitad

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3V29, 3V30, HR7200, HR7300	€4.95
3V35, 3V36, 3V38, 3V39 HRD120	£4.95
Sanyo	
VTC9100, VTC9300 VTC5000, VTC5150, VTC5300,	£4.95
VTC5400, VTC5150, VTC5300,	£4.95
Sony	24.30
SLC5, SLC7	25.95
SLC6	£5.95
SL8000, SL8080	£5.95
Sharp VC7300, VC7700, VC7750	€4.95
VC8300	£4.95
VC9100, VC9300, VC9500	£4.95
VC381, VC383, VC386	£4.95
VC651 etc.	£4.95
Hitachi	05.05
VT5000, VT5500 VT8000, VT8300, VT8500	£5.95 £4.95
VT9300, VT9500, VT9700	£4.95
VT11E, VT14E, VT17E, VT19	£4.95
VT33E	£5.95
Akai	
VS9700	£6.95
VS2, VS3, VS4, VS5 VS9300, VS9500, VS9700	£6.95 £4.95
Amstrad	24.33
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,	Sharp VC9300, VC381 etc	£18.20
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	Sanyo VTC5000, 5300, 5400	. £9.90
	Panasonic NV7000, 7200	£19.80
	DRUM MOTORS	
	Ferguson/JVC3V00, 3V22, etc	£29.90
	Sharp VC7300, VC7700	€26.40
	Sharp VC8300	£26.40
	Hitachi VT5000	€24.80
	CAPSTAN MOTORS	
	Sharp VC8300	£39.90
Ε	Sharp VC7300, VC7700	£29.30
	Ferguson/JVC 3V00, 3V16, 3V22	£29.90
	Ferguson/JVC 3V29, 3V30	£34.50
S	Ferguson/JVC 3V35, 3V36, etc	£25.80
•	Hitachi VT5000	€24.80
	Hitachi VT8000, 8500, etc	€34.50
	Hitachi VT9300, 9500, etc.	£34.50
	Hitachi VT11, VT14, VT17	£26.80
	Sony C5, C7	€29.90
	Akai VS1-VS5	£29.90
	Many, many more!	

REPLACEMENTS
Panasonic

£3.50 £3.00 £3.00 £3.95

£3.50 £2.90

€2.90

21.00 £2.50 £4.25

£3.60 £4.95

£4.25 £3.50 £3.90

£3.90 £3.90

£4.50 £1.50 £1.50 £3.90 £3.90

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£1.80 £0.65 £2.90 £1.80 £2.30 £1.80

£2.90 £2.90 £5.75

£1.20 each

Panasonic NV2000, NV2010 NV7000, NV7200 NV333, NV366 NV8600, NV8610 Ferguson 3V00, 3V16, 3V22

VC8300 VC9100, VC9300, VC9500 VC381, VC383, VC386 *Hitachi* VT5000, VT5500 VT8000, VT8300, VT8500 VT9900, VT9500, VT9700 VT11E, VT14E, VT17E, VT19 VT33E

V133E Akai VS9700 VS2, VS3, VS4, VS5 VS9300, VS9500, VS9800 Many others available

All Panasonic All Ferguson/JVC. Sharp VC9300 etc. Sharp VC7300 etc. Amstrad 7000..... All Hitachi....

END SENSORS Hitachi VT64E

SENSOR LAMPS

SENSOR L.E.D.'s

Sanyo VTC5000, VTC5150 VTC5300, VTC5400 VTC9300

Sony SLC5, SLC7 SLC6.....

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NV2000, NV2010(Genuine)	£2.90
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Sham	
Sharp VC0100 VC0300 VC0500 (Genuino)	C2 00
VC9100, VC9300, VC9500 (Genuine)	£3.90
VC9100, VC9300, VC9500 (Genuine)	£3.90
VC9100, VC9300, VC9500 (Genuine) VC381, VC383, VC386 (Genuine) VC482, VC483, VC581 (also Saisho) (Genuine)	£3.90 £3.90
VC9100, VC9300, VC9500 (Genuine)	£3.90 £3.90 £2.98
VC910, VC9300, VC9500 (Genuine) VC381, VC383, VC386 (Genuine). VC482, VC483, VC581 (also Saisho) (Genuine). VC482 etc. (Equivalent) VC9300, 381 etc. (Equivalent)	£3.90 £3.90
VC9150, VC9300, VC9500 (Genuine) VC381, VC383, VC386 (Genuine), VC482, VC483, VC581 (also Saisho) (Genuine). VC482 etc. (Equivalent) VC9300, 381 etc. (Equivalent) Hitachi	£3.90 £3.90 £2.98 £2.98
VC9100, VC9300, VC9500 (Genuine) VC381, VC383, VC386 (Genuine). VC482, VC483, VC581 (also Saisho) (Genuine). VC482 etc. (Equivalent) VC9300, 381 etc. (Equivalent) Hitachi VT8000, VT8300, VT8500	£3.90 £3.90 £2.98 £2.98
VC310, VC9300, VC9500 (Genuine) VC381, VC383, VC386 (Genuine) VC482, VC483, VC581 (also Saisho) (Genuine) VC482 etc. (Equivalent) VC9300, 381 etc. (Equivalent) Hitachi VT8000, VT8500, VT8500 VT9300, VT9500, VT9700	£3.90 £3.90 £2.98 £2.98 £4.72 £4.75
VC9100, VC9300, VC9500 (Genuine) VC381, VC383, VC386 (Genuine), VC482, VC483, VC581 (also Saisho) (Genuine), VC482 etc. (Equivalent) VC9300, 381 etc. (Equivalent) Hitachi VT8000, VT8300, VT8500 VT9300, VT9700 VT9300, VT9700 VT11E, VT14E, VT17E, VT19	£3.90 £3.90 £2.98 £2.98 £4.72 £4.75 £3.96
VC9150, VC9300, VC9500 (Genuine). VC381, VC383, VC386 (Genuine). VC482, VC483, VC581 (also Saisho) (Genuine). VC482 etc. (Equivalent). VC9300, 381 etc. (Equivalent). W1800, V18300, V18500 V19300, V19500, V19700 V111E, V114E, V177E, V119 V133, V163, V165.	£3.90 £3.90 £2.98 £2.98 £4.72 £4.75
VC9150, VC9300, VC9500 (Genuine) VC381, VC383, VC386 (Genuine), VC482, VC483, VC581 (also Saisho) (Genuine). VC482 etc. (Equivalent) VC9300, 381 etc. (Equivalent) Hitachi VT8000, VT8300, VT8500 VT9300, VT9500, VT9700 VT11E, VT14E, VT17E, VT19 VT33, VT63, VT64, VT65 Akai	£3.90 £3.90 £2.98 £2.98 £4.72 £4.75 £3.96 £3.96
VC9150, VC9300, VC9500 (Genuine). VC381, VC383, VC386 (Genuine). VC482, VC483, VC581 (also Saisho) (Genuine). VC482 etc. (Equivalent) VC9300, 381 etc. (Equivalent) ###################################	£3.90 £3.90 £2.98 £2.98 £4.72 £4.75 £3.96
VC910, VC9300, VC9500 (Genuine) VC381, VC383, VC386 (Genuine) VC482, VC483, VC581 (also Saisho) (Genuine) VC482 etc. (Equivalent) VC9300, 381 etc. (Equivalent) Hitachi VT8000, VT8300, VT8500 VT9300, VT9500, VT9700 VT11E, VT14E, VT17E, VT19 VT33, VT63, VT64, VT65 Akai VS2, VS3, VS4, VS5	£3.90 £3.90 £2.98 £2.98 £4.72 £4.75 £3.96 £3.96 £4.50
VC91 ⁵ 0, VC9300, VC9500 (Genuine). VC381, VC383, VC386 (Genuine). VC482, VC483, VC581 (also Saisho) (Genuine). VC482 etc. (Equivalent) VC9300, 381 etc. (Equivalent) V18000, V18300, V18500 V19300, V19500, V19700 V111E, V114E, V117E, V119 V133, V163, V164, V165 Akai V52, VS3, VS4, VS5 Fisher FVHP615, FVHP710, FVHP725, etc.	£3.90 £3.90 £2.98 £2.98 £4.72 £4.75 £3.96 £3.96 £4.50 £6.90
VC910, VC9300, VC9500 (Genuine) VC381, VC383, VC386 (Genuine) VC482, VC483, VC581 (also Saisho) (Genuine) VC482 etc. (Equivalent) VC9300, 381 etc. (Equivalent) Hitachi VT8000, VT8300, VT8500 VT9300, VT9500, VT9700 VT11E, VT14E, VT17E, VT19 VT33, VT63, VT64, VT65 Akai VS2, VS3, VS4, VS5	£3.90 £3.90 £2.98 £2.98 £4.72 £4.75 £3.96 £3.96 £4.50 £6.90

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All packs are £1 each, if you order 12 then you are entitled to another free. Please state which one you want. Note the figure on the extrme left if the ref number and the next figures is the quantity of items in the pack, finally a short description

- BD4 5 Surface mounting 5 amp switches. Intended for mains but equally suitable for battery circuits
- 3 white flush switches. Will replace any standard BD5 size switch
- 2 30 volt 80 watt brass cased elements. Ideal for BD8 frost protection, pet warmers
- RD14 4 photo transistor Mull:ard reference OCP70
- BD16 4 reel to reel tape heads, 2 record, 2 erase
- BD17 1pr ultrasonic transducers, 1 to transmit the other to receive
- BD20 4 different mains micro switches, each average 1 000 000 operations
- BD23 1set loud speaker cross-overs up to 40 watt for woofer, mid-range and tweeter
- BD26 2 counters, belt driven as in tape decks
- BD36 2 air spaced tuning condensers. 1/4in spindle with trimmers
- **BD37** 2 ditto, but solid di-electric
- **BD41** 6 standard size rocker switches, 13 amp at 230 volts
- BD46 1 time-on switch. Stays on up to 6 hours, depending on control setting
- **BD48** 2 reed relays. 4-8 volt coil operated
- 1 12 volt relay. Miniature enclosed with 2 change-over contacts. 700 ohm coil BD51
- **BD57** 5 miniature switches for battery circuits, dolls houses, etc.
- BD60 4 ferrite rods. 4in long, 1/4in diameter. Suitable for aerials, inverter transformers, etc.
- BD64 10 assorted control knobs, 1/4in spindles, push-on
- and grub screw type BD65 4 different thermostatic switches. Control mains or
- battery devices
- BD69 2 25 watt 8 ohm variable resistors (pots)
 - 4 wire wound pots with built-in knob. Dne each 18 ohm, 35 ohm, 50 ohm and 100 ohm
- BD78 5 5 amp rectifiers, 50 volt

BD71

BD114

- BD82 4prs porcelain fuse carriers and fuse holders (make your own fuse board)
- 10 .1mfd 250 volt mains supressor condenser (cut **BD84**
- BD85 1 mains shaded-pole motor with 1/4in shaft
- **BD86** 4 5in aluminium fan blades. Will fit 1/4in shaft
- BD93 4 11pm bases for relays, etc
- BD94 5 B7G valve bases
- BD95 4 B9A valve base with metal skirt BD98
 - 1 motor driven stud switch Ex-fruit machines
- BD101 1 Delayed-on switch. Can be set at any time up to 2 hours. 115 volt so supplied with dropper
- RD104 1 cased mains unit. 4.5 volt regulated out-put
- BD106 2 12 volt alarms. Round, approximately 2in diameter. Sounds like a car hom
- 10 assorted 1/4in spindle volume controls BD109
- BD110 10 slider type volume controls
 - 1 2 watt amplifier made by Mullard, their reference 1172
- BD115 1 wall mounting thermostat, 24 volt
- BD126 4 batten holders, MES, will take torch bulbs, etc

Most other packs still available and you can choose any as your free

VERY POWERFUL 12 VOLT MOTORS - 1/2 and HORSEPOWER Made to drive the Sinclair C5 electric car but adaptable to power a go-kart, a mower, a rail model railway, etc. Brand new. Price £15.00 plus £2.00 postage. Our

WHITE CEILING SWITCH 15 amp 2 way surface mounting with cord and Made by the famous Crabtree Company. Price £1 each. Our ref

MAINS TRANSFORMER Upright mounting normal mains input, gives 28v at 3.5A so should be ideal for big amplifier, etc. Price only £4. Our ref 4P24, please add £1 postage.

POWERFUL IONISER

Generates approx. 10 times more IONS than the ETI and similar circuits. Will refresh your home, office, shop workroom etc. Makes you feel better and work harder — a complete mains operated kit, case included £12.50 + £2 P&P. Our ref 12P5/1

ORGAN MASTER. Is a three octave musical keyboard. It is beautifully made, has full size piano size) keys, has gold plated contacts and is complete with ribbon cable and edge connector. Can be used with many computers. We can supply information sheet. Brand new, only £15 plus £3 postage. Our ref 15915.

ULTRA SONIC INTRUDER ALARM. Small, nicely cased, will detect movement in a room up to 10m × 10m. Ingenious construction makes it independent of the mains, cannot be switched off, even with its orviorff switch, until you know the secret; has delayed action enabling you to switch it on and leave the room; it has an inbuilt piezo sounder which is very penetrating and high pitched and would finghten away most intruders. Has internal switching and could be coupled to an outdoor alarm if

required.

It is the basis of a very efficient burglar alarm, or has other uses. For instance, you could disconnect the internal sounder and using the internal switches you would know when somebody arrives without that person being aware that you know. Similarly, the unit could be used to operate other equipment uthar-sonically, it is brain deve, quaranteed OK, complete but less battery (PP3 alkaline type). Pice is £20 plus £3 insured delivery.

110 DECIBEL HORN. For use with the ultra sonic intruder detector ideal for external positioning to attract the attention of neighbours should you have an introduder. This unit has its own mounting bracket and comes complete with good length of lead Price E7. Our rel 7P9, Inodentally, this could also be used as a loud speaker.

31/zin FLOPPY DISC DRIVE - DOUBLE SIDED, DOUBLE DENSITY, 80 TRACK. Shugart compatible, has 34 way IDC connector and will interface with almost any computer. Made by the tamous Japanese NEC Company. Pince E595 Optus 23 insured post.



ATARI 65XE COMPUTER
At 64K this is most powerful and suffable for home and business. Brand new, complete with PSU, TV lead, owner's manual and six games. Can be yours for only 125 plus 13 insured

65XE COMPENDIUM. Containts: 65XE Computer, its data recorder XC12 and its joystick, with ten games, for £62.50 plus £4 insured delivery.

TIME AND TEMPERATURE LCD MODULE. This is a 12 hour clock, a Celous thermometer, a Fahrenheit thermometer, a too hot alarm and finally a too cold alarm. Nice size, approx 50mm x 20mm, with 12.7mm digits which clearly display the time or temperature. Requires only a 1 5v battery and a few switches. Comes complete with circuit diagram and explanation. Price 86. Our rel 6 P12.

CAMERAS. Three cameras, all by famous makers, Kodak, etc. One disc one 35mm and one instamatic. All in first class condition, believed to be in perfect working order but sold as untested. You can have the three for £10 including VAT, which must be a bargain – if only for the lenses, flash gear, etc. Our ref 10F58.

1/8th HORSEPOWER 12 VOLT MOTOR. Mace by Smiths body length of this is approximately 3in, the diameter 3in and the spindle 5' 16th of an inch diameter. It has a centre flange for fixing or can be fixed from the end by means of 2 ruts. A very powerful little motion which revs at 3,000 pm. We have a large quantity of them so if you have any projects in mind then you could rely on supplies for all teast two years. Price \$6. Our ref 6P1, discount for quantities of 10 or more.

PHILIPS LASER
This is helium-neon and has a power rating of 1.6mW
Completely safe so long as you do not look directly into the
beam when eye damage could result. Brand new, full spec.
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or this tube gives 8ky striking and 1.25ky at 5mA running.
Complete kit with case £15. Battery operated P.S.U. now
available at £15.

HAND-HELD VIDEO LAMP. Mains operated and will enable you to take professional s:andard videos. Made by the famous Ferguson Company, this uses a 1000w halogen lamp in a fan cooked, hand-held and hand-switched metal housing. Comes complete with obtonal bamdor assembly and camera bar. Óbviously intended to retail at over £60, we ofter these at £30 each plus £31 insured delivery. Our ref 30P3.

HIGH RESOLUTION MONITOR. 9n black and white, uses Philips tube M24/306W. Made up in a lacquered frame and has open sides. Made for use with OPD computer but suitable for most others. Brand new, £16 plus £5 post. Our reference 16P1.

12 VOLT BRUSHLESS FAN, Japanese made. The popular so shape ($4^1 {\rm Zin} \times 4^1 {\rm Zin} \times 1^3 {\rm Zin})$. The electronically run fans not oncourse very little current but also they do not cause interference a brush type motors do. Ideal for cooling computers, etc., or for a care

ACORN COMPUTER DATA RECORDER. (Ref ALF03) this is a mono data recorder with switchable motor control intended for use with the Acom Electron or BBC computers but also functions with almost any other computer and can be used for normal record and play back of music and speech. Can be battery operated but its supplied with a maints adaptor. Brand new in manufacturer's wrapping. Price £10. Our ref 10P44.

MUSIC FROM YOUR SPECTRUM 128. We offer the Organ master university out 28. You can then compose, play, record, store, etc., your own music. Price £19 plus £3 special packing and postage. Order ref 19P1

FDD BARGAIN

31/zin made by Chinon of Japan. Single sided, 80 track, Shugar compatible interface, interchangeable with most ofter 31/zin and 51/4in drives. Completely cased with 4 pin power lead and 34 pin computer lead. £40. Our ref 40P1. le sided, 80 track, Shugart with most other 31/zin and

OUR ALADDIN'S CAVE. You may be a new reader and not know that we have a shop at 12 Boundary Road, Hove, where you can go and have a browse around at our assortment of 'goodes'. Unfortunately, because of staff shortages, we cannot be open on Saturdays yet, so the hours are 9.00am to 5.00pm, Monday to Friday, We of course still serve callers at 250 but request that you bring a completed order form as 250 is

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POPULAR ITEMS Some of the many items described in our current

EHT TRANSFORMER, 4kv 2mA Ex-unused equipment, £5, Our ref 5P139.

FOIL CAPACITORS. Axial ended .33uf m1,000v 4 for £1. Our ref BD672

4 CORE TINSEL COPPER LEAD. As fitted to telephones, terminating with flat BT plug 2 for £1. Our ref BD639.

FHT TRANSFORMER 8ky 3mA \$10 Our ref 10P56

DOUBLE MICRODRIVES. We are pleased to advise you that the Double Microdrives which we were offering at about this time tast year as being suitable for the "OL", "OPO" and several other computers are again available, same price as before namely 15. Jur ref 5P113.

NOISE FIXTERS — MAINS INPUT PLUG TYPE. Japanese made, this is a chassis mounting block with a built in noise litter to cut out surges and voitage peaks which could interfee with and possibly even damage your equipment. These are easy to mount and tave a flange with two frung holdes. They take the standard 3 flat pin plug, 2amp model. Price £3 each Our ref 3P50.

LEAD LAMP. Motorists' Special Normal hand-grip type holder, with glass cover to protect the lamp and further protection in the form of a wire guard with a hook for nanging I deal as lott light or for car repairs, etc. Takes 60w lamp. Has good length flex Price \$1.5 Our ref 4P31

PHONE LEADS. 3 metres long, correctly colour coded, one end has flat plug which fits standard BT socket, other end has tag connectors $2 \text{ for } \Omega 1$ Our ref BD639. SUB-MIN TORGLE SWITCH. Body size 8mm \times 4mm \times 7mm SBDT with chrome dolly fixing auts 4 for £1.00 Order ref BD649

VERY POWERFUL MAGNETS. Although only less than 1in long and not much thicker than a pencil these are very difficult to pull apart. Could be used to operate embedded reed switches, etc. Price 50p each, 2 for £1.00. Our ref B0642.

CLEAR LACQUER. Quick drying for the protection of transfers, markings, maps, etc. Also protects wood and metal. Exceptionally clear. Large can for £1.00. Order

PAPST AXIAL FAN. MANUFACTURERS REF NO TYP4580N. This is mains operated 15watr rating and in a metal frame with metal blades so OK in high temperature. Body size approximately 43/4in square × 158in thick. £6 00 each, plus £1 00 postage. Our re 5F6.

SOFTWARE FOR REMAKING. Just arrived. Large quantity of maily games. All are on normal taze spool in cassette holders and should be suitable for wiping out and re-making irro games or programmes of your own design. We other 5 different for \$2 or 100 assorted for \$20. Important note: We cannot say which titles you will get nor accept owders for specified titles or 'so many, all different', etc., so only order if you can take them as they come. Order ref 5 for \$2 is \$29224, 100 assorted is

VERY USEFUL MAGNETS. Flat, about 1 in long, \(^1\)/2 in wide and \(^1\)/4 in thick. These are polarised on their faces which makes them ideal to operate reed switches in doors and windows or to hold papers or labels, etc., to metal cabinets, or even to cupboard doors firmly closed. Very powerful 6 for £1. Our ref BD274(a).

3 CDRE FLEX BARGAIN No. 1 – Core size 5mm so ideal for long extension leads carrying up to 5 amps or short leads up to 10 amps. 15mm for £2. Order Ref 2P189

3 CORE FLEX BARGAIN No. 2 – Core size 1.25mm so suitable for lon leads carrying up to 13 amps – or short leads up to 25A, 10m for Σ 2

ALPHA-NUNERIC KEYBOARD — this keyboard has 73 keys with contactless capacitance switches gring long trouble free life and no contact bounce. The keys are arranged in two groups, the main area field is a OWERTY array and or the right is a 15 key marber pad, board size is approx. 13" x 4"— brand new but offered at only a fraction of its cost namely £3, plus £1 post. Ref 3P27

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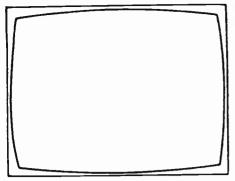
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CORRECTIONS

In Nick Beer's article on pages 512-3 last month the Panasonic NV-G21's "capstan motor" (VXP0777) should have read "capstan rotor". Salora Model 24K67 should have read 24L67.

COVER PHOTO

This month's cover photograph shows the Panasonic NV370 with the top and front covers removed to show the mechanism/internal layout. See article on pages 590-3.

TELEVISIOM

Business Slows

Here we are at the beginning of the age of satellite TV broadcasting in the UK. Business should be booming, but isn't. Which is not to say that the TV trade didn't do well last year. In fact sales of colour sets rose to yet another record in 1988, up nine per cent at 4·4 million. But, as so often, there wasn't a lot of profit in it. For the first time, sales of small-screen sets overtook those of large-screen models, suggesting that the market is now primarily one for additional sets. And we all know the silly prices that are being asked for many of these small sets, with 14in. CTVs having been on offer for as little as £90. The chancellor's attempts to dampen demand through high interest rates have depressed sales this year. The silly prices seem to reflect an attempt to maintain turnover at the expense of profit margins. Perhaps this is inevitable when the large chain stores operate by placing massive orders with manufacturers. The stuff has to be kept moving somehow.

The public, having sated itself on CTVs and VCRs (2·3m in 1988, with market penetration now at 64 per cent of households), is not at present in the mood to invest in satellite TV equipment. Consumer research carried out by Ferguson has shown that only one per cent of those interviewed intended to buy a satellite TV receiver this year. Two per cent said they would probably buy, four per cent said they "might or might not" while a massive 85 per cent said they definitely wouldn't. Hardly a vote of confidence in the present offerings. In fact of course this reflects the present uncertain situation, with Sky seeking to establish itself on a shoestring and the advent of the BSB services in the autumn awaited. Sky gambled on getting in first. It must be getting worried as the summer slips by with so little consumer interest being apparent. All the signs are that a sizeable market won't develop until the two sets of services are in operation.

In the past Ferguson's market forecasting has been remarkably accurate. Its recent report on the consumer electronics market in the UK – from which the above figures have been taken – suggests that satellite TV will begin to take off in 1990 and 1991, when sales of 1.2m and 2m installations respectively are predicted. On the Sky/BSB battle, the report comments that "the system that wins the long-term battle will be the one that provides the best quality popular programming, and is sure to have little to do with technological advantages, manufacturers or retailers".

It's deeply unfortunate that satellite TV should have to be seen as yet another systems battle. But the two services require different technology, and although compatible units are possible and will doubtless come on offer they will tend to be expensive, calling for a steerable dish and wideband LNB plus duplicated decoding and descrambling circuitry. Possibly both systems will attract enough viewers to survive. But the problem is that satellite TV is basically an extra alternative to the already established and popular terrestrial services. Technically, Sky has proved to be a great success. BSB with its stronger signals should be equally easy to receive. It will, to say the least, be interesting to see how things develop.

Konosuke Matsushita

Konosuke Matsushita, founder of the world's largest manufacturer of consumer electrical/electronic products, known for its Panasonic, National and Technics brands, died in Osaka on April 27th, aged 94. Matsushita's father had lost heavily through speculating on rice futures and as a result Konosuke was forced to seek work at the age of nine. He started as an apprentice at a charcoal seller, then took a job in a bicycle shop. In 1910 he took up employment at the Osaka electrical utility. When, in 1918, his superiors showed no interest in his ideas for improving electrical sockets he left to start his own firm. That was the beginning of Matsushita Electric, as an electric light bulb manufacturer in a two-room apartment. Between the wars Matsushita became a pioneer in the mass production of consumer electrical products. The post-war story will be familiar to readers, as National and Panasonic became internationally known brands. Konosuke retired in 1973.

It goes without saying that to have built up such an enterprise Konosuke must have been a remarkable man. Many facts and stories about him confirm this. Apparently during the great depression, when the government decreed belt-tightening and many manufacturers laid off staff, Matsushita put his staff on half-day working at full pay and urged his employees to sell the backlog of stock. Within three months the stock had been cleared and Matsushita had worked itself back to profitability. He was known for his writings, as an authority on management techniques, and also for his educational and cultural activities. He wrote that "the ultimate aim of production is to wipe out poverty and create prosperity . . . to make all products as inexhaustible and as cheap as tap water". In the post-war period he established first the PHP (Peace and Happiness through Prosperity) Institute and then, in 1983, the Science and Technology Foundation of Japan, to promote scientific research and development. He expected dedication and hard work, and was perhaps rather excessively nationalistic in regarding the 21st century as the time when the world would consist of a Japanese hegemony – the century of Japanese man. Be that as it may, the company he started with 200 yen had sales of 5·45 trillion yen in 1988 and employed some 180,000 people in approaching forty countries.

Still Video Systems

George Cole

Although the video camcorder has largely replaced the cine camera for home movie making, film is still used for conventional photography. A still video camera offers a number of useful features such as instant picture display via a TV set, a recording medium that's reusable and the possibility of picture transmission down a telephone line. Still video has yet to match the quality and price of film however. The gap between film and video is nevertheless narrowing, and at last year's Photokina exhibition a number of manufacturers demonstrated still video systems. Marketing of still video cameras (SVCs) in Europe may start this year.

The first electronic still-image video camera, called MAVICA (MAgnetic VIdeo CAmera), was unveiled by Sony in August 1981. The camera closely resembled a 35mm SLR camera in appearance, but a magnetic floppy disc rather than conventional chemical film was used to store the picture information.

The initial MAVICA system was a prototype which Sony used as a means of persuading other companies to join in, agree upon and develop a common still video recording system – it seems that someone had learnt something from the VHS/Beta video format war! In February 1983 twenty electronic, photographic and film companies formed the Electronic Still-Image Video Camera Committee and started work on establishing a world standard system. By May 1984 the committee had grown to 32 companies and agreement had been reached on a standard Video Floppy System (VFS). During the same year Sony's still video camera was demonstrated at the Los Angeles Olympics. A number of companies had in addition started to develop professional still video cameras

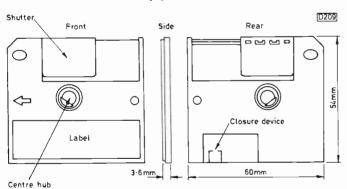


Fig. 1: Appearance of the disc jacket.

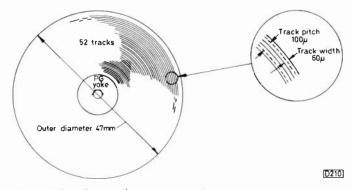


Fig. 2: The disc track arrangement

which were used and assessed by newspaper photographers.

Fuji introduced the Fujix TV-Photo system in April 1985. In use the photographer shoots pictures on conventional film which is processed in the normal way. The images can then be transferred to a disc, inserted into a player and viewed on a TV screen. After viewing, the photographer can order the best shots for development on normal film.

In April 1986 the Electronic Still-Image Video Camera Committee, which by now had members from 42 companies, agreed to an optional method for recording sound with pictures. Then in July 1988 the committee agreed to a "hi-band" format for improved VFS picture quality.

The first domestic SVCs were unveiled at last year's Photokina and the first models went on sale in Japan late last year.

The Storage Disc

The committee decided to adopt a 47mm (two inch) single-sided floppy disc which looks like a miniature version of the standard 3.5in. computer floppy disc. The 47mm size allows up to 50 shots to be stored using a light, compact still video camera. The disc sits inside a hard plastic protective jacket whose dimensions are $60 \times 54 \times 3.6$ mm (see Fig. 1). Its weight is 8.7g.

Conventional computer floppy discs have a magnetic layer that's composed of ferric oxide. Instead, the video floppy disc has a coating of metal powder. This increases the coercivity and also gives a very high information packing density. The video floppy disc has a recording capacity of 1.5 Megabytes unformatted, 0.8 Mbytes formatted. Its recording density of 64KBPI (kilobits per inch) is way ahead of standard 3.5 and 5.25 inch computer discs, whose recording densities are around 9KBPI and 6KBPI respectively. The magnetic layer is four microns thick (the total disc thickness is 40 microns) with a coercivity of 1,250 Oersteds and remanence of 1,800 Gauss.

The disc can store a mix of audio, video and computer data as a series of concentric tracks (see Fig. 2). Each track is 60 microns wide, the track pitch being 100 microns. The disc holds a total of 52 tracks, but track 51 is not used. Fifty tracks store video images, audio signals and data while the 51st track (actually at track position 52), called the cue track, stores digital data. Each track has a 16Kbyte capacity. The recording radii of the main tracks are 15·1-20mm, the cue track radius being 14·9mm.

A fixed head that tracks across the disc's surface reads and writes the tracks. The head has two gaps, spaced 100 microns apart, to allow fast reading and writing of two tracks – the purpose of this arrangement will become apparent later.

Several features are incorporated in the disc and the drive unit to ensure that the head reads the correct track at the right point. First the disc hub contains a spring that holds the disc firmly to the drive spindle to prevent slippage. Stability is also ensured by incorporating a magnetic plate into the hub – it comes into contact with a magnet in the spindle. For accurate start positions when

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reading or writing the hub contains a pulse generator (PG) yoke and the drive a PG coil (see Fig. 3).

Recording

All SVCs use a solid-state CCD image sensor. This has an array of photodiodes that correspond to the image pixels (picture elements). Exposure to light charges the photodiodes. Horizontal and vertical CCD shift registers are used to scan the array, producing a sequential output signal. For more on solid-state image sensors see Steve Beeching's article last month. The image sensors used in most SVCs have some 400,000 pixels.

For PAL and SECAM systems the disc rotates at 3,000 r.p.m. while for NTSC the rotational speed is 3,600 r.p.m. These speeds correspond to one field period of the respective TV systems.

The video signal, see Fig. 4, consists of luminance and colour-difference (R-Y) and B-Y information. These three signals are frequency modulated and then multiplexed on to a single track. The deviation of the luminance carrier is 6-7·5MHz while the two chrominance signals have carriers with centre frequencies of 1·2MHz (R-Y) and 1·3MHz (B-Y). An alternate line chrominance recording system is used with the VFS format, i.e. the two chrominance signals are recorded on alternate lines. This method is similar to the SECAM TV system and helps to maintain picture quality during demodulation.

With the standard VFS format the horizontal resolution is around 360 lines, though with some cameras it may be possible to dispense with the chrominance carriers and extend the lower luminance sideband, producing monochrome images with slightly improved resolution.

SVC users can choose between two recording modes. In the field mode a single track is used to record the image, allowing up to fifty images to be stored on the disc. The penalty is a loss of vertical resolution. In the frame mode two tracks are used to record each picture. This halves the number of pictures recorded to twenty five. The two fields are recorded sequentially by the twin-gap head.

The VFS system has been designed to be very versatile.

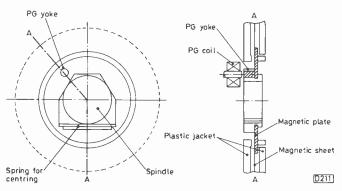


Fig. 3: The disc hub and drive spindle.

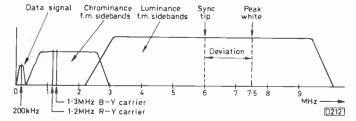
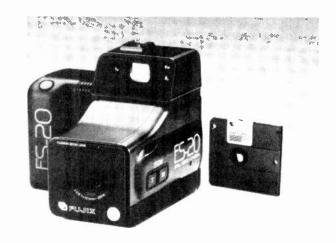


Fig. 4: Frequency spectrum of the recorded signals.



The Fujix ES-20 still video camera.

It's possible to record, erase and reuse specific tracks. Field and frame recordings can be mixed on the same disc.

Hi-band Format

The hi-band VFS system was developed to improve the picture quality and make the idea of still video more appealing to the discerning photographer. The frequency of the luminance carrier is increased and the deviation widened to 7·7-9·7MHz, increasing the horizontal resolution to 500 lines. As with the S-VHS system, hi-band cameras have dual-system capability, i.e. they will also store and reproduce pictures in the standard VFS format.

Several companies have produced hi-band still cameras using high-resolution image sensors with around a million pixels. Kodak recently announced the development of a four million pixel image sensor.

Unfortunately there's no agreed standard for making direct picture quality comparisons between still video and film. Electronic companies estimate that a colour 35mm photograph has a resolution equivalent to three million pixels while film companies put the figure at nearer twenty million pixels!

Multiplexed Data

It's possible to multiplex digital data on to the video track in addition to the composite video signal. As a result text or numerical information can be added to the video image. The data is recorded at the same time as the video signal.

Four groups of data can be added: (1) the track number; (2) the date of recording in year, month and day;



The Fujix DS-1P digital SVC, with storage card.

(3) field/frame identification; (4) user's specification. This latter information is at the discretion of the manufacturer and can include such things as the exposure value, shutter speed and whether the recording is standard or hi-band. Because this user data is not standardised a disc recorded by one maker's camera may not display some or all of the user information when reproduced via another maker's equipment.

The data stream modulates a 200kHz carrier (see Fig. 4). A form of differential phase shift keying (DPSK) is used. With this system each phase change represents a binary digit (bit) – the Nicam stereo sound system uses a variant of DPSK in which each phase change represents two bits.

Audio Recording

There's provision within the VFS system for short audio recordings, though not all SVCs will offer this facility. It enables users to accompany the video images with narration, music or sound effects. Since the video tracks are already hard pushed to accommodate the luminance and chrominance signals, and because of the possibility of interference, the audio signal is recorded on a separate track. This means that only up to twelve frame or twenty five field images can have sound accompaniment.

To make an audio recording in the time equivalent of one disc rotation, i.e. one fiftieth of a second with the PAL system, time compression has to be used. The recording process is shown in block diagram form in Fig. 5. The analogue audio signal is filtered and then passed through a 2:1 companding noise-reduction system. Time compression is then applied. The system works as follows. After analogue-to-digital conversion the signal is stored briefly in a random access memory, being read out at a faster rate. The difference between the read-in and readout rates determines the compression ratio. A flag control code is added as a marker for the compression ratio. After digital-to-analogue conversion, pre-emphasis is applied and the signal is then fed to an f.m. modulator, the centre frequency being 6MHz. The output goes to the record amplifier and is then recorded on the disc. Quite a lot of technology here! The playback process is the reverse of course.

There are three specified compression ratios, though most SVCs that incorporate audio recording will offer only one. For the PAL system the agreed ratios are 1:272, 1:544 and 1:1,088. These give around five seconds of 10kHz sound, ten seconds of 5kHz sound and twenty seconds of 2.5kHz sound respectively. The NTSC ratios are 1:320, 1:640 and 1:1,280. Sony has a professional NTSC model that can replace the video tracks with 480 seconds of 5kHz sound.

Data Tracks

Storage of tracks of digital data is also written into the VFS specification. At present the only data-only track is the cue or data control track which is used to control the playback order, text or number superimposition, audio

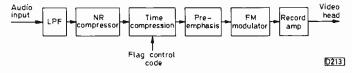


Fig. 5: Block diagram of the audio recording system.

recording etc. Future models however may allow for a mixture of computer programs, video, text and sound on a VFS disc.

Hardware

The features and specification offered by a particular SVC are, not surprisingly, determined by its price. Basic models have a fixed focus lens, auto white balance, auto exposure, auto flash and even field only recording. Playback is via a still video player or adaptor. Upmarket models may offer field/frame recording, a zoom lens (typically ×3), an auto timer, fast shutter and high-speed shooting operating at some 3-10 frames per second. Other possible features include sound and data recording and integrated modulators to allow instant playback via a TV set.

Most recorders and players will be equipped with a variety of sockets to allow interfacing with a number of items including a camera, TV/monitor, computer, printer, modem and VCR. TV/monitor socketry is likely to include provision for r.f., composite video, RGB and Sterminal.

Playback can vary from simple display to audio dubbing and digital effects such as multiple image display.

High-quality video printers are very expensive, the prices running into thousands of pounds. Thus SVC users are likely to take their discs to local dealers if they require hard copy print-outs.

There are several ways of printing video images. The sublimate dye thermal transfer line printing system brings ink paper and cartridge paper into contact with each other. Heat is then used to transfer the dye to the plain paper. The contact exposure system shines light from a fibre-optic tube on to photosensitive material to produce the image. Konica estimates that a single hard copy print should cost around Y100 (50p).

Digital System

At last year's Photokina Fuji produced a surprise in announcing a prototype SVC that didn't conform to the standard VFS format. The Fujix DS-1P is an all-electronic camera that uses a 16Mbit RAM card instead of a floppy disc. Thus the image is stored in digital rather than analogue form. The card can store ten field or five frame images, although Fuji says that compression techniques could increase this to forty frame images. More recently Fuji has announced a cartridge system that holds five RAM cards, giving 25 frame recordings or 50 recordings in the field mode.

The advantages of digital storage are many: no moving parts to wear out, no image deterioration during copying, and easy interfacing with personal computers and other electronic equipment. The snag is that the compression techniques required are expensive. Thus it may be years before consumer digital SVCs become viable. By that time the analogue SVC will probably be firmly established in the market. As the VHS/Beta/V2000 format battle clearly illustrated, it isn't always the most advanced technology that wins in the end.

Acknowledgements

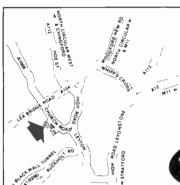
My thanks are due to Mike Maclachlan, Technical Support Manager, and Gary Godfrey, Senior Product Engineer, of Sony UK for their assistance in the preparation of this article.

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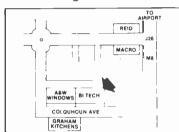


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Long-distance Television

Roger Bunney

With the intense solar activity, one of the biggest auroras for many years was seen in March. There has naturally been good F2 reception, with a sprinkling of Sporadic E signals and a touch of tropospheric activity. Certainly a lively and interesting month. The winter/spring of 1989 has produced for us an active spell during a period that's normally quiet if not worse. The sunspot maximum for the present cycle is expected to be this December, with a smoothed estimated count of 190. So to the general log for the period.

5/3/89 F2 layer reception from Iran ch. E2, Malaysia. ZTV (Zimbabwe) ch. E2, GBC (Ghana) ch. E2, TSS (USSR) ch. R1 plus unidentified ch. E2 signals. Tropospheric reception produced signals from ORF (Austria) chs. E5 and E24, Switzerland chs. E6, 7 and 34 plus TDF (France), RTL+ (Luxembourg), Belgium and Holland in Band III and at u.h.f.

6/3/89 F2 reception from VOK (Kenya) ch. E2, Dubai E2, ZTV E2. SpE signals from YLE (Finland) in chs. E3 and 4.

7/3/89 F2 reception of TSS ch. R1 plus unidentified ch. E2 signals.

8/3/89 Unidentified F2 signals from the east in the early morning and the south at midday in ch. E2, plus TSS R1

10/3/89 F2 reception from Dubai E2, VOK E2 and ZTV E2. SpE reception from TVE (Spain) chs. E2, 3 and 4. Improved tropospheric conditions with Band III and u.h.f. signals from TDF plus suspected Basque TV on ch. E35.

11/3/89 Tropospheric reception as on the 10th.

12/3/89 Unidentified F2 signal from the south east, ch. E2.

13/3/89 F2 reception from TSS R1 and VOK E2. Also major auroral event, see later.

14/3/89 Auroral event continues.

16/3/89 F2 reception from ZTV ch. E2.

17/3/89 Minor aurora with unidentified ch. E2/R1/E3 signals.

19/3/89 F2 reception from Iran ch. E2 midday.

20/3/89 F2 reception from Iran (IRIB) ch. E2 and Dubai ch. E2. Unidentified SpE signal in ch. E2.

22/3/89 F2 reception of PM5544/5534 test patterns floating/fighting, thought likely to be ZTV/VOK.

23/3/89 SpE reception from TVE E3 and RAI (Italy) ch. IA. 24/3/89 Unidentified ch. E2 and TSS R1 signals via F2 at 0700

GMT.

25/3/89 F2 reception from Dubai ch. E2.

30/3/89 Major tropospheric opening with signals from West and East Germany, TDF and the Benelux countries in Band III and at u.h.f. The new RTL+ ch. E36 outlet was well received in the south east.

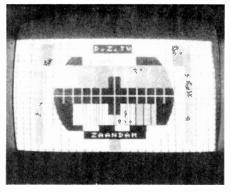
31/3/89 Tropospheric reception as on the 30th.

There was daytime F2 reception throughout the month starting from around 0800 GMT, with typically signals from the farther areas of Russia, then from Malaysia and Iran (often noted with the FUBK test pattern), Dubai with teletext pages, VOK with the PM5544 pattern and ZTV with the PM5534 pattern. It appears that a ch. E2 third network transmitter is in operation in Malaysia – Garry Smith noted a suspected caption on March 5th. Ghana ch. E2 was seen on the 4th with a "darkish" variation of the FUBK pattern, very distinctive.

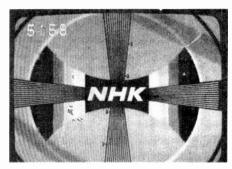
The auroral event on the 13/14th was spectacular both visually and in terms of v.h.f. reception. One could see it with the naked eye even in the south. Simon Hamer (Powys) described it as a hillside fire in the sky. The v.h.f. results were extraordinary. For many enthusiasts simply aiming an aerial towards the north produced incredible levels of interference in Bands I and III, so much so that signals were often impossible to resolve. Radio effects extended throughout Band III and Ryn Muntjewerff (Holland) noted evidence of low-level signals at the lower Band IV frequencies. For the persistent, signals could be resolved. Simon Hamer identified TSS chs. R1, 4 and 7, RUV (Iceland) ch. E3, SVT-1 (Sweden) chs. E2, 3, 4 and 8, NRK (Norway) chs. E4 and 5, DR (Denmark) ch. E7, ARD (W. Germany) chs. E9 and 10, DDR (E. Germany) ch. E12, TVP (Poland) chs. R2 and 3, RTE (Ireland) chs. B, D, F, G, H, I and J. Many other signals were unidentified, including a 525-line one on ch. A2 (North American). The TV signals were fair/poor with much distortion and hum. Optimum reception was with the aerials pointing to the north east.

In Australia Anthony Mann (Perth) experienced the southern version of the aurora, which he describes as "spectacular" with the visual effects reaching to an elevation of $50\text{-}60^\circ$ and to $\pm 50^\circ$ of due south. The event lasted from 1130-2130 GMT with a three-hour gap between the two phases (1300-1600). It was seen throughout New Zealand and as far north as Queensland, with many white vertical streamers. Garbled interference was noted in ch. R1 but there were otherwise no signals.

Cyril Willis (King's Lynn) comments that March was "the best I can remember", with F2 signals on most days. His most dramatic reception was a definite sighting of China chs. R1/C1 on the 5th at 0957 GMT, with athletics. He noted Malaysia ch. E2 and many other unidentified signals at this frequency – four separate E2 carriers were

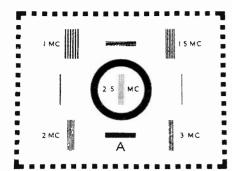


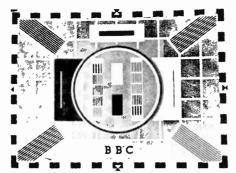


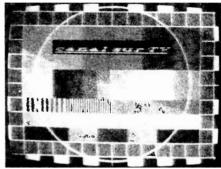


Left: Test pattern used by a Dutch pirate TV station, on ch. E2. Centre: Dortmund ch. E48 "Local TV" caption. Both photos courtesy Ryn Muntjewerff. Right: The Japanese NHK test card, courtesy Fred Robins, Stubbington, Hants.

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Left: Vintage TV – Test Card A, the BBC's first one. Centre: Test Card C, used by the BBC from 1948-1964. Can anyone fill the gap by providing any information on Test Card B? Photos provided by HS Publications. Right: The Canal Sur TV test pattern seen in Gibraltar on ch. E65 originates from Mijas. Photo courtesy George Gaskin.

noted at one particular time. Robert Copeman in Australia (Victoria) also noted good F2 reception, with RTM (Malaysia) ch. E2 on the 18th. Nearby, Todd Emslie logged F2 reception on several days, with China chs. C1 and R1 (several transmitters) on the 15th and RTM/China on the 17/18th.

Mike Foubister (ZL3TIC) in New Zealand uses an upmarket receiving system consisting of a 22-element logperiodic aerial with integral GaAs f.e.t. tuned preamplifier covering 40-110MHz. He noted considerable Pacific/North American traffic in the low v.h.f. band. Of some importance to us is his list of the following transmitter offsets - essential for positive identification. Timaru TV2 (South Island) 45-24MHz vision, 50-74MHz sound. Wellington TV1 45-25MHz vision, 50-75MHz sound. TV2 Far North 45-26MHz vision, 50-76MHz sound. In addition ABC-TV Wagga Wagga (Australia) has 46-24MHz vision, 51.74MHz sound while TVQ0 (Brisbane) has 46.17MHz vision, 51.67MHz sound. Incidentally we've just heard that DDQ0 ch. 0 Queensland now has stereo sound on 51.91 and 51.67MHz – this corrects the details given in the April column.

All in all then an excellent month. The sunspot count was over 200 on the 20th, and despite the severe magnetic storms on the 13/14th F2 remained active. It all looks good for autumn F2!

It seems that Belgium may be testing for a new service, possibly Belgian Canal Plus – Anderlues has been seen testing with an identified ch. E58 test card on a 24-hour basis

My thanks to the following for sending in reception reports: David Oliver (Birmingham), Peter Schubert (Rainham), Simon Hamer (Powys), Mark Baldwin (Rugby), Garry Smith (Derby), Tim Anderson (St. Leonards), Cyril Willis (King's Lynn), Roger Fussel (Torpoint) and Ryn Muntjewerff (Holland).

News Items

USA: A committee of ch. A2 broadcasters is being established. This particular channel suffers badly from SpE interference and the use by viewers of poor aerials. One proposed move is to tilt the transmitted beams below the horizon to reduce skywave radiation, and to seek FCC approval to lift transmitter powers by 3-4dB to compensate for the loss of signal quality in fringe areas. Discussions are also to be held with manufacturers of domestic aerials with a view to improving low-band performance.

The CIA sponsored Radio Marti service is intended for Cuba, operating in the medium-wave band. Thought is now being given to the start of a TV Marti service

operating in ch. A7. The transmitter would be atop a captive balloon at 10,000ft, sited in the extreme south of Florida. US broadcasters are not too happy about the prospects of co-channel interference and have objected to the FCC.

West Germany: The BDXC reports that new transmitters are planned as follows: NDR-1 Hamburg ch. E26, 20kW e.r.p.; Niebull ch. E29, 100kW e.r.p. Both will carry the regional programme from Kiel.

The satellite SAT-1 service is transmitted from Aachen on ch. E27 at 0-1kW. This station also transmits RTL+ on the adjacent ch. E26, at the same power.

Ireland: New information sheets are available free of charge from RTE, Reception Investigation, Donnybrook, Dublin 4. One sheet covers the RTE radio network transmitters while the other covers the community-owned TV schemes in operation at January 1st.

DIY Satellite TV

From time to time we receive letters describing quite remarkable reception obtained using novel equipment/ techniques. Recently we received a long letter from Paul Matthews in Surrey describing, amongst other things, his 11GHz satellite TV reception using a 31cm Chinese wok lid and a system that includes water pipe, kitchen foil and plasticine. This has given him Astra signals and TDF-1 at 19°W. It's evident that we have a genius amonst us! Paul has been invited to contribute articles describing his equipment and we look forward to reading about it.

The Chinese wok lid, with wooden knob, was pur-



Paul Matthews' wok dish system brings in signals from Astra and TDF-1, the latter completely noise free.

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chased for £2 in 1987 from Lee Fook Domestic Electrical Supplies, 25 Wardour Street, London W1. It has a diameter of 31cm, a focal point of 72mm, and was adapted for Cassegrain feed by means of a 22mm length of copper water pipe with a 40mm diameter disc suspended at one end using 16g copper wire. Plasticine was added to the disc, covered with aluminium foil, to form the reflector. Focus is adjusted by means of a 22mm water pipe coupler plus flange screwed to the back of the dish. A transition flange is made from a flattened coupler to provide a link to the LNB.

With a 1-6dB noise LNB and a home-constructed receiver with 18MHz i.f. bandwidth just sparklie-free signals are obtained from Astra, though saturated colours tend to be noisy. The 62dBW TDF-1 signals give completely noise-free reception, stable picture display with the MAC coding being obtained by means of a home built sync inserter. This is based on an SAA5020 sync divider and a 6MHz crystal, with varicap diode control.

Paul has seven dishes at his satellite receiving station. In addition to the wok there are ex-Jumbo Jet 75cm radar dishes, a home-made 5ft petal dish for Gorizont at 4GHz and others covering various bands.

One project we hope to feature uses a cheap u.h.f. TV tuner to downconvert Astra signals to 600-800MHz for distribution to up to six receivers, using cheap coaxial cable and simple i.c. technology. Briefly, the output from a 2-2dB noise LNB is downconverted using a BFY90 multivibrator and HP2800 Schottky diode. At the receiver a standard tuner (e.g. ELC1043) provides an output at 70MHz which, via a 22MHz bandpass filter, is fed to an MC10116 limiter/amplifier, MC1496 demodulator, 72733 video amplifier, NE564 clamp and then a PLL, sound demodulator etc. We look forward to hearing more about this.

EBU Transmitter Listings

France: Carcassonne TDF-6 (M6) ch. E43, 300kW; Auxerre TDF-6 (M6) ch. E49, 100kW; Sens TDF-3 (FR3) ch. E50, 20kW; Toulon TDF-5 (La 5) ch. E57 and TDF-6 (M6) ch. E60, both 50kW. Polarisation is horizontal in all cases

Syria: Haddar (Ortas-1) ch. E4, 0·2kW horizontal – one for the optimists!

We understand that the Siedlee TVP-1 (Poland) service has been transferred from ch. R1 to ch. R52.

Satellite News

Things move quickly in the world of satellite TV. This unfortunately means that items we publish may be history by the time they are read. There are rumours that a new Intelsat craft is to be launched soon at 30°E, carrying several 11GHz downlinks. At 16°E ECS-F1 has been carrying ITC Stockholm tests at 11-47GHz horizontal, with programming from time to time. Italian outside broadcast links have been seen via ECS-F5 at 10°E and about 11GHz horizontal. The Intelsat craft at 27-5°W is at present transmitting a high-level blank carrier. This was formerly used by MTV and is shortly to be used for the new scrambled BBC European all-day service which you too can view at £270 for the first two years, including a new decoder. It seems that this service will not use the Sat-Save scrambling system.

PanAmSat at 45°W was seen carrying the 259th Mormon Conference from Salt Lake City live on April 1st, with 625-line PAL on the second of its three Ku band transponders. This transponder has previously had occa-



sional use, e.g. for the US elections, generally with System M video. The Mormon Conference was broadcast with English sound on a 6-6MHz subcarrier and German sound on a 5-8MHz subcarrier.

Hugh Cocks reports from Portugal that the vertically polarised Astra transmissions are well received there using 1.5m dishes. The horizontally polarised transmissions are some 10dB down however, calling for a dish of 3m or more to provide adequate quality reception.

The Russian Ekran (window) satellite series is now providing two services. The original 714MHz (ch. 51) service is captioned "Orbita III" and provides time-shifted Moscow TV transmissions. It's intended for Siberia and the far north but can be received at good strength across most of India using appropriate Yagi aerials. In India, programme times are approximately 0500-1100 and 1400-2300. A new service at 754MHz (ch. 56) provides a further time shift to 0230-0900 and 1130-2100 Indian time. It's captioned "Orbita II" and carries the same programming, apparently intended for the extreme north east of the USSR. As a result signal levels in India are somewhat lower. Test transmissions lasted for a month until the service started at the end of February. Nanda Kumar (Madras) has seen reference to a "Global Antenna" that would bring Russian TV services to the farthest corners of the world. This was in a locally circulating Russian magazine, Science and Technology (February 1989 issue). The standard would be SECAM with a 6.5MHz sound subcarrier. Does anyone have further information on this proposed service? It seems that the Gorizont series will be carrying 11GHz Russian TV services to the USSR and Eastern Europe in due course: could this perhaps be the service referred to?

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TV Fault Finding

Reports from Philip Blundell, Eng. Tech., Paul Hardy, Hugh MacMullen, Ian Bowden, Nick Beer and J.R. Armagh

ITT CVC1200 Series Chassis

For low h.t. at 90V instead of 145V check whether the pulse feedback transformer Tr712 in the switch-mode power supply is open-circuit. You get the same effect when the line output stage isn't working, for example if the line driver stage is inoperative because the h.t. feed resistor R744 is open-circuit.

P.B.

Philips K35 Chassis

This set was dead with no 140V h.t. supply. The 12V feed to the power supply was low and was being dragged down by the wire connected to pin 3 of plug M2. This led us to the TRD4 panel where plugs V25 and V23 had accidentally been swapped over. . . Be careful to mark the plugs as you disconnect them — there are six white two-pin plugs that go to this module and it's easy to get them mixed up.

P.B.

Philips 2A Chassis

This set was dead. On investigation we found that the protection thyristor 6727 had fired because the voltage at L5601 in the EW modulator circuit was too high. We noticed that C2608 ($4.7\mu\text{F}$) was missing, but a check on a few stock sets showed that this is not fitted in models that have 45AX tubes. All the flyback tuning components and supplies were o.k. Attention was then turned to the EW modulator, where the driver transistor Tr7599 (BD234) was found to be non-conductive. D.C. checks revealed that R3598 hadn't been pushed through the print at the factory.

Philips CTX-E Chassis

This chassis normally uses a TDA2577 as the sync/field generator chip. Don't try a TDA2577A in this position – you'll end up with excessive height.

P.B.

Philips CP90 Chassis

For field collapse check whether R3623 (8·2Ω) is opencircuit. This removes the 163V supply to the base circuit of Tr7571 in the field output stage. R3623 is by the line output transformer. P.B.

Philips CTX-E Chassis

There was no picture – just a blank raster when the brightness control was turned up. The voltage at the TDA3560 colour decoder chip's contrast control pin 7 was low at 1V because C2565 (39nF) in the beam limiter circuit was open-circuit.

P.B.

Grundig GSC100 Chassis

This set had horrible field linearity problems. A check revealed that the supply to the field timebase panel was low at about 11V, but changing the TDA1170 chip made no difference. Voltage checks in the line output stage showed that several of the supplies were a bit low, though not significantly. When the field module was powered by

a separate 18V supply the scanning was correct, so the problem was a supply one. It eventually transpired that fuse Si627 had gone high-resistance, though not high enough to show on my initial meter check. This fuse is between rectifier diode Di627 and its reservoir capacitor C628 and was thus limiting the peak current into C628.

Toshiba C2085, C2090/Rank T24 Chassis

This set was actually a Toshiba C2090. The fault was intermittent colour. Changing the colour decoder chip IC501 made no difference and meter checks were inconclusive, so the scope was brought into action. This revealed that the line pulses at pin 4 of IC501 didn't look too healthy, though the manual doesn't show the waveform. On checking back to the source of the pulses I found that R229 ($3.6 \mathrm{k}\Omega$) on the main panel was virtually open-circuit. For those of you who may be interested, the waveform would appear to be about 1.5V peak-to-peak with nice straight sides and tops!

Philips K40 Chassis

This set had field linearity problems at the top of the picture, with teletext lines visible. While investigating the cause of the trouble the TDA3650 field timebase chip blew up. After replacing it along with the safety resistor R3186 I powered up the set, having made a few more checks and sensing victory. You've guessed of course, the TDA3560 and R3186 both failed. After extensive checks in the field output section of the circuit I eventually found that C2107 (100 μ F, 63V) had gone low in value. Replacing this provided a complete cure.

Philips 2A Chassis

This set would switch off after exactly twenty minutes and no amount of tapping would bring it back to life. When the fault was present there appeared to be a short between pin 17 of the line output transformer and chassis. A freezer test eventually showed that C2609 (9·1nF) was short-circuit when warm. Normally this capacitor cracks and goes black, giving a visible clue.

H.MacM.

Panasonic TC261G

The problem with this set was very low h.t. We found that D812 (SV03) in the self-oscillating switch-mode power supply had gone very high-resistance while the d.c. amplifier transistor TR802 (2SA636) was short-circuit.

H.MacM.

ITT CVC1210 Chassis

This set came in with very intermittent sound and vision. After a few minutes the fault disappeared and no amount of tapping would bring it back. The cause was eventually traced to glue on pin 32 of the tuner/i.f. module (CMR800/3). This glue is used in some quantity to secure

C1075 (2,200 μ F) in position and had spilt on to the contacts. H.MacM.

Salora M Series

This set was completely dead, with the 2AT mains fuse and the 2·2Ω, 5W surge limiter resistor RB701 both open-circuit. I spotted the cause of the breakdown as soon as the back cover was removed – CB705 (680pF) hadn't been fitted correctly during manufacture. Only one end was soldered through the board, the other end resting on the surface of the PCB. As this capacitor is part of the snubber network across the primary winding of the combitransformer it wasn't surprising to find that the chopper transistor TB701 (BU603) was short-circuit, hence the blown fuse and surge limiter. Zener diode DB709 (12V) in TB701's base circuit had also failed. TB701 was in fact shorted between all its connections. When these various items had been replaced, with the capacitor fitted correctly, the set was restored to correct working order. I.B.

Panasonic TC2205 (U2 Chassis)

After several hours' use a dark area would appear across the bottom of the screen. The size of this area increased with time, moving upwards to obliterate more of the picture. If the contrast control was set to maximum the darkness would retreat back to the bottom again. Use of a hairdryer and freezer enabled us to prove that the field output chip IC401 (TDA1104SP) was the cause of the problem.

Salora J20 Series

At switch on this set would start up on channel one as normal. It couldn't be shifted by using either the remote control unit or the on-board buttons however. We found that if the standby button on the remote control unit was held down the channels could be changed normally. When this button was released the set stuck on the selected channel. The remote control decoder/set keypad encoder chip ICC9 (SAA1251) was suspected and when it was replaced the fault had cleared.

Tatung MQ7703

The problem with this monochrome portable was no results and a quick check on the 12V rail showed that the voltage was less than 5V. Checking the regulation and removing the loads proved fruitless. I eventually found that the line output transformer had a short-circuit winding.

N.B.

B and O MX2000

A colleague was dealing with this set, the initial problem being severely reduced height. The cause was soon traced to 1G01 (TDA4950) which was short-circuit internally and RL28 (1.5Ω) which had gone high in value. This situation is not unknown. Destruction of these devices is nearly always caused by dry-joints on the EW modulator diodes DG05/6. He attended to this and was rather distressed to switch on and find that there were severe EW distortion problems – the picture was bowed in significantly at either side and the correction controls had no effect. He rechecked the diodes and their joints, changed a resistor that had gone slightly high in value, then checked other

likely items. Getting even more upset and being already harassed by a number of Pioneer compact disc players that wouldn't set up very well he asked me to take a look.

Bearing in mind my colleague's thorough and logical checks I took the view that the fault was probably due to something unusual. A scope check on the three relevant waveforms showed that they were all of excessive amplitude. So it seemed to me that the series coil LG02 had to be short-circuit or low-resistance, which proved to be the case.

N.B.

Hitachi CPT1646 (NP84CQ Chassis)

This was a new set. When we tried to tune in the stations the raster would suddenly flash white and the video vanish as the correct tuning point was approached. The field blanking period would then roll down the screen and a moment later a normal picture would return. This effect pulsed on and off about once a second. Reducing the brightness and contrast control settings was not very helpful and it was impossible to store any station in order to make a detailed study of the a.g.c., a.f.c. etc. While attempting these latter two checks we got hum bars with wavy verticals and weak contrast between the bars. This effect disappeared as quickly as it came and didn't return.

Lengthy checks were made on the decoupling and we discovered that reducing the first anode voltage from 470V to 440V markedly improved matters, though the picture was then too dark. Flicking the contrast suddenly to fully up seemed to provoke the fault, while on low contrast scenes reducing the contrast and brightness way down cleared it. These things suggested a fault in the beam limiter circuit. Replacing D702 and D703 improved matters noticeably but didn't provide a complete cure. C718 $(10\mu F, 50V)$ measured o.k. on the Avo but fitting a replacement finally cured the bother.

Philips KT3 Chassis

Odd symptoms with this set: when switched on from cold there was intermittent line failure, the "squegging" wriggle flashing down the middle, and tripping occurred. Everything was o.k. once the set had been persuaded to warm up. Not dampness nor corona. In fact two dry-joints on the degaussing posistor. When cold the posistor conducts hard, the pulsing load doing the rest.

J.R.A.

Hitachi CPT2250/Salora J40 Series

This set's front controls worked all right but there was no remote control of the brightness. Also there was a marked irregular variation in the black level of not only the brightness (luminance) but also the red.

We took these two faults one at a time despite the temptation to assume that there was a single cause. Pin 11 of the video chip ICB200 showed no d.c. variation when the remote control was operated, nor did pin 2 of ICB9 on the control panel. Replacing ICB9 cured this fault.

The second fault was eventually found to be caused by dry-joints on the attachment legs of the metal screen in the video section, above the c.r.t. neck on the main chassis. This screen is in fact part of the link between the red black-level potentiometer and the other video resistors to chassis. Adding flux and solder cleared this one up. The arrangement in the Salora J40 is not quite the same but would be worth checking in the event of this type of trouble.

J.R.A.

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Teletopics

SATELLITE TV PROSPECTS

The findings on consumer interest in satellite TV contained in Ferguson's second annual report on the UK consumer electronics market created quite a stir in the industry. The report focused on satellite TV as the next major marketing opportunity. It found that 14 per cent of those interviewed were interested in receiving the new satellite TV channels (4 per cent very interested, 10 per cent fairly interested while 58 per cent were not at all interested). However only one per cent stated that they would buy a TVRO installation this year while two per cent said they would probably buy one. Forty four per cent of those with an Astra installation were likely to buy a VideoCrypt decoder for the Sky Movie channel.

The Ferguson research found that because of the two competing and incompatible systems most of those interviewed indicated that they intended to wait to see how the services developed. Ferguson concludes that the satellite TV market is unlikely to be as large this year as the broadcasters had predicted. A more optimistic view is held of the future: Ferguson points out that the prices of satellite TV equipment are comparatively low and suggests that the market should grow faster than video in its early days. Ferguson's satellite TV consumer offtake forecasts are 400,000 installations this year, 1.2m in 1990 and 2m in 1991.

Sky's own research shows that over 60,000 households are now receiving the Astra transmissions direct. The company has investigated the supply of dishes/receivers and believes that some 200,000 should be available by late May. As a result a national advertising campaign has been launched. On the advertising side the company has made almost half its sales staff redundant.

BSB intends to make available receiver kits for DIY installation. The kits will include a receiver, a Squarial and some aids for DIY installation. It's understood that the Squarial is somewhat less sensitive to alignment inaccuracies than an equivalent dish. People don't seem to be having all that much difficulty with dishes come to that – and there's a report that Stan Bacon, who runs a TV shop in Andover, Hants, has done what we all joked about, received Sky TV using a steel bin lid. For some information on the use of a wok, see Roger Bunney's long-distance TV column.

VIDEO NEWS

A CCD colour video camera module has been announced by Philips Components. It has an image sensor with 450,000 pixels and can operate satisfactorily at light levels down to 0.45 lux. Simply adding a lens, chassis and case should enable manufacturers to produce cameras to sell at around £400. The module weighs 150g and measures 195 \times 42 \times 48mm.

A new addition to the Philips range of VCRs, Model VR6182, is of interest in incorporating teletext and the ability to record subtitles. The suggested retail price is around £380.

Panasonic has released a Super VHS-C camcorder equipped with hi-fi sound. Model NV-MS50B has a suggested price of £1,400. Its other features include a ½in. 420,000 pixel image sensor, a piezo auto focus system with

three-zone select, three-speed fast shutter operation, audio dubbing, insert edit, VISS marking, a self-timer and interval record.

Sanyo is to launch a Hi-band Video 8 camcorder this November. Model VMH100P has a claimed horizontal resolution of over 400 lines, which compares with 270 lines for standard Video 8 equipment. Other features will include stereo f.m. sound, a ½in. 390,000 pixel CCD image sensor, three-speed fast shutter operation and a stereo microphone. The price is expected to be around £1,300.

Mitsubishi is to invest £7.5m on increasing the output capacity at its VCR plant in Livingston, Scotland. About 200 jobs will be created. The aim is to increase the output capacity to 500.000 machines a year by 1992.

40 YEARS OF THE BATC

This year is the fortieth anniversary of the British Amateur Television Club. It's publication *CQ-TV* first appeared in October 1949, when the circulation was 25 copies. The club now has several thousand members and is very active. Membership is only £6 a year and includes the excellent *CQ-TV* magazine. Anyone interested can obtain details from Dave Lawton, G0ANO. "Greenhurst", Pinewood Road, High Wycombe, Bucks HP12 4DD. Our best wishes to the club for its next forty years!

LATEST TV SETS

Models using the new G90 chassis have been announced by Philips and Pye. This chassis is being produced initially in Italy and is of particular interest in making extensive use of surface-mounted components. The first models have 19 and 21in, tubes, on-screen display functions and a sleep timer facility which enables the viewer to programme the set to switch itself off within a ninety minute time block, in fifteen minute segments. There are text and non-text versions. Sets with 15 and 17in, tubes are to follow and in the autumn sets fitted with the 110° version of the chassis (the G110) will be introduced.

Sanyo has released advanced details of its 32in. Model CBP3272. Features will include a Dolby Pro-logic decoder for surround sound effects, a Nicam decoder, five speakers, a flicker-free picture, fastext, multistandard (PAL/SECAM/NTSC) operation, twin scart sockets, an S terminal and an auto switch-off timer. The launch date is January 1990 and the provisional price is £2,300.

THIRD IRISH TV SERVICE

The go-ahead for a third TV network, TV3, has been given by the Irish Independent Radio and Television Commission. The service will be based mainly on cable networks and local microwave transmissions and will be operated by the Windmill Hill consortium. TVS Entertainment and Ulster Television are involved in the project. The service is expected to start next spring and will be financed by advertising.

The Irish government is shortly expected to announce the first microwave TV service, broadcasting eleven channels to an area with a radius of thirty miles.

NEW PRODUCTS

P.D. Systems International Ltd., Estate House, Pool Close, West Molesey, Surrey KT8 0RN has introduced the LineLok, which enables individual TV lines to be

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reliably displayed on an oscilloscope. By means of thumbwheel switches one of up to 1,250 possible lines in the display (interlaced or non-interlaced) can be selected. The unit works by providing a pulse for the scope's external trigger input. The unit is battery powered for portability and uses PLL circuitry to eliminate jitter. Price is £340 plus VAT.

Rendar Ltd., Durban Road, South Bersted, Bognor Regis, West Sussex PO22 9RL has introduced a comprehensive range of quality BNC, TNC, F and MIL-specification N connectors manufactured in Japan by Marushin. The firm also has a large selection of adaptors to make cross-connection between different types of connector easy.

Litesold has introduced the Project ETC-5 range of soldering stations with electronic temperature control. There are three models, Viper (20W), Cobra (50W) and

Mamba (80). Each has its own dedicated soldering iron with the 5-pin DIN plugs differently wired to prevent damage from wrong insertion. All control units are housed in similar enamelled steel cases that provide full screening and earthing. For further details apply to Light Soldering Developments Ltd., Spencer Place, 97/99 Gloucester Road, Croydon CR0 2DN.

Schlumberger has introduced a new signal generator for testing D-MAC and D2-MAC packet transmission paths and reception equipment. The S17765 provides comprehensive test patterns and signals to EBU specifications to simplify installation and maintenance of DBS equipment. The price is £4,300-£5,950 depending on the facilities incorporated. A colour brochure is available. For further details apply to Schlumberger Technologies, Instruments Division, Victoria Road, Farnborough, Hants GU14 7PW.

Here We Are Again!

Yes, we're still here, but I wonder for how long?

It's thirty five years since I wrote my first article for *Practical Television*, as this magazine was then called. It was the first one in the "Servicing TV Receivers" series. Seems only yesterday, honest. Many of my articles over the years have appeared under pen-names, such as S. Simon. Did you get the joke I wonder? Simple Simon you see! When I read some of those articles now I'm quite surprised. Did I really know all that? There was also Peter Gaymead Frazer and, going back to earlier days, N. Mead. So I must have been a clever fellow, though I didn't realise it.

There must be many of you who can write a lot better than I can and haven't yet reached the winding down stage. You will though. It seems that in my case I've done so much earlier than most people do. I find myself doing daft things but there have been no complaints so far except from that lady who is going to sue me for chucking out her set after she told me she didn't want it done as it was going to cost thirty quid to replace the tripler etc. and then left it for some time in the shop. She still hasn't returned the set I gave her in exchange and I do wish her solicitor would stop writing to me. I've told him I'm trying to get a white portable, Thorn 9900 chassis, with remote control sticking out the front, but they seem to be a bit thin on the ground. Frankly I'd thought it was the 9000 chassis, but Keith and Alex put me right about that - they popped up from Portsmouth the other day. I've not been right for a long time, which is perhaps why I've not yet sold this shop though I've bought a bungalow and am now in debt to the bank because of a bridging loan. Not for long, I hope.

Sets still come in, though there are very few of them. I never got around to taking in videos for repair. The family's videos, including our own, are taken to Geoff's at Moon Lane for repair. Geoff isn't upset by this as he too is short of TV repairs. I suspect that there are a lot of you in this situation, what with all these imported sets being sold with guarantees that last for years. They'll start to give trouble eventually, but will it be worth repairing them when spares and data are expensive and difficult to obtain?

Be that as it may, perhaps I can briefly return to those early days thirty five years ago. The editor then wasn't our

Les Lawry-Johns

John. It was F.J. Camm, the magazine's founder, who had his name up front. F.J.'s brother was Sir Sidney Camm of Hawker aircraft fame – he designed the Hurricane, the Fury and all the other famous Hawker aircraft made before and during the second World War. I could give you a long list as aircraft were my all consuming hobby at that time – I can remember giving lectures on aircraft recognition when I was in the Fleet Air Arm – but this interest began to wane as I worked on the aircraft in this country, Gibraltar and Alexandria (just past the stinking tannery). I still have photographs taken at the time and the memories keep flooding back, more so than of what happened yesterday but I dare say there are lots of you like that.

The Fidelity CTV14R

We had another Fidelity CTV14R (ZX2000 chassis) in the other day. I expected to have to fit a new line output transformer but this wasn't necessary. The complaint was that the picture kept rolling and going off. After a while I discovered that the focus control was damaged. This was no problem since we keep having to remove the focus control in these sets, together with the first anode control, when fitting the ZX3000 series line output transformer. A new focus control was fitted in no time and the picture no longer rolled and hopped on and off. I then noticed the matchstick in the on/off switch. When this was pulled out the switch no longer worked. So in went another, complete with the remote contacts.

I phoned the owner and she agreed to pay what I asked (none of your business!). Anyway she came in later and handed me a twenty pound note and I handed her a fiver.

Colour Changeover

I'm sorry about the set that changed its colours. Should have realised it was the degaussing unit. But honestly the changeover was so complete I didn't think it could be that. The set lives over the road so I'll hear about it if it mucks about again, and so will you.

That's all for now. Anyone want to buy a famed store in a prestige position? Mr. Fayed from Alexandria perhaps?

Practical Astra Installations

D.J. Stephenson, B.A., I.Eng.

There have been widespread rumours and horrendous tales about the alleged difficulties of setting up dishes for reception from the Astra satellite. I suspect that many of these stories are intended to scare off competition from TV technicians intruding into the domain of the aerial rigger. In reality the job is simplicity itself, provided the right equipment is to hand. The purpose of this article is to pass on practical experience gained by carrying out many such installations, for the benefit of those who are contemplating whether or not to enter this potentially lucrative business. We won't delve into the theory of satellite TV reception: many books and articles have been published on this subject.

It's unlikely that the general public will have much success with DIY satellite dish installation simply because of the alignment accuracy required. To try to find the satellite by trial and error or by following the manufacturer's instructions is likely to lead to many hours of frustration followed by a call to a TV technician/aerial rigger for help. The DIY enthusiast also has to contend with the fact that the flat pack systems obtained from major retail outlets come without cable, F connectors and mounting hardware such as wall plugs, screws etc. Fig. 1 shows an Astra receiving system in simplified block diagram form.

Ladders

If you are going to go into this business, perhaps the most important things you will require are a roof rack and a set of ladders. A good ladder size is 28ft double, which extends a few feet above the gutter height of the average semi-detached house. Since you will not be carrying heavy loads up it a class 3 domestic ladder is quite adequate and is considerably cheaper than say the type of ladder used by builders. A 15ft roof ladder may be an advantage for pole mounting where a suitable wall is not available. In my experience however this has not been necessary. Many modern houses have a flat garage roof adjoining a southfacing wall. This calls for an additional single ladder or a step ladder. In such cases I've found that a two-way single/ step ladder is the most versatile type.

Planning Permission

At the time of writing planning permission has to be obtained when a dish is mounted above roof height. Permission may also be required under other circumstances, e.g. a conservation area. Check with the local council planning department.

Tools and Fixings

You will need to keep a selection of fixings in the van. Experience shows that 2.5in. No. 12 galvanised or blacked screws and 8 and 10mm Rawbolts are the most commonly specified fixings. The appropriate plastic wall plugs and masonry drills will also be needed. Fixing should be into bricks, not the mortar course, so it's vital that a powerful professional hammer-drill with a half-inch chuck is purchased. The small domestic type will soon burn out with punishing work such as this. A 40m extension lead drum is

recommended, terminated with a residual earth circuitbreaker plug.

Other more mundane tools required are a large screwdriver, claw hammer, spirit level, set of metric ring or combination spanners and a pair of mole grips. A metric socket set is also an asset. A tool belt saves a lot of footwork when working up ladders.

For drilling the coaxial cable entry holes into wooden window frames a five sixteenth inch auger bit and handbrace does the neatest job. Where plastic double glazing is encountered it's better to drill the wall at the corner of the window frame, using a long 8mm masonry bit. This long bit is also needed in a small number of cases to drill dividing walls.

Something that's often omitted from the tool-box on the first job is 7mm round section cable clips – or 10mm if extra polariser leads are involved (see later). An adequate supply of F connectors and coaxial plugs should also be carried. Finally, silicone rubber compound is needed to encapsulate the connection to the LNB (low-noise block) to ensure that it's waterproof.

Instrumentation

Perhaps the most important single instrument required is a compass. The cheap Christmas cracker variety is definitely out. A good sighting compass can be purchased for about £27. The Silva ranger type 15T is a particularly useful one. It includes a mirror, sighting lines and 360° bearing graduations and can be purchased from camping/sports shops. An inclinometer is useful for elevation measurement, but most manufacturers stamp elevation scales on the mounting brackets. Unless the wall to which the dish is to be mounted is truly vertical however these are not too accurate. Care is required in using an inclinometer with an offset focus dish as the offset angle has to be taken into account.

A satellite signal strength meter is a boon for optimising picture quality. The small Connexions satellite signal strength meter can be obtained from HRS Electronics plc (11 Garretts Green Lane, Garretts Green, Birmingham B33 0UE) for just £45 plus VAT (trade only). This wideband unit is simply connected in series with the LNB-receiver coaxial cable, using F connectors, and is thus powered by the LNB voltage feed. It enables the f.m. first i.f. output from the LNB, at approximately 950-1,750MHz, to be monitored.

Site Survey

The purpose of the rather pretentiously named "site survey" is to check the lie of the land and offer the customer the maximum amount of choice as to dish location. Some customers like the dish to be unobtrusive while others like to advertise the fact that they have one.

It's important to ensure that no tall buildings or trees are in the direct line of site. If this situation cannot be avoided the customer should be told that reception will be either degraded or impossible. A site survey may involve running up and down ladders at various locations on a south- or east-facing wall, checking the line of sight. Since

dishes can be rotated through 90° an east-facing wall can be used for Astra as a last resort.

Four items of information are relevant to the choice of site. They are best calculated before you arrive at the customer's address. A programmable scientific calculator with continuous memory or a computer will help here.

- (1) The satellite's geostationary position. For Astra this is above the equator over Zaire, at 19·2° east of south of the Greenwich meridian.
- (2) Elevation. This is the angle of inclination from the horizontal to the satellite's line of sight. It's given by:

Elevation = Arc tan $[(\cos C - 0.151269)/\sin C]$ where $C = Arc \cos [\cos (Ls - Lr) \times \cos B]$

Ls = longtitude of satellite

Lr = longitude of receiving site

B = latitude of receiving site.

For example Astra from the Wirral peninsular, Merseyside, longitude 3°W, latitude 53·33°N, gives the elevation as 25·74°.

(3) Azimuth. This is the bearing of the satellite depending on the location of the receiving site and is given by:

Azimuth = Arc tan $[\tan (Es - Lr)/\sin B]$.

For the Wirral, Merseyside the true azimuth is 153·03°. (4) The local magnetic variation. True south can be 3-7° to the right of magnetic south depending on the location of the receiving site and varies by nine minutes or so a year. Current information can be obtained from the latest edition of the Ordnance Survey Landranger series of maps for your area.

As an example the magnetic variation for the Wirral, Merseyside is 5.5°, therefore the corrected azimuth or compass reading is 158.53° or 21.47° east of south.

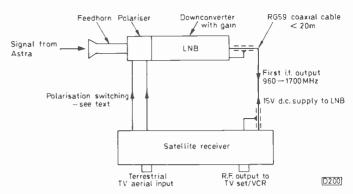


Fig. 1: Simplified block diagram of a receiver system for Astra transmissions.

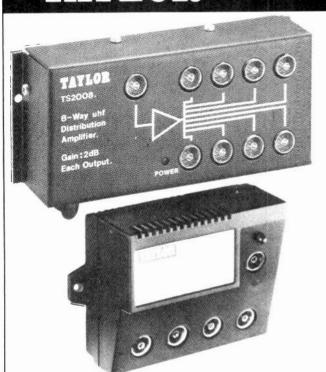
These calculations may seem a bit tedious to perform for each installation, but in the long run they do save time. If, as is often the case, work is confined to a small geographical area the figures obtained will not vary significantly.

Computer Program

The calculations for any geographical location and any satellite can be performed in a fraction of a second by computer. An Acorn Electron or BBC B computer system can now be bought very cheaply second-hand and is ideal for calculations such as these. A suitable program that will perform all the necessary calculations is listed in Table 1.

When using this program it's important to remember that longitudes west of Greenwich (0°) are entered as negative values. For example the Wirral, Merseyside is 3°

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Mains: 240V A.C.

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Minimum Gain per outlet: 2dB

Mains: 240V A.C.



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west and is thus entered as -3. Grossly ridiculous inputs will not be accepted.

When the program is run the first prompt asks for the longitude of the satellite. Astra is 19·2° east of south and is therefore a positive value. Enter 19·2.

The second prompt asks for the longitude of the site. For the Wirral, Merseyside this is 3° W and is thus entered as -3.

The third prompt is for the latitude of the site. For the Wirral this is 53·33°N, so enter 53·33.

The prompt for local magnetic variation is finally displayed. From Ordnance Survey maps this is 5.5° for the Wirral, so enter 5.5.

The program will calculate the elevation, true azimuth, compass bearing and path distance. With the data fed in we get 25·74°, 153·03°, 158·53° and 39,001·1km respectively. Simply type RUN to repeat the program. A printout can be obtained by pressing the CTRL and B keys simultaneously prior to typing RUN CTRL C disables the printer again. Anyone with a working knowledge of the BASIC computer language should find it easy to transpose the program for use with other machines.

Cables

There appears to be no standardisation with regard to the cable requirements for various manufacturers' dishes. Amstrad/Fidelity use single coaxial cable. The i.f. signal from the LNB is fed down the cable and a d.c. voltage from the receiver is fed up it to power the LNB. This d.c. voltage can be threshold varied to switch the solid-state polariser. Grundig use coaxial cable with an additional polariser lead to switch the polariser's polarity. The 15V supply for the LNB is fed up the coaxial cable and a further 12V supply lead is used to switch the polariser – 0V for vertical polarisation, 12V for horizontal polarisation. The earth return is via the coaxial braid. Tatung use coaxial cable with two separate polariser leads.

The special coaxial cable with one or two additional polariser leads is very costly at the time of writing – about £125 for a 250m drum. An alternative solution is to run up a separate cheap cable for the polariser requirements and use cheaper coaxial cable.

There are many grades of 75Ω low-loss cable. With short runs, say less than ten metres, ordinary u.h.f. low-loss coaxial cable can at a pinch be used with no appreciable picture quality degradation. Better quality cable such as RG59, at about £69 for a 250m drum, should be used for longer runs. This cable has a loss figure of 27dB per 100m. For a really professional job you can, provided the customer is willing to pay the extra at about 75p per metre, use Pope H100 cable. This is available from HRS and has a loss figure of 13dB per 100m. In practice however RG59 is an adequate, inexpensive general-purpose cable. With really long cable runs line amplifiers need to be inserted at every 20-30m or so.

The Installation

An installation team should consist of a technician and someone skilled in ladder agility. Public liability insurance cover should be taken out along with employee liability. This costs about £250 for a turnover of less than £45,000 a year. Further insurance against personal injury is advisable due to the potentially dangerous nature of the work.

Once all the groundwork has been completed the easy part is erecting the wall-mounted dish. For drilling the dish mounting holes some manufacturers supply a template on the back of the flatpack. A slight breeze up a ladder with a large flapping piece of cardboard in one hand and a hammer-drill in the other has to be seen to be believed! Throw it away. Drill and temporarily fix one point first, put a spirit level on it, then mark out the other holes.

The light-weight dish and LNB are best assembled at ground level and taken up the ladder in one piece for offering up to the mounting bracket. Be careful not to knock the feedhorn/LNB assembly – this is a precision unit manufactured to the highest standards and any dent could make the whole assembly useless.

Fit the F connector to the LNB temporarily, fit polariser leads as necessary, and tack up the cable(s) to the receiver. Never bend the coaxial cable at a sharper angle than about ten times its diameter otherwise significant signal attenuation will occur.

Table 1: BBC computer program for satellite dish alignment.

```
>LIST
   20REM ★
   30REM★
             EUROPEAN SATELLITE FINDER
   40REM★
   50REM ★
                  DJ Stephenson 1989
   60REM ★
   80MODE 7
   90PROCline:PRINT"EUROPEAN SATELLITE
   FINDER": PRINT TAB(20)"DJ Stephenson
   1989":PROCline
   100PRINT"Enter Longitude of Satellites/Sites WEST of
  Greenwich as NEGATIVE Values"
  110PRINT:PRINT"Enter Longitude of Satellite
  (deg)":LS=FNip(-90,90)
  120PRINT"Enter Longitude of Site
  (deg)'':LR=FNip(-90,90)
  130PRINT"Enter Latitude of Site (deg)":SL=FNip(30,80)
  140PRINT"Enter Local Magnetic Variation
  (deg)":var=FNip(2,8)
  150A=LS-LR:sign=SGN(A):A=ABS(A)
   160A=RAD(A):B=RAD(SL)
  170C=ACS(COS(A)*COS(B))
  180Elev=ATN((COS(C)-0.151269) /SIN(C))
   190IF Elev<0 THEN PRINT"Satellite over horizon":GOTO
  290
  200Azimuth=ATN(TAN(A)/SIN(B))
  210Azimuth=180-sign*FNround(DEG(Azimuth))
  220Pathdist=(42164*SIN(C))/COS(Elev)
  230PROCline
  240PRINT"Elevation = ";FNround(DEG(Elev))" degrees"
  250PRINT"True Azimuth = ";Azimuth" degrees"
  260PRINT"Compass bearing = ";Azimuth+var" degrees" 270PRINT"Path Distance = "; FNround(Pathdist)" Km"
   280PRINT:PRINT"Type 'RUN' to repeat program ";
   290END
  300
  310DEFPROCline
  320PRINT STRING$(39,"__"):ENDPROC
  340DEF FNip(min, max)
   350REPEAT
  360INPUT A$:A=VAL(A$)
   370IF A=0 AND A$>"0" THEN A$=""
  380UNTIL A>=min AND A<=max AND A$<>""
  390 = A
  400
  410DEF FNround(N):N=INT(N*10^2+0.5)/10^2:=N
```

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Next tune in the TV set or VCR to the satellite receiver's output. Most receivers provide a test pattern tuned to channel 38 – this may need to be retuned if there is interference from local terrestrial transmissions. With receivers that don't provided a test signal, f.m. noise as opposed to a.m. noise should be detectable from the LNB when the tuning is correct.

The BSI and the CAI strongly advise that the dish assembly metalwork is earthed via an approved clamp to an earthing point or buried rod. The minimum earthing wire thickness is specified as 1.5mm. This also applies to aerials for the reception of terrestrial transmissions, but I must admit that I've never seen it done in practice. Although at present not a legal requirement, the reason for doing it is to discharge to earth static build-ups to prevent damage to tuners and the possibility of a customer receiving a static shock. The high failure rate of r.f. amplifier transistors in video r.f. splitters and TV tuners is blamed on omission of this safety precaution.

Adjustments

We come now to the dish adjustments. Proceed as follows.

- (1) Tighten all elevation and azimuth adjusters. Take up any slack but do not tighten so much that the dish cannot be moved with moderate effort.
- (2) Stand directly below the dish with a sighting compass and note some landmark, such as a roof apex, at the calculated magnetic bearing.
- (3) Climb up the ladder and sight the boom to the chosen landmark.
- (4) Set the elevation adjuster, using either the manufacturer's stamped graduations or an inclinometer. With Grundig dishes a ruler will be needed to set this.
- (5) Since satellite TV receivers are pretuned at the factory, Astra reception should now be possible. If your calculations are correct you will get reasonable picture quality immediately without need to use a signal strength meter.
- (6) Switch off the receiver to disable the 15V LNB supply. Note that any temporary shorts in the cable connections can blow fuses in the receiver! a multimeter check for shorts is a good idea before switching on. Connect the signal strength meter in series with the coaxial cable to the LNB, with a short stub. Switch on the receiver and trim the elevation and azimuth adjustments for maximum signal strength.

Some dishes, such as the Grundig ones, have a skew adjustment which also needs to be optimised. Skew is the rotary adjustment of the feedhorn/LNB assembly.

Finally, tighten the adjusters fully, thread the coaxial cable through the boom, and refit the F connector. Ensure that there are no sharp kinks in the cable.

- (7) Check the received picture quality. If o.k., encase the whole LNB F connector with weatherproof silicone rubber compound.
- (8) Mark or scratch lines on the adjusters so that dish realignment is easy if, at a later date, wind moves the dish.

APOLLO LANCASHIRE **PHONE FOR QUOTE** NATIONWIDE MAIL ORDER SONY TYPES £69 470DLB22/FWB/KHB/KTB KLB-520SB22/NB/RB/XB LOCAL DELIVERY - 2 YR GUARAINTEE A47 342/343X – 470 BCB22/CTB22/BGB22/ 470-ESB22/EFB22/ERB22/FTB22 A51-220X/132X A49JHT00X-570DB22/EB/H8 GB/JB-A53JBW01X/JCG00X JB00X-680CB22/DB/EB (£79) A51-161Y/162/163/168 510-JKB22/JEB22/JDB22/JGB22/ALB22/GLB22 510-VLB22/DTB22/001/RFB22/RCB22/SFB22 14" PORTABLES £59 3708UB-AXT3001-37-550/2/3/4-A37-570/580/590 A51-570X/580/001/210/241 £56 £39 £56 £56 £56 £39 £56 £56 A56-1207/123/140/410 560-DZB22/HB22/AKB22/TB22/AWB22 560-ETB22/DTB22/CSB22/DMB22/DNB22 CASH PAID FOR ALL SIZES SONY GLASS 66-510/540 560 DZB A56-611X/615X A66-120X/A67-120X/140/150/200/410 20AX – A56-500X/510X – A66-500X/510X 30AX – A56-540X – A66-540X PIL TYPES PLEASE PHONE BEFORE CALLING LOCAL DELIVERY FROM ACCRINGTON, LANCS. Phone enquiries and letters to: Apollo, The Potters Wheel Mullion Cove, Mullion, Nr. Helston, TR12 7ET.

(9) Seal the coaxial cable entry hole in the wall or window frame with putty or silicone rubber compound.

0326 240781

Guarantees

It's customary to guarantee your work for a period of at least a year against wind altering the dish alignment or water penetrating the coaxial cable etc. Point out to the customer that this doesn't cover vandalism or freak weather conditions such as the Force 10 hurricanes experienced in late 1987. It's the customer's responsibility to insure against such risks.

Repairs

It's normally not advisable to attempt to repair the LNB assembly or the tuner unit in the receiver. These items employ a lot of surface-mounted technology and, at the frequencies involved, component layout is critical. The units are best replaced if necessary, and it's hoped that manufacturers will introduce an exchange service for them.

Repair of the other sections of the receiver should be a comparatively easy task for a TV or video technician. There's a complication however. Since the various manufacturers use so many different standards and polarising arrangements servicing can be difficult unless you have available the relevant dish. The idea of having ten or so dishes on the workshop wall seems ludicrous. Fortunately the problem can be overcome by building a separate unit to supply the various voltage feeds required by the chosen workshop dish installation. The first i.f., which appears to be standard, can then be fed into any make of receiver via isolation capacitors to block any d.c. sent up the cable from the receiver being repaired. I hope to provide details of such a unit shortly.

In Conclusion

It's hoped that this article will persuade many TV technicians to enter this new field, which is expected to be an expanding one until at least 1996 when it's estimated that twenty million receivers for the Astra transmissions will have been installed in the UK. There should be sufficient work for large numbers of installation crews to make a good living, provided the trade sticks to a reasonable installation charge and doesn't advertise "free installation" in order to shift over-ordered stock. The larger retail outlets are the most likely to offend in this respect.

The Panasonic NV370/830/850

Nick Beer

The Panasonic NV370 is a "basic" model that was introduced as a replacement for the NV333. It incorporated several firsts including front loading, standby OTR (onetouch timer record operation), a picture sharpness control and a large multi-function fluorescent display. It has cordlinked remote control, a one event/14 day timer and a two-head drum (VEH0218). The NV830 came later and is basically a hi-fi sound version, its drum (VEH0266) incorporating two audio heads. Further features were added with the NV850, in particular an eight event/14 day timer and a third video head in the drum (VEH0231) for perfect stills and general improvement in the trick modes. In addition to the two drum-mounted audio heads the two hi-fi machines have a single mono linear audio head. The absence of a stereo linear sound track facility gave rise to a certain amount of criticism, due to the number of stereo (not hi-fi) library tapes available. The hi-fi machines both have a comprehensive infra-red remote control system, though you can't use it to set the timer. These two machines have black cases whereas the NV370 is in silver. From the servicing point of view the differences between these machines are minimal. We'll mention them as they arise.

The function display is separate from the clock/channel display, being mounted above the deck function selectors. The electronic counter is a four-digit type with electronic memory. Dew warning is given by the counter display's far right-hand digit changing to "d", something that might not be immediately obvious. Addition of standby to the OTR function already seen on some previous models allows the OTR start to be delayed by up to two hours in thirty minute steps. The NV850 has memory back-up when the mains supply is interrupted – this feature is not present on the two cheaper machines.

The mechanism is very quiet in operation – welcome after the NV7200 series! One point about its operation that I personally find annoying is that it returns to the stop position during mode selection. For example if you make a test recording then push stop and immediately after select play it won't, as with the NV7200s, go straight into play. It will unlace and relace.

Dismantling

To remove the top cover, undo the four silver screws at the sides of the unit and pull the top upwards, gradually pulling the front edge away. The bottom cover is held by nine brass-coloured screws. It covers the entire bottom area of the machine. Later decks have just a plate over the mechanism.

The bottom, main PCB covers part of the mechanism and for a lot of work has to be unhinged. To do this you have to remove the front, operation PCB which is hinged on it. This is a similar idea to the NV333/NV366 series, but only the small operation PCB is attached, not the timer/presetter as well, previously a single unit. First remove the cabinet front by undoing the three red screws, one at each clip across the top of the front, then undoing each of these clips and the three across the bottom. After removing the two red screws in the top two corners the operation PCB can be hinged out. The main PCB can be

released by undoing the eight red screws and two clips which, with the machine stood on its back, are one third and two thirds of the way down on the right-hand side. The whole assembly can be hinged towards the back of the machine, but you will need to unsolder the earth wire to the front left-hand side of the mechanism.

The screening can over the head drum is removed by loosening the five red securing screws and then moving the can across and up to allow the screw heads to pass through the larger holes in the plate.

The capstan brake is countersprung and is mounted on the capstan flywheel support bracket.

The Mechanism

The mechanism in all three machines is similar to the D1 type, with only minor modifications. The drum is a typical Panasonic direct-drive unit, of slightly more compact design to those previously used. There's a directdrive capstan which also provides the kick idler drive, via the capstan belt (VDV0149). A separate motor is used for tape loading, via a loading belt (VDV0148). This is significantly smaller than the two-belt system used in the NV7000 and NV333 series machines. Front loading is performed by a carriage-mounted motor and belt (VDV0074). Mechanism state detection for the syscon is carried out by a linear mode switch (VES0246 for Models NV370/NV850, VSS0091 Model NV830) which is somewhat different in appearance from those previously used. It has a skeleton-style look, the leads being soldered directly to the contacts rather than to a PCB.

Whereas in previous models the drum static discharge angle was fitted at the top of the drum, this time it's fitted to the bottom – part no. VXS0059. Since the bracket construction is different the earlier type cannot be used. The new type rarely fails however.

Moving back up to the top of the mechanism we come to the thing that most people will probably associate with this deck for ever more, the reel idler (VXP0521). There can't be many people who didn't have to change one during the first twelve months because of tape chewing. The answer is to fit the modified type, which is far more reliable and has the length of life you'd expect. The old type is plain white while the modified type is black and white. A machine came in quite recently with the old type still fitted. It was working all right but we nevertheless changed it, as you always should – don't tempt fate!

Mechanical Service

The majority of the jobs on the top of the deck, for example reel idler or brake band replacement, require removal of the cassette carriage. The reel idler can be replaced without doing this, but is then a more difficult operation. To remove the carriage, undo the four red bolts at each corner of the top plate, remove the multi-pin plug (P1507) on the small PCB at the rear right-hand side, then lift the carriage out. This assumes that you've already removed the screening can from the head drum, as it mounts over the front lip of the carriage.

Idler replacement is straightforward. Unhook the spring

that runs over its back edge then remove the slit washer from the shaft to allow the idler to slip up over the pivot. When fitting the replacement ensure that it is completely bedded down and mating with its drive surface. To do this, push the idler wheel towards the back of the machine against its spring while pushing it home, then fit the slit washer again. You don't get a replacement washer now with each new idler, though one comes with the maintenance kit for this series (kit part no. VUD4092, see Ian Bowden's article in the October 1988 issue of *Television*). Refit the spring and check the review torque (see later).

The brake bands are beginning to suffer from the usual Panasonic ailment: the glue on the pad dries out and the pad drops off. The result of course is virtually no back tension, the symptom looking as though one video head has failed. Replacement is marginally easier than with other Panasonic decks as the band is fixed to the backtension lever by means of a moulded plastic spring clip instead of a second circlip. The lever will usually have to be removed to undo the old unit, but sometimes it can be pulled out from above. To fit the replacement, simply push it through the hole. Set up the back tension afterwards (see later).

Head Drum Replacement

This was the first series of Panasonic decks to have the pin-connection style head drum instead of the flexible leads previously used. It saves a lot of time, fiddling about, and burnt fingers. The two things to watch are first that all the arrowed connections on the PCB are free after unsoldering - otherwise you'll end up with broken connections to the rotary transformer and will then need a new DD unit. Don't unsolder any connections other than those arrowed: unsolder all those arrowed even if there appear to be too many. The head section is held to the DD unit by the usual two screws. To prevent any nasty experiences, always remove them as the last job before the head and refit them first after replacement, before resoldering the pins. This is to ensure that the upper and lower drum sections are fully mated - if you solder then tighten the bolts and the head drum moves you'll crack the head PCB or damage the DD unit. The other point to note is that since there's no lead colour coding the head can be fitted the wrong way round. To prevent this, half the PCB in the drum is coloured white and there's a white mark on the DD unit: these should, not surprisingly, be matched up.

With the NV850 the DD unit is covered by the stator not present on the other two models. This has to be removed to enable the head drum to be replaced. The stator angle is held on by two bolts, one in each rear corner. There's also a multi-pin connector (P4501) which has to be removed. Underneath there's the rotor base, again held by two bolts. With this removed you'll find that the head drum (VEH0231) is secured by the usual two screws. To reinstall the stator assembly after replacing the drum calls for the stator angle adjustment jig (part no. VFK0268) to ensure correct positioning.

Pinch and Impedance Rollers

Pinch roller replacement is straightforward. Remove the bolt that holds the dew sensor bracket, then the single circlip that holds the pinch-roller arm. Pull it off, at the same time releasing the counterspring.

One final point about the top of the deck. With the hi-fi

models when you replace the impedance roller (VDP0908) on the left-hand side, beside the erase head, or carry out any tape path adjustment, ensure very careful alignment while looking at the audio f.m. envelope. A very slight discrepancy that might not affect the picture adversely can have a dramatic effect on the audio f.m. envelope. This roller is part of the maintenance kit and should be changed at the appropriate time – no skimping!

The Belts

The mechanism has three belts. The loading belt (VDV0148) simply slips over its two pulleys. The capstan belt (VDV0149) does the same but the support bracket over the bottom of the capstan motor has to be moved out of the way. It's not necessary to undo all three bolts: remove the two at the rearmost end and loosen the other one to enable the belt to be manoeuvred over it. The third belt is on the carriage and can be slipped off both its pulleys in alternate directions. Thus there's no need to remove any motors or brackets. The belts rarely fail but they do get to be tired looking and, being part of the 1,000 hour kit, should be changed.

Mode Switches

The mode switches are less reliable than those on the earlier machines and are in turn more reliable than the very similar looking ones on the later NV230/NV430 series machines. Faults range from no drum rotation to being stuck in the laced-up state - in general, any weird mechanical happenings (see also the fault list). Always disconnect the deck from the mains supply before working on the mode switch, otherwise you'll end up with a retiming job. A single bolt holds the switch and should be changed along with the switch. The old switch gives you a useful guide to the positioning of the new one. You'll see a clean area around the slot, inset in the blackened, corroded area. This is where the old bolt head was located. Fit the new switch in the same way, ensuring that the white peg is correctly located on the main lever, and you won't go far wrong. Remember to write down the wiring connections to the switch. A note in the manual is worthwhile, but I've seen more than one set of wire colours.

Take-up Torque

The take-up torque should be within the following limits for each mode. Play 105-145g/cm, fast forward and rewind over 400g/cm, review $200\text{g/em} \pm 10$ per cent. If there's a large discrepancy the drive systems should be investigated (look for worn idlers etc.). Adjustment is by altering the notch to which the left-hand side of the spring is attached. This is the spring across the rear half of the reel idler.

Back Tension

The back tension should be between 25-30g. You will very often find that the best performance, especially for searches, is with the back tension set at 30g. This figure should not be exceeded. Adjustment is by altering the position of the back-tension spring mounting bracket. This assumes that you've not changed the brake band and upset the level. If so, the back tension should be aligned with the brake band set as shown in Fig. 1.

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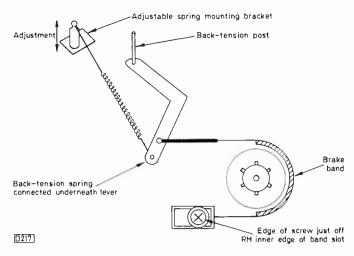


Fig. 1: The back-tension arrangement

The position of the brake band, and thus the falling range of the back-tension lever, should be set using the adjustment plate (part no. VFK0187). A few machines will not warrant this, so the diagram can be used as a guide.

Electronic Features

In this section we'll briefly consider the circuits that are likely to require attention.

The syscon is designed around a microcomputer chip, circuit reference IC6001 as always. All three machines use the same device (MN15342VGC-3). An optosensor under the take-up reel provides detection of rotation and pulses for the electronic counter. The troublesome cassette up and down switches are mounted on the right-hand side of the carriage – see fault list. There is also an insert switch (VSM0047) in the middle of the top of the carriage.

A larger number of chips are used in the servos than in

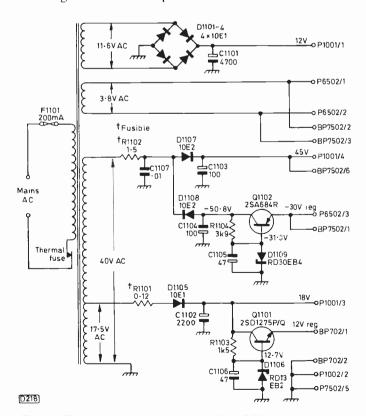


Fig. 2: The mains transformer/rectifier PCB circuit, Model NV370.

the previous models and a manual will usually be required for any in-depth fault finding.

The power supply is simple. Fig. 2 shows the mains transformer/rectifier board circuit which should help if you don't have the manual – there's a tendency with these machines for the fusible resistors to go open-circuit randomly.

There are obviously various differences in the timer/presetter arrangements used in the different models. The basic NV370 has a step up/down selection system with presets for its 16 channels, a single M54836AP chip (IC7503) being used for control. The NV850 on the other hand uses the single thumbwheel and store system that was to become familiar on later machines. It also has a back-up system for memory when there's no mains input. This takes the form of three 3·3F, 2·3V gold capacitors, as in the NV366. They suffer the same fate!

The hi-fi circuits are on two boards situated around and over the presetter PCB.

Remote Control

The NV370's cord-linked remote control unit, part no. VSQ0330, gives control over only the basic functions play, rewind, fast forward, record and search. It works on the same switched resistance principle as the system used with the NV333/NV366. The single-screened lead is terminated with a 2.5mm two-pole plug.

The IR unit used with the hi-fi models, part no. VSQ0338, gives control over virtually everything apart from the timer and hi-fi selection functions. There are no real stock faults. Spillage is the most common cause of trouble – it can corrode the contacts of the rubber mat. The buttons tend to wear so we replace them when a machine is in for service to keep up the appearance of the unit.

Fault List

Here's a list of some of the more common faults we've experienced with these machines.

- (1) No or slow rewind/fast forward and/or chewing tapes. Usually caused by a worn reel idler, especially if the plain white type is still fitted (see earlier remarks).
- (2) Cassette will not stay in. Cassette up/down switches on carriage faulty. See earlier comments.
- (3) No results. 5V rail missing as D1002 (3.9V zener diode) short-circuit and R1001 (0.39 Ω) open-circuit.
- (4) Hum on sound and vision. C1102 (2,200 μ F) leaky or open-circuit. This is the reservoir capacitor for the unregulated 18V supply.
- (5) Incorrect function selection fast forward instead of play and rewind instead of record. C6011 (0·18 μ F) in key scan two line faulty.
- (6) Capstan speed incorrect and will not set correctly. Can be caused by IC2001 (AN6359N) or 1C2002 (MN6168VIF) sometimes both fail together.
- (7) Drum motor does not rotate. If the outputs at pins 1, 2 and 23 of IC2005 (AN6387) are absent or "pulsing" suspect this i.c.

- (8) Function display not working. Check D6504 (RD75EB) and IC6501 (MN1450BUF2). The display (VSL0030) might have an open-circuit heater.
- (9) No or incorrect colour in record and playback. IC8001 (VEFC007) faulty. It's on the folded FPC.
- (10) No 5V supply to capstan servo, causing shunting fore and back. Q1104 (2SD1275) in the power supply faulty.
- (11) Capstan and kick idler shunting. R1101 in power supply open-circuit, usually for no apparent reason though Q1101 (2SD1275) and D1105 (10E1) may be short-circuit.
- (12) Machine goes off after about three seconds. Note if when switched on the characteristic loading "shuffle" occurs. If not check the loading motor drive chip IC6003 (BA6209) as it will probably have an internal short.
- (13) Horizontal picture twitch. Impedance roller (VDP0908) sticky. Replace along with its insert (VMX0541). Note previous remarks about precise adjustment with hi-fi machines.
- (14) Dew indicator stays on. Try resetting the microcomputer chip IC6001 (MN15342VGC-3) by disconnecting the mains supply for a minute or so then switching back on. If this fails to cure the problem and the machine is not damp IC6001 is suspect.
- (15) Capstan does not rotate. Assuming that all the supplies are present, as opposed to being excessively loaded, suspect IC2004 (AN3821K) and check the continuity of the capstan stator (VEK2038).
- (16) When play is selected the machine laces but the drum doesn't rotate, the machine won't unlace then switches itself off. Suspect dirty contacts on the mode switch.
- (17) Machine switches off as soon as review is selected. Mode switch faulty.
- (18) Machine cuts out after a few seconds in review and the left-hand reel is slow to turn or doesn't turn at all. Replace worn reel idler.
- (19) Machine cuts out after a few seconds in play, a slightly shorter time in rewind or fast forward. Check whether the electronic counter works before the machine cuts out. If not, check for reel pulses at pin 19 of IC6001. If these are not present and the supply to the optosensor (type ON2160) is present, suspect a faulty sensor. Otherwise suspect IC6001. Both items have been known to cause this fault.
- (20) Grainy, black and white playback picture. Video heads worn or drum fitted wrong way round (see earlier remarks).
- (21) Knocking noise, particularly noticeable in play. Check for dents in idler wheel VXP0521 and its clutch gear VDG0147 - shadow of BSR turntables! In nine cases out of ten however clutch VXP0523, under the clutch gear, is responsible. This fault will very often not be reported but will nevertheless be very evident.

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- (22) Mis-operation of the hi-fi channel indicator LEDs, not corresponding with switch selected. In order of probability, check QR4306 (DTC124A), QR4304 (DTC144A) and QR4301 (DTA114A).
- (23) No front panel selection of play etc. possible with Model NV370. Check that the remote control unit is not plugged in, then suspect that the remote control socket is faulty.
- (24) No remote control operation, front panel controls o.k., Model NV370. Suspect that the remote control unit's lead is open-circuit, particularly the screen connection. It can be replaced with normal single-screened lead if you remember to save the cable gland/strain from the old lead.

In Conclusion

In this article we've taken a basic look at the mechanical set up and operation of these machines, the electrical make-up of the circuits that tend to give trouble and listed the more common faults. These VCRs are not old - the majority just require a mechanical overhaul and a few are now being swapped over on rental. They can be rerented or sold for a very respectable price, and after a service can be expected to work well for the foreseeable future. Head wear is particularly good, but only when the back tension is set correctly. If you don't have a Panasonic account you'll find that spares are available from many advertisers in Television. Should replacement heads be necessary I particularly recommend those available from MCES.

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Letters

THE SPARES BUSINESS

We would like to comment on some of the points raised in your leader in the April issue. As specialist spares distributors we've been "knocking on the doors" of various setmakers for some time to be allowed to stock and sell their components. Some doors have been opened but others remain firmly closed. How long will it take for some manufacturers to realise that many customers do not want to or are unable to take their equipment back to the dealer from whom they bought it and therefore want a repair to be done by someone else? If the second dealer doesn't have an account with the manufacturer and spares are not available through distributors it can take weeks to get the part required. This delay reflects badly on the service department and also on the brand name. What will the customer think next time he makes a purchase? It would be so much better if all parts were available through distributors, thereby ensuring engineer and customer satisfaction.

Your point about smaller customers who require individual parts is one we understand all too well. As a result we have always supplied trade customers with whatever quantity they want, no matter how small the order. In the belief that offering a good service means just that, we have no minimum order level and no small order handling charges other than postage. This, along with the fact that we have a department that specialises in obtaining out of the ordinary components, means that we are doing our part in filling the gaps left by others.

Our job here at Wizard Distribution is to supply spares to the trade. Some manufacturers have other, understandable priorities. Why not let us all do what we do best, thus ensuring all-round customer satisfaction? R.T. Blyth, Managing Director, Wizard Distributors, Empress Street, Manchester M16 9EN.

NICAM TRANSMISSIONS

Andrew Sykes' letter (May) suggests that the Nicam decoder chips being used in current TV sets and VCRs may not be able to handle future ITV and Channel 4 Nicam broadcasts satisfactorily. From our experience gained since starting Nicam test transmissions from the Crystal Palace and Emley Moor transmitters in February we do not believe this to be the case. It's important to realise that the broadcasts currently taking place are test transmissions which are intended to allow dealers and the public to hear demonstrations of the capabilities of the new service, also to enable us to gain practical experience and sort out any teething troubles with the equipment we are using before the start of scheduled programmes in September.

In the very early days of our tests we did discover incompatibility between one receiver chip and our transmissions. This gave rise to distortion on low-level sound. Although our transmissions complied with the published Nicam specification it was fortunately possible to solve this problem by making a minor change to the transmitted data within the specification.

We have also found that manufacturers have applied different logic to the interpretation of the use of the C4 control bit. C4 set to zero indicates that the Nicam signal and the conventional f.m. sound have different audio content. In this mode some Nicam receivers can reproduce only the f.m. audio. Conversely with C4 set to one some sets can receive only the digital sound. We are therefore carrying out test transmissions with C4 set to zero. C4 will be set to one when the scheduled service starts. Other sets allow the user to make the selection whatever the setting of C4, as do VCRs. We consider this to be the best arrangement.

When the full service starts the digital sound will of course be the preferred option where available. There have also been some Nicam VCR users who have apparently not realised that while the Nicam trade tests have been recorded on hi-fi sound tracks the f.m. programme sound has also been recorded on the conventional linear sound track. They can be selected by means of a switch.

The clicks Andrew Sykes mentioned are one of the teething troubles we have encountered since starting the test transmissions. We have chosen to encode the sound signals in the Nicam format in the studios, carrying them over the links to the transmitter in this form to modulate the new Nicam sound carrier. In this way the audio remains in the same digital form all the way from the studio to the viewer's receiver. The clicks have been caused by data errors occurring between the studio and the transmitter. These errors should not occur. We have investigated the problem and intend to make some changes to the equipment shortly to eliminate them.

We remain confident that once the system is fully operational Nicam digital stereo will provide very high quality sound from all existing and future Nicam receivers. Paul Gardiner, Principal Engineering Information Officer, Independent Broadcasting Authority, Winchester.

CURING FIELD JUDDER

I was interested in John de Rivaz's suggestion for curing field judder (April) and would like to point out that a simpler way of implementing this good idea is to use an exclusive-or gate as shown in Fig. 1. The time-constant of the resistor and capacitor is the same as with John's circuit, but because a 4030's input impedance is so high we can use a higher resistance value and a lower capacitance value. Incidentally, if you want to invert the output another section of the 4030 can be used – an exclusive-or gate can invert the output or not by being wired as shown in Fig. 2.

Keith Cummins, Holbury, Hants.

NOISY NV333 BEARINGS

In the November 1988 issue of *Television* Nick Beer, writing about the Panasonic NV333/NV366 VCRs, mentioned the problem of noisy bearings in the lower drum assembly. In view of the prohibitive cost of replacing the entire drum assembly I decided to examine the possibility of replacing the bearings, and have done this successfully on eight of these machines since August 1988.

It's necessary to remove the complete drum assembly from the VCR, then to dismantle it in the following sequence: remove the drum flywheel, stator assembly, mica washer, brass collar, spring washer and brass washer, then separate the upper and lower drum assembly by pulling them apart, thus exposing the bearings. See Fig. 3.

It's very important to make a reference mark on each of the following components as the unit is being broken down: (1) the end of the main shaft where it projects

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below the drum flywheel; (2) the drum flywheel; (3) the stator assembly; (4) the brass collar. Each mark must bear a direct relation to the next one. If this is not done carefully it won't be possible to get the head switching point aligned correctly. When reassembling the unit pay special attention to the correct sequence of replacing the brass washer and spring washer. The two screws that secure the flywheel should be tightened with a torque screwdriver – a little more than hand tight pressure will suffice.

The bearings cost £IR5 each here and are available from my local bearings distributor, the identification number on them being SSR-1560ZZ. The complete job takes one hour.

Pearce Heffernan, Madden TV, Cork, Ireland.

CHEQUE CARD WARNING

The following experience with bank cheque guarantee cards might serve as a warning to others. I recently sold a second-hand TV set for £85, taking two cheques for it, one for £35 and one for £50. These were dated April 1st and 2nd respectively. I realise that the banks restrict the use of these cards to one cheque per purchase per day. But as everyone knows, £50 is not nowadays a realistic amount and rather than lose sales one is forced to break the rules.

On this occasion things went wrong. A "customer" rang us up on Tuesday to enquire about our opening times, asking "are you open at the weekends?". I replied that we are open on Saturday but not Sunday and the caller rang off. On the Friday the £50 cheque was returned, stating "not drawn in accordance with cheque card criteria". I phoned the bank – Nat-West at St Budeaux, Plymouth –

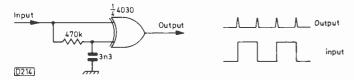


Fig. 1: Use of an exclusive-or gate to obtain substitute field sync pulses from the head switching waveform in a VCR.



Fig. 2: An exclusive-or gate can be used as a non-inverting buffer (a) or an inverting buffer (b) depending on the way in which it is wired.

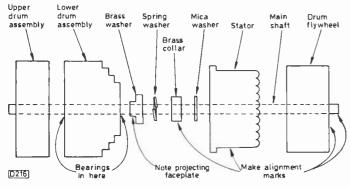


Fig. 3: The various items that comprise the drum assembly in the Panasonic NV333 VCR.



to ask about this and was told that as April 2nd was a Sunday they wouldn't honour the cheque. When I asked what this had to do with it I was told "you close on Sunday, we rang to find out". I was flabbergasted in discovering that a bank would phone anonymously to check on opening times and use this as a reason for not clearing a check, and have lost the money. The moral is obviously not to use Sunday's date on cheques.

S. Woodbridge-Smith, Proprietor Argyle TV & Video, Peverell, Plymouth.

HELP WANTED

Can anyone supply a line output transformer and/or a service manual for an Elizabethan T12 monochrome portable? It uses a Toshiba chassis and components (not to be confused with the Indesit model with the same number!).

Phil Nichols, 19 Kendal Avenue, Copnor, Portsmouth PO3 5AX.

SOUND FROM NTSC TAPES

Being interested in life extension and cryonic suspension I have obtained from various American societies NTSC cassettes on their activities. The problem is that conversion costs are way beyond economic good sense. Much if not all the information that may be required is however usually available on the sound track.

If you play an NTSC cassette on a PAL VCR the sound runs slow because the machine tries to lock the 60Hz fields as though they were at 50Hz. If you use the double-speed feature the sound is too fast. I got round the problem by modifying an old audio cassette recorder to

run at variable speed. This was done by fitting a front panel control in place of the speed control preset. The VCR was then run in the fast mode while the audio cassette recorder was used to record the sound, running faster than its usual speed. It was then used for playback with the speed adjusted so that the speech sounded normal.

I would advise turning the video monitor or TV set off rather than applying out-of-lock 525-line signals for any length of time. A computer monitor with the timebases adjusted for 525 lines shows part of the picture, but the VCR's head circuits have the wrong timing to display it all. Any information on how to get a PAL VCR to produce a locked 525-line picture in monochrome would be appreciated, also which old models would be easiest to convert.

John de Rivaz, B.Sc. (Eng.), A.M.I.E.E., Truro, Cornwall.

PHILIPS V2000 VCRs

B. Ross's article on the Philips VR2021 (February) mentioned the use of components from scrap machines.

With VR2020s, to overcome failure of the capstan pressure roller to engage correctly as a result of stretching/ wear of the threading cord and pulleys, the easiest "fix" is to replace the small pulley at the left front with a medium size pulley. The pulleys are simply eased off and pushed home. Although there's a tensioning arm this has a

limited range of adjustment. I suspect that larger adjustments can be made by separating the left rear pulley assembly and then refitting with the location peg in a different hole, but I've not tried this.

One cause of no deck functions is failure (short-circuit) of a cell in the ni-cad battery. This is likely to become increasingly prevalent.

J.C. Sparks, Maghull, Merseyside.

VCR TIP

It may be useful to other readers to known that the idler in the Granada VHSCC1 is almost exactly the same as that in the Orion VHL3. After removing the cassette carriage to change the idler you have to press eject before refitting the carriage. Otherwise when the cassette is loaded the loading arms move into the play position and the power light flashes in the fault mode. I found this out when working on one of those machines without the help of a manual, not knowing whose design the machine is based on. After successfully placing the carriage back in I found that there's a mode switch on the carriage.

I'm looking for a power-luminance-chrominance PCB for a Panasonic NV333 to replace one damaged by water. If anyone has a working board at a reasonable price please write to the address below.

C. Taylor, 8 Echo Barn Hill, Kendal, Cumbria LA9 5NA.

Hum Problems

George Wilding

Particularly with older TV sets, where a hum bar's severity has gradually increased over a period of time, with possibly some slight reduction in picture size, the most common cause is partial drying up of an h.t. reservoir electrolytic capacitor, since the capacitor has to be able to take sufficient charge during rectifier conduction to maintain the sets's full current demand. Where there's no significant reduction in picture size or in the h.t. voltage, but usually with field timebase tripping, a smoothing electrolytic is generally at fault. The simplest and surest way to check on these possibilities is to shunt a known good electrolytic across the suspects - the value of the test capacitor need be only a fraction of that of the suspect. The test capacitor should be temporarily soldered in circuit, not held across the suspect: this will avoid damaging surges and sparking.

Particularly when the electrolytic concerned is a multiple type, check the soldering at the earth connection. Where a series resistor has been replaced, check that its value is not less than that of the original.

Where the h.t. or l.t. supply is derived from a bridge rectifier and the hum bar has developed suddenly the usual cause is an open-circuit rectifier diode. When checking remember that unless the transformer's secondary winding can be isolated from the rectifier diodes by plug removal or disconnection the pairs of diodes will, from the d.c. point of view, be in parallel. Thus – see Fig. 1 – when testing D1 the ohmmeter is also across D2. When the diodes aren't isolated from the transformer's secondary

winding the only evidence of an open-circuit diode will consist of an increased forward resistance compared to that of the other pair in the bridge.

Similar conditions apply where a conventional twodiode full-wave rectifier circuit is used, as in many portables (see Fig. 2). Unless the transformer's secondary winding is isolated, if one diode goes open-circuit this will be masked by the other one, ohmmeter application to them in situ seeming to indicate that they are both o.k.

Then in some models two series-connected transformer windings are used instead of a single centre-tapped winding, to simplify manufacture. It's not unknown for one of these windings in a replacement transformer to be connected in the wrong phase, so that only half-wave rectification is provided. This can be a misleading cause of hum and hum bars.

Where a series regulator transistor or i.c. is used and the severity of the hum bar tends to increase as the working temperature rises, leakage within the transistor or chip is very likely.

Some sets use an active ripple filter. The basic circuit is shown in Fig. 3. The great advantage of this arrangement is that the small base current required by the transistor can be provided ripple-free from a relatively large-value resistor in series with a small electrolytic capacitor. The output at the transistor's emitter should thus be ripple free (the value of the electrolytic capacitor in the transistor's base circuit is in effect multiplied by the transistor's d.c. gain). If collector-base leakage develops however the ripple present at the transistor's collector will be partially impressed on the base, producing ripple at the emitter output by normal transistor amplifying action.

The regulator transistor in a series regulator circuit (see Fig. 4) may be driven by one or two low-power types. One of these senses the output, the idea being to maintain the output voltage at a preset figure and in addition

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provide active filtering. A collector-emitter short-circuit in the power transistor will thus produce an over-size, hummodulated picture.

Shading and Brightness Modulation

The occasionally encountered shading or brightness variation across the screen is akin to a hum bar except that the unwanted raster modulation occurs at line frequency instead of at 50Hz or 100Hz. A common cause of this trouble is serious value loss and/or leakage in a capacitor providing the supply for the tube's first anode(s). Similar trouble can occur in brightness control circuits.

Hum on Sound

There are basically four causes of hum on sound: (1) as with hum bars, inadequate smoothing of a mains-derived supply; (2) pick-up of a mains or field frequency waveform, especially from the magnetic fields around a transformer, due to badly earthed a.f. screened leads, an unearthed volume control casing or misplaced wiring; (3) a "floating" high-impedance a.f. input circuit; (4) modulation of the sound signal by the vision signal (not strictly speaking hum).

The "buzzy" nature of this latter type of interference arises from three factors, (1) the large low-frequency luminance content of the vision signal, (2) the 50Hz repetition rate of information and (3) the high-amplitude, relatively long-duration field sync pulse trains.

Vision buzz generally arises in the i.f. circuitry or in the tuner. There are several possible causes. In some cases it

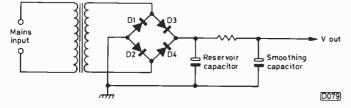


Fig. 1: Basic bridge rectifier circuit with RC filter.

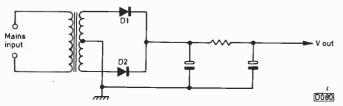


Fig. 2: Basic two-diode full-wave rectifier circuit with RC filter.

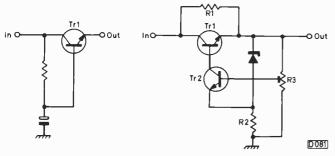


Fig. 3 (left): Basic active filter circuit.
Fig. 4 (right): Typical series regulator configuration. R1 provides a start-up supply and shares the dissipation with the power transistor Tr1. The error voltage is developed across R2, driving the emitter of Tr2. R3 sets the ouptut.

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may simply be due to an over-advanced sensitivity or r.f. gain control. Other common causes are: a.g.c. failure or reduction below the working level appropriate to the signal strength; impaired decoupling of an a.g.c. rail; a 33-5MHz sound attenuator circuit failing to provide the correct level of attenuation; alignment drift preventing the f.m. sound signal from being correctly positioned on the overall i.f. response curve; and, in particular, misaligned 6MHz intercarrier sound tuned circuits. Where a ratio detector circuit is used to demodulate the f.m. sound the problem can be caused by a misaligned transformer, an open-circuit detector diode, a badly matched pair of diodes or loss of capacitance in the detector circuit's reservoir capacitor.

Inadequate a.g.c. action will generally also result in a noticeably over-contrasted picture, possibly with a tendency to sound-on-vision (cross-modulation). For confirmation of an a.g.c. fault, feed the aerial via a plug-in attenuator so that negligible a.g.c. action occurs. Then, if tuning for optimum picture resolution coincides with maximum, buzz-free sound, the overall alignment can be regarded as satisfactory with failure of the a.g.c. circuit to develop an adequate control voltage as the likely cause of the trouble.

Where vision buzz is not accompanied by increased contrast and tuning for optimum h.f. definition peaks with maximum volume, check that the fixed trimmer in the 33.5MHz attenuator trap is not dry-jointed and that the trap is still correctly tuned to 33.5MHz.

When vision buzz develops only after a period of use, thus suggesting that a sound i.f./demodulator chip is being adversely affected by rise of temperature, a faulty electrolytic in this area is a strong possibility.

Camcorder Servicing

Part 5

Steve Beeching, T.Eng.

Before considering fault symptoms with solid-state image sensor camcorders, which we'll be doing next month, more ought perhaps to be said about the basic colour processing principles. Its important to understand these if such camcorders are to be handled successfully.

Colour Filter

The colour filter used with solid-state image sensors has magenta (M), green (G), cyan (C) and yellow (Y) sections. As we saw last month, M = R + B, G = G, C = B + G and Y = R + G. We also saw that successive lines are added within the sensor, so that the output from the horizontal shift register is G + C, M + Y, M + C or G + Y. These represent G + (B + G), (R + B) + (R + G), (R + B) + (B + G) and G + (R + G). The output obtained from the sample-and-hold circuit consists of a luminance component plus an h.f. carrier that's modulated by the colour information.

The simplest way to show what happens is to use

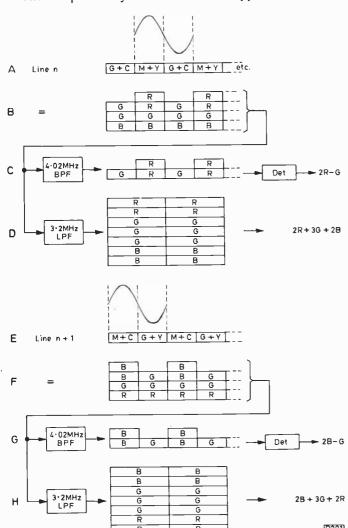


Fig. 1: The way in which the signal samples (pixels) are processed to produce separate luminance and 2R - G/2B - G colour signals on alternate lines with the earlier system that uses filtering and matrixing.

blocks, as before – see Fig. 1. A and B show a section of one line n in G+C, M+Y etc. and G+(G+B), (R+B)+(R+G) form respectively. As shown at C and D, the bandpass and low-pass filters produce an h.f. colour component and a lower frequency luminance component which combines the elements from successive samples (pixels).

Luminance Output

Taking the section shown under the sinewave in A we have

$$(M + Y) + (G + C)$$

= $(R + B + R + G) + (G + G + B)$
= $2R + 3G + 2B$.

This is the luminance component on line n.

On line n + 1 the sinewave is phase shifted by 180° and the luminance signal this time – see E and F – is

$$(M + C) + (G + Y)$$

= $(R + B + G + B) + (G + R + G)$
= $2R + 3G + 2B$

the same as in line n.

Colour Component

Now since each pair of blocks is, from the colour point of view, the equivalent of the positive and negative excursions of a 4MHz sinewave, the colour component obtained on line n is

$$(M + Y) - (G + C)$$

= $(R + B + R + G) - (G + G + B)$
= $(2R - G)$

while on line n + 1 we get

$$(M + C) - (G + Y)$$

= $(R + B + G + B) - (G + R + G)$
= $(2B - G)$.

Matrixing Outputs

The matrixing system thus yields a wideband luminance signal on each line while 2R-G and 2B-G are produced in alternate lines. We saw last month how simultaneous R-Y and B-Y signals are subsequently obtained for PAL encoding.

High-resolution System

With the later high-resolution system that employs sampling and filtering to separate the luminance and h.f. colour signals (see Fig. 8 last month) the equivalent conditions are shown in Fig. 2.

Sample-and-hold circuit SH1, fed with sample pulse 2, samples the M+Y signal in line n and holds it over the next G+C component. Sample-and-hold circuit 2, fed

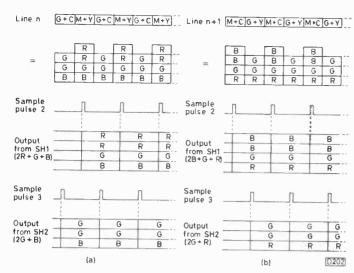


Fig. 2: Equivalent conditions with the later high-resolution system that uses sampling instead of simple filtering to separate the h.f. components of the output from the image sensor. (a) Line n; (b) Line n+1.

with sample pulse 3, on the other hand samples the G+C signal. On line n+1 SH1 samples M+C and SH2 samples G+Y.

This gives rise to the following outputs. On line n the l.f. luminance (YL) is 2R+G+B and the colour component 2G+B, while on line n+1 YL is 2B+G+R with 2G+R colour. As shown in Fig. 8 last month these signals are fed to add and subtract networks. The result of this in line n is

$$YL = (2R + G + B) + (2G + B)$$

= $2R + 3G + 2B$
colour = $(2R + G + B) - (2G + B)$
= $2R - G$

while on line n + 1

$$YL = (2B + G + R) + (2G + R)$$

= $2B + 3G + 2R$
colour = $(2B + G + R) - (2G + R)$
= $2B - G$

Now for something a bit more complex. As green is more or less equivalent to YL the expression G=K.YL holds, where K is a constant. So within the adder and subtractor a constant K.YL is added to the 2R-G and 2B-G signals, giving 2R-G+K.YL=2R and 2B-G+K.YL=2B, i.e. we end up with 2R and 2B on alternate lines in both the systems shown in Figs. 7 and 8 last month.

Correction – Saticon System

On the subject of colour processing there remains a correction to be made to paragraph three of Part 3 (page 470 in the April issue). With the Saticon tube the cyan diagonals, sloping from left to right, give cyan, green, cyan, green etc. (not cyan, gap etc.). The yellow stripes sloping from right to left give yellow, green, yellow green etc. The scanning is horizontal of course, not diagonal, giving in Fig. 2 gap (white), green, gap, green etc. on line n and yellow, cyan, yellow, cyan etc. on line n + 1. The error was introduced during the editing of the article: J.A.R. has been suitably chastised for trying to oversimplify everything!

next month in

TELEVISION

• THE FERGUSON ICC5 CHASSIS

The ICC5 represents a considerable departure from previous Ferguson practice. It's derived from the current Thomson chassis and is being used in fullfeature top-of-the-range models. The new approaches relate to both the mechanical and the electronic aspects of the design. Mechanically the chassis is compact, using plug-in modules to give a degree of flexibility. Considerable use is made of surface-mounted components and the new tuner lies flat on the chassis. Electronically there's microcomputer control via four bus rails, some new chrominance-luminance processing arrangements and a thyristor field output stage with a common line/field output transformer. In all there's a lot to get to know. J. LeJeune takes you inside the ICC5.

SATELLITE TV RECEIVERS

Following Steve Beeching's recent review of the Grundig satellite TV receiving system, lan Martin describes his experience with the Amstrad SRX200 system. The only slight problem was cured by carrying out a preset adjustment suggested by Amstrad's technical department.

Nick Beer reports on a couple of faults and some modifications to the Luxor Mk II satellite TV tuner.

BETTER FIELD SERVICING

Malcolm Burrell describes various ways in which field servicing can be made more effective, with hints on some common troubles and advice on dealing with customer complaints. A few extra tools can make a lot of difference.

CD PLAYERS – DIGITAL AUDIO

Next month's compact disc player servicing article will concentrate on the audio data recorded on the disc. In order to deal with many aspects of the player it's necessary to understand the make-up and content of the data stream that comes off the disc. The whole subject will be dealt with, including digitising and coding the audio signal.

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The Philips CP90/CP110 Chassis

Harold Peters

When I last wrote on the evolution of Philips CTV sets (June 1987) it seemed that the 2A chassis with its single panel construction would for some time be the main general-purpose chassis. This was not to be. As we went to press the CP90 and CP110 were announced as replacements, a pattern that is about to be repeated.

Many of you, being quite happy with the 2A, must have wondered "why change?" Now that responsibility for the design of Philips TV sets has been moved to the other side of the language barrier perhaps we shall never really know. I suspect that market forces dictated the move, for no sooner had the 2A become established than flatter, squarer tubes were with us — and with them the "square look" that made it convenient to stick the customer controls on the main chassis itself.

Much of the circuitry in the CP90 and CP110 is inherited from the 2A chassis. We will concentrate on the differences therefore. While on the subject of differences, the main changes to be found in the CP110 as opposed to the CP90 are in the line timebase (designed for 110° tubes) and in the chopper power supply, where a TEA1039 control chip is used instead of the CP90's discrete component circuitry. There is also a different colour decoder chip and the circuitry used in the RGB output stages differs. Our comparison will for the most part be between the CP90 and the 2A.

Mechanical Features

While the overall layout of the CP90/CP110 make them look like a 2A with user controls added, individual component layout is vastly different between all three chassis.

The control panel area follows the trend of the portables by including the on-off switch on the PCB, but without the attendant hazard of the incoming lead being anchored to tags at the back of the board. With these sets the mains supply arrives at the board via a connector which is close to the switch. At the other end of the front of the board there's a phone jack with a loudspeaker muting switch. Next to it (CP90 chassis only) there are input jacks for baseband video and audio signals. These jacks are connected in parallel with the complementary scart connector pins. In their place in the CP110 there's a contrast control — the only knob on the set. Everything else is done by pressing buttons. And therein lies a snag.

The pushbuttons are black on a dark background and are mounted beneath the tube in such a way that when you use them your eyes will be on a level with and very close to the brightly lit tube face. You just can't see what you're pressing — or anything else for that matter for about five minutes afterwards. This wouldn't matter too much were it not for the fact that the open-memory button is next to the channel-up button, with the result that many a user accidentally starts the tuning-up procedure (or more likely the detuning procedure) when all he wanted to do was to go from ITV to Channel 4. The writer's colleagues all fit a small plastic sleeve over the open-memory button to serve as a kind of braille warning. The CP90/CP110 were designed with remote control operation in mind of course, but there are occasions when

you need to use the front control panel.

The previously mentioned scart socket at the rear of the chassis is a full scart connector with provision for RGB inputs and the control line at pin 8. A button on the remote control handset switches from off-air to baseband signals.

A number of different types of c.r.t.s are used in these sets, including some with grey glass faceplates. This means that minor changes in the timebase and video circuits are required to obtain the correct drive conditions. The things to check when doing a tube swap are the c.r.t. mounting bolts and the degaussing coil fixings, which vary from set to set.

Serviceability on the bench is good, but the design limits serviceability in the field — you are left balancing the chassis on one knee while taking voltage readings . . .

Circuit Features

The tuner, i.f. strip, colour decoder and sync circuits are in the main all handed down from the K40/2A series chassis. In the field output stage there's a cascaded pair of transistors in place of the chips previously used. Connectors are fitted so that a teletext decoder and SECAM transcoder can be added — the latter is a board that identifies a SECAM transmission and turns it into "quasi-PAL" for processing on the main board.

The chopper and line output stages are conventional. A BUT11AF is used as the line output transistor (BU508A in the CP110). By having two separate chassis for 90° and 110° tubes the massive 16-way permutation of components and links found in the 2A chassis is avoided. The set itself looks no tidier but the circuit is much easier to follow.

The chopper circuit used in the CP90 chassis is much like that in the 2A, but in the CP110 a TEA1039 chip replaces the discrete control circuitry. With both circuits the chopper goes into a "tickover" state when the set is in the standby mode, to provide sufficient current to keep the remote control receiver going.

The intercarrier sound, switching and audio circuitry are all contained within a TDA8190 chip. A welcome feature here is the inclusion of a tunable sound detector coil in place of a fixed ceramic filter. This enables you to maked sure that sibilance doesn't occur.

Remote Control and Tuning

Both chassis have a remote control system with VST (voltage synthesised tuning). It's a new system, VST2, that retains some of the features of the version used in the CTX chassis, such as the RC5 handset code and the need for a ni-cad back-up battery, but is this time integral with the main board.

The 2A chassis used FST (frequency synthesised tuning), in which a crystal generated frequency is compared to the tuner's local oscillator frequency and a.f.c. is applied to synchronise the two. It was a user-friendly system that permitted station selection by channel numbers, but was rather heavy on components.

VST is more economical with parts and you would think that the ability to turn up the correct varicap tuning

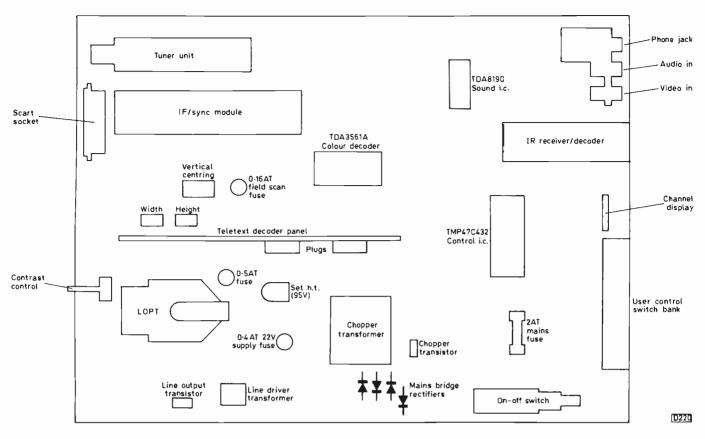


Fig. 1: Basic layout of the Philips CP90 chassis, showing the main components.

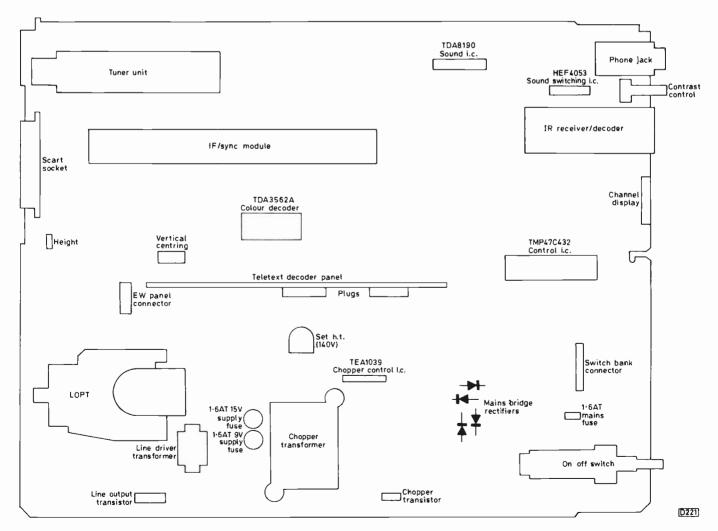


Fig. 2: Basic layout of the Philips CP110 chassis, showing the main components.

voltage on demand would be just as effective as with FST. For the most part it is. There are two shortcomings however. First, the elements inside the tuner settle down physically from new, needing a slightly different voltage to select the required channel than that first set. This is readily overcome by reprogramming the tuning after a few days' use or even after a pre-delivery soak test. The other shortcoming is not so easily fixed but was eventually acknowledged as being a problem. It's the fact that a 1V change in the varicap tuning voltage at the lower end of Band IV can shift the tuning by up to three channels while the same voltage change at the upper end of Band V hardly moves the local oscillator off vision carrier, due to the exponential voltage/capacitance characteristic of the varicap diodes. Normally at the top end the a.f.c. hardly has any effect at all. It can be increased of course — there are volts to spare with all a.f.c. systems — but then when the user tries to tune in to his VCR down at ch. 33 the set "locks up" or jumps channels due to the excess voltage. This occurred at first with the CP90/CP110 chassis, but later models have been extensively modified to improve the a.f.c. action at the top end of the band. The changes are spread all over the chassis, so it's not possible to provide a simple diagram. The gist of what happens is that varicap voltages above 12V get extra a.f.c. while those below don't. Engineers wanting to know more should ask Philips for Service Tip 92A.

Non-remote Version

When the CP90/CP110 series were being designed it was assumed that remote control would be fitted on all sets. This overlooked the needs of vast numbers of rental customers with basic sets, wanting to renew without going up a step in charges. For this and other reasons a couple of non-remote control versions of the CP90 chassis were introduced, one with a scart connector and one without. In these sets the front control pushbutton assembly is in part replaced by rotary controls while the VST system is replaced by a TUON (tuning only) unit similar to that fitted in non-remote 2A sets. Both have the discrete component chopper circuit, both can have the SECAM transcoder added, but neither will accept a teletext board.

Hints and Tips

To work on the CP110 you should have the CP90 data as well. The order codes for the servicing information are as follows:

Item	CP90	CP110
Service manual	727 15737	727 15947
Circuit description	725 15748	727 15889
Teletext decoder supplement	727 16185	727 16185

As with all contemporary designs the CP90/CP110 has a reliability record that makes it difficult to list "stock faults". In fact most of the service tips that have come from Philips Service relate to the wide variety of different c.r.t.s you may encounter. This is mainly because after production commenced the style was changed with the adoption of a range of tubes with grey-tinted faceplates. This involved changes to the brightness and beam limiting circuits. Another change was to a fastext decoder which Philips perversely call FLOF (full level-one features). If it were not for the Philips Service Link and John Spilsted's carefully maintained fault log we would not be able to provide the following service notes.

First the chopper power supply, which is best serviced using a variac and with a 60W bulb as a dummy load in place of the receiver circuitry.

The BUT11AF chopper transistor in the CP110 chassis fails from time to time, usually with high mains voltages. Before replacing it check that C2661 has been changed from $1,500\mu$ F to $2,200\mu$ F, that R3658/9 have not changed value and that C2657 (2.7nF) has been removed. Then replace the TEA1039 chip and bridge rectifier diodes D6657-D6660 as well as the BUT11AF.

When the BUTIIAF chopper transistor fails in the CP90 chassis D6674 should be changed from type BAX14 to type BYD33J. It's good preventive practice to make this change whenever one of these sets comes in for service.

No sound and vision with the set stuck in the standby mode occurs when D6670 (1N4148) in the CP90 chassis goes open-circuit.

For poor width/e.h.t. regulation, flutter at the edges, with the CP110 chassis check T7671 (BC328) and the chopper transformer. The chopper transformer in the CP110 chassis can be responsible for odd faults such as flicker, jumping, supply collapse etc. because of loose wound foil not connecting with the leadouts. Check the transformer by pressing it. This doesn't happen with the CP90 chassis which uses a conventional wire-wound chopper transformer.

No results with the CP90, the h.t. being low at 50V, can be caused by two items in the line output stage, the transformer and D6610.

A shorted line output transformer in the CP110 chassis produces the following symptoms: no results with a loud tripping noise. For striations on the left with this chassis check whether D6630 is open-circuit. If you have intermittent failure to start up with the CP110 chassis check for a dry-joint on the line driver transformer. Unfortunately access to this component is poor.

Two things have been found to cause low width with the CP90 chassis, a dry-joint on D6609 in the diode modulator circuit and R3600 (8·2 Ω) going open-circuit. Low width with the CP110 chassis occurs when C2620 (22nF) goes open-circuit, taking with it R3599 (47 Ω), R3629 (1M Ω) and R3630 (47k Ω).

For lack of height with the CP90 chassis check R3582 (3.3Ω) which can go high in value.

Field foldover with the CP110 chassis should lead to a check on C2574 (680 μ F).

For intermittent picture fade with the CP110 chassis, check for a dry-jointed link wire at R3438 on the c.r.t. base panel.

If there's low video from pin 19 of the scart connector with the CP90 chassis, reduce the value of R3517 from $6.2k\Omega$ to $1k\Omega$.

Buzz on quiet sound passages with the CP90 chassis can be cured by replacing the ceramic filter 1103 with the four-legged type 310 27563.

For no sound or vision with a snowy raster present on the CP110 chassis check for a dry-joint on the 10Ω safety resistor R9051. This is in the 12V supply to the tuner and is not shown on the circuit – it's used in place of link 9051.

No sound with the CP90 chassis has been traced to C2046 being leaky, upsetting the video recognition input to the sound chip. It's not shown on the circuit diagram, being inside the sync module – not an obvious one!

For tuning drift on high channels, see the previous remarks on the VST a.f.c. modifications.

A faulty SAA5243 chip on the teletext panel can cause

the following symptoms: memory changes pages without being asked; characters are displayed double, e.g. PP112200; the fastext buttons have no effect.

The G90 and G110

After a successful couple of years the CP90 is already going out of production, the new G90 chassis gradually taking its place. Suffixed /A for mono, /B for stereo and / E for European, the layout of this chassis is basically the same as the CP90 but as you look in the back you see few conventional discrete components. This is because wide use is made of surface-mounted components which are on

the copper side of the board.

The G90 takes several features from the 3A chassis—the multistandard colour decoder chip set, the colour transient improvement (improved!) and the on-screen channel display. This latter feature will also show up to eight fault conditions, F0-F7. If there's no raster you can still find what code is being produced by using an oscilloscope to measure the off time of the flashing LED just below the c.r.t.

Another feature is the "sleep" facility. You can program the set, in increments of fifteen minutes up to a maximum of ninety minutes, to turn off to standby. The G110 version is due this autumn.

Product Review: Satellite TV Filter

Roger Bunney

In the August 1988 issue I described a simple i.f. bandwidth filter unit for use with weak satellite TV signals. It can lift an otherwise unusable signal to something approaching watchable quality. Using new components from Maplin, it costs only around £3 to build.

Recently I noticed that Micro-X (telephone no. 01-459 1200) has introduced a variable bandpass filter, the Phantom IFP70, for use with 70MHz i.f. receivers and obtained one for evaluation. It's housed in an attractive black aluminium case with contrasting brushed aluminium front panel and measures approximately $6 \times 13/4 \times 4$ in. excluding the two front knobs that add a further half inch depth and the rear sockets. The front panel controls are for power on/off, gain and bandwidth. Even when the unit is not being used as a filter a 12V input is required to maintain signal continuity via the switching diodes. The unit incorporates a stabiliser and will work with a supply of 9-15V, via a standard low-voltage tubular 2.5mm plug. Input/output at 70MHz is via American F sockets. Though F plugs are simple they are difficult to wire unless a crimping tool is available. With the larger Radio Shack F plug however you can solder the coaxial screen to the plug body on its crimping ring, two layers of heatshrink providing adequate mechanical strength. Maplin can supply inexpensive F plugs.

The filter is connected into circuit via the i.f. loop facility at the rear of the receiver – you will find that this is present on most receivers, intended for making a connection at 70MHz to an unscrambler. It also gives you access to the i.f. strip to enable filtering to be introduced – connect the receiver's output to the filter's input and the filter's output back to the receiver's input. Most receivers also have F connectors, so it may help to obtain from a dealer two F-plugged leads, say about two feet long, to make interconnection simple.

Imported manual receivers like mine tend to have minimal facilities. They offer maximum "hands-on" operation however. It's unusual to find dual bandwidth video switching, the i.f. bandwidth generally being fixed at around 30-32MHz. Because of this you will tend to get sparklies with a weak signal – also when a half transponder signal is displayed via a full bandwidth receiver. For improved results with weak or half transponder signals you need to optimise the i.f. bandwidth. The aim is to improve the signal-to-noise ratio.

Operation of the Phantom IFP70 unit is extremely simple and the results can be dramatic. Connect the filter to the i.f. loop and apply 12V. Set the gain control to mid-

travel and the bandwidth control fully anticlockwise (wideband position). Select a weak satellite TV downlink signal, push the power button to the on position and rotate the bandwidth control slowly clockwise. You will see the picture change. Many receivers don't have a readily accessible a.f.c. on/off switch, and as the bandwidth is reduced you may get slight detuning. Correct for this with slight adjustment of the main tuning knob. If the a.f.c. can be disabled easily do this to avoid the need for retuning. Reducing the bandwidth gives a dramatic reduction in the residual noise (sparklies) on the screen – they may even disappear, leaving you with a very good picture.

Bandwidth limiting is a very effective means of noise reduction. Half transponder signals from Intelsat craft can be lifted out of the noise since you are tailoring the i.f. passband to the bandwidth of the incoming signal. With weak full transponder signals, gradual bandwidth reduction provides a considerable improvement, though there's a critical point where highly saturated colours such as red or blue go into heavy noise. Slightly backing off the bandwidth control will give you an acceptable compromise.

With the gain control at minimum (fully anticlockwise) the unit introduces about 10dB of attenuation. At normal mid-setting the gain is around 14dB.

The filter has a maximum bandwidth of 32MHz (-6dB points) and gives continuous reduction to 12MHz. The input/output impedance is 75 Ω .

Inside the unit there's an extremely neat and well designed board. The single sided A4 instruction sheet describes it as a "dual varactor tuned notch with three-pole fixed 70MHz bandpass filter".

I found that all noise could be removed from Astra signals – reception of these at my location is through trees and is thus normally noisy. With a 1-5m prime-focus dish directed at 18-5°W I found that almost sparklie-free reception of the Italian downlinks was possible. This was also the case with Scandinavian signals from 1°W. The EBU news feed from 27°W was similarly noise-free apart from the reds. I don't have access to measuring equipment, but a comparison of the results obtained with photographic signal/noise charts displaying noisy off-screen images shows that the unit can provide a very worthwhile 10-12dB improvement in the signal-to-noise ratio.

The unit is perhaps expensive at around £100 plus VAT – but I was so impressed with the sample that I purchased it.

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EC	OI	VOI	VII	C D	EVIC	ES	PO	В	OX	1	5, W	0	LVE	R	HAI	ИE	PTO	N,	W	V2	44	Z
15/80H 15/85R 17052 17053	2.72 3.28 5.61 5.61	2SC1678 2SC1741 2SC1810 2SC1815	1.99 1.25 1.70 0.20	AN2140 AN234 AN236 AN240P	2.40 BC207 5.09 BC2128 3.33 BC213L 0.99 BC214	0.14 0.26 0.10 0.10	BDX54B BDX62A BDX63A BDY20	0.31 1.96 1.96 1.21	BU126 BU137 BU205 BU206	1.10 6.53 1.15 1.27	HA1196 HA13001 HA1306 HA13402	7.43 1.73 2.26 7.87	MC1330P MC1350P MC1351P MC1352P	1.98 0.90 1.32 1.40	SAS560T SAS5/0T SAS570S SAS580	5.42 5.42 2.61 2.85	STR1096 STR4090 STR440 STR451	4.98 9.52 5.37 4.93	TBA970 TBA990 TCA270S TCA270SQ	1.98 2.15 1.05	TDA4440 TDA4442 TDA4500 TDA4600-2	3.26 4.15 4.75 2.10
17074 17089 17127 17376	9.30 3.45 2.50 1.58	2SC1826 2SC1829 2SC1875 2SC1893	0.67 2.25 4.50 3.02	AN241 AN245 AN253 AN260	1.71 8C225 4.90 BC237 1.80 BC238 3.85 BC238B	0.40 0.10 0.10 0.08	BDY81 BF115 BF117 BF118	1.18 0.29 0.66 0.67	BU207 BU208 BU208/02 BU208A	1.65 1.12 1.88 1.12	HA13342 HA13365 HA1366WR HA1367	2.65 4.02 1.38 2.75	MC1357P MC1358P MC14493P MC14494P	2.15 1.48 4.20 2.15	SAS6600 SAS660 SAS6700 SAS670	1.33 1.33 1.33 1.33	STR453 STR454 STR6020	8.16 4.95 5.85	TCA290A TCA420A TCA440 TCA530	2.16 2.25 2.24	TDA4610 TDA4620 TDA5500 TDA5700	6.88 6.73 7.45 2.75
1N4001 1N4002 1N4003 1N4004	0.04 0.06 0.06 0.05	2SC1906 2SC1921 2SC1923 2SC1929	0.98 1.37 0.30 2.25	AN272 AN295 AN301 AN302	7.92 8C2398 5.52 8C251A 2.45 8C294 3.09 8C300	0.25 0.31 0.50 8.35	BF121 BF123 BF127 BF137	0.25 0.13 0.13 0.29	BU208D BU209 BU226 BU326A	1.43 1.93 2.45 0.99	HA1368R HA1368 HA1370 HA1374	2.45 2.07 3.71 1.80	MC14497 MC14510BAL MC14511BCP MC14528BCP	3.46 3.75 1.10 2.15	SAS6710 SBA750 SC84203 SC9504P	2.21 1.61 19.35 1.95	T6029V T6035V T6036 T6037	7.96 0.73 0.67 2.11	TCA640 TCA650 TCA660B TCA730	2.25 3.05 2.60 3.81	TDA7270S TDA8190 TDA9403 TDA9503	2.25 3.96 1.50 2.92
1N4005 1N4006 1N4007 1N4148	0.05 0.08 0.07 0.03	2SC1942 2SC1959 2SC1957 2SC1953	1.98 0.26 0.95 1.93	AN305 AN315 AN316 AN318	8.88 BC301 2.46 BC302 5.53 BC303 9.35 BC307A	0.23 0.53 0.30 0.06	BF153 BF154 BF157 BF158	0.58 0.26 0.33 0.18	BU406 BU406D BU407 BU412	1.49 1.53 0.82 5.29	AA117 HA1377 HA1389R HA1389	9 1.75 2.05 2.39	MC1712 MC5192 MC7724CP MCR106 5/6	3.88 19.50 3.49 1.23	SDA2006 SDA2112/2 SG264A SG613	17.95 10.29 5.26 8.75	T6044V T6045 T6049 T6052V	0.97 1.20 1.45 0.87	TCA750 TCA8000 TCA830S TCA890	2.25 5.95 2.38 5.44	TDA9513 TDB1033 TDE1081 TEA1002	3.15 2.68 7.05 2.30
1N4448 1N5401 1N5402 1N5403	0.05 0.11 0.13 0.18	2SC1962 2SC1969 2SC1983 2SC1985	1.93 1.78 3.28 1.55	AN320 AN321 AN322 AN337	5.47 BC308A 2.25 BC309 6.78 BC317A 5.37 BC327	0.17 0.13 0.33	BF159 BF160 BF167 BF173	0.18 0.31 0.38 0.34	BU426A BU500 BU508A BU536	1.67 1.45 1.89 1.65	HA1392 HA1394 HA1397 HA1398	1.38 2.37 3.76 2.95	MCR220/7 ME0411 ME6002 ME6102	2.28 0.75 0.26 0.28	SG629 SG6533 S11125H S11630HD	8.27 10.31 7.50 20.50	T6058 T6059 T9003V T9005V	3.08 2.77 1.25 2.38	TCA900 TCA910 TCA940 TCA940£	2.04 1.65 0.82 2.93	TEA1009 TEA1014 TEA1020SP TIC106C	0.80 1.50 4.93 0.61
1N5404 1N5408 1N914 1S1555	0.15 0.14 0.04 0.31	2SC2009 2SC2029 2SC2028 2SC2063	0.34 2.33 2.11 0.99	AN340P AN355 AN362 AN370	1.53 BC328 5.98 BC337 1.50 BC338 3.95 BC368	0.11 0.09 0.12 0.18	BF177 BF178 BF179 BF180	0.55 0.40 0.36 0.36	BU608 BU705 BU806 BU807	1.65 2.50 0.85 1.40	HA1406 HA1452 HD14538 HD38702-A2	2.07 0.85 2.07 7.95	ME8001 ME0411 MJ2501 MJ3001	0.75 3.30 1.43	SKE2F1/04 SKE2G3/04 SKE4F1/06 SKE4F2/08	1.39 0.85 0.35 1.07	T9011V T9013V T9014V T9016	1.40 4.95 2.42 1.02	TD3F800R TD3F900H TDA1001B TDA1003A	3.67 5.36 2.31 1.79	TIC106M TIC44 TIC45 TIC47	0.77 0.72 0.56 0.77
1S44 1S921 2N2219A 2N3053	0.10 0.10 0.37 0.35	2SC2078 2SC2073 2SC2085-Q 2SC2091	3.39 1.54 1.65 1.30	AN5111 AN5120N AN5132 AN5250	3.43 BC440 4.50 BC441 4.42 BC454 4.40 BC460	0.69 0.46 0.36 0.42	BF181 BF182 BF183 BF184	0.32 0.34 0.39 0.43	BU826A BUW84 BUX84 BUX85	1.95 1.39 0.50 0.69	HD38750A53 HD38750A-7 HD38800A50 HD44801A05	5.77 7.25 14.09 12.50	MJ481 MJE2955 MJE3055 MJE340	1.33 1.39 1.25 0.49	SKE4F2/06 SKE4F2/10 SKE4G2/02 SKE5F3/10	0.80 1.33 0.96 1.60	T9019VV T9034V T9035V T9051	1.98 1.45 1.40 7.14	TDA1005A TDA1006A TDA1010AF TDA1011	2.22 7.00 4.25 2.40	TIP120 TIP110 TIP112 TIP117	1.55 0.53 0.34 0.95
2N3054 2N3055 2N3442 2N3702	0.99 0.79 1.16 0.14	2SC2141 2SC2166 2SC2216 2SC2233	2.44 0.87 0.69 1.20 1.69	AN5610 AN5612 AN5613 AN5630 AN5701N	7.43 BC461 2.07 BC462 4.20 BC463 3.95 BC478 1.66 BC479	0.47 0.51 0.30 0.32 0.41	BF195 BF196 BF197	0.39 0.14 0.14 0.17 0.16	BY126 BY127 BY133 BY164	0.13 0.13 0.06 0.44	HISH1004 HISH1002 HM6231	8.59 6.00 9.50 9.81	ML231 ML2328 ML2378 ML2378	0.49 0.99 3.01 2.51 5.77	SKS1/10 SL1310 SL1430T SL414	2.15 3.14 2.31 3.69 3.44	T9054V T9057V T9062V F9064 TA7027	5.46 2.77 0.49 3.90 4.80	TDA1010 TDA1011A TDA1028 TDA1034B TDA1035S	1.02 1.51 2.45 2.42	TIP121 TIP126 TIP132 TIP137	0.40 0.30 0.99 0.96 0.84
2N3703 2N3705 2N3706 2N3707 2N3711	0.18 0.16 0.14 0.16 0.11	2SC2236 2SC2278 2SC2314 2SC2335+K 2SC2551	1.14 0.87	AN6250 AN6300 AN6310 AN6340	2.95 8:0532 4:40 8:0546 4:54 8:0547 6:46 8:0548	0.28 0.17 0.10 0.10	BF198 BF199 BF200 BF218	0.17 0.17 0.37 0.36	BY176 BY179 BY182 BY187 BY189	0.52 1.42 1.05 0.77 1.76	HM6232 HM6251 HM7103 HM9032 HM9012	10.95 5.25 4.85 4.00	ML923 ML926 MM5314N MM5316N	3.10 3.58 8.99 9.16	SL432A SL439 SL471 SL480 S1490	2.48 2.88 3.14 2.37	TA7050 TA7051 TA7054 TA7060AP	1.74 1.74 2.55 0.71	TDA1035T TDA1037 TDA1037D TDA1044	2.95 2.55 1.95 2.05 1.95	TIP29 TIP2955 TIP29A TIP29B TIP29C	0.86 0.46 0.63 0.40
2N3771 2N3772 2N3773 2N3819	2.04 1.55 2.20 0.40	2SC2565 2SC2570 2SC2577 2SC2578	3.84 0.80 1.60 6.75	AN6341 AN6363 AN6531 AN6551	1.42 BC549 16.00 BC550 1.95 BC556 0.50 BC557	0.10 0.10 0.16 0.10	BF224 BF237 BF240 BF241	0.17 0.65 0.19 0.17	BY198 BY207 BY208 BY210 400	1.62 0.22 1.11 0.18	HM9015 HT4207 HT4208 KA2101	3.24 13.25 20.65	MM5318N MM5369N MM5387AA/N MM5841N	3.11 2.01 6.20 6.64	SL901B SL918A SN16861AN0 SN16862AN	8.32 9.07 0.82 2.98	TA7061AP TA7069 TA7070P TA7072P	1.27 3.13 1.83 2.57	TDA1047 TDA1059B TDA1054M TDA1060	3.25 0.80 1.21 2.60	TIP290 TIP3055 TIP30A TIP30C	0.75 0.66 0.41 0.40
2N3823 2N3904 2N3908 2N4101	1.17 0.15 0.62 1.33	2SC2671 2SC288A 2SC3153 2SC372	0.91 1.85 6.50 1.40	AN6552 AN6610 AN7111 AN7115	0.68 BC558 1.65 BC559 1.25 BC560C 2.52 BC635	0.10 0.10 0.14 0.34	BF245 BF245B BF246A BF255	0.50 0.49 2.52 0.20	BY210-600 BY210-800 BY223 BY224-600	0.27 0.19 1.43 1.88	KC581C KC582C L200CV LA1201	7.68 4.85 1.69 0.75	MN1400VL MN1405 MN1435VX MP1192	13.65 792 9.50 5.07	SN16966N SN29717N SN29716N SN29715N	7.19 3.66 6.04	TA7074P TA7076P TA7089P TA7092P	1.98 7.50 3.10 9.94	TDA1082 TDA1151 TDA1190 TDA1190Z	3.25 1.22 2.11 2.48	TIP31A TIP31B TIP31C TIP32A	0.34 0.38 0.30 0.35
2N4240 2N4444 2N5293 2N5294	2.00 0.90 0.50 0.50	2SC373 2SC383 2SC388 2SC394V	1.16 1.33 1.27 0.81	AN7145 AN7146 AN7151 AN7156	2.80 BC636 9.90 BC637 2.37 BC639 2.85 BC640	0.29 0.24 0.36 0.24	BF256 BF257 BF258 BF259	0.20 0.34 0.33 0.34	BY226 BY227 BY228 BY229-1000	0.25 0.20 0.60 1.12	LA1210 LA1230 LA1320 LA1357N	1.56 1.44 2.87 9.00	MP2794 MP2812 MP8512 MPC596	4,00 5,07 1,57 2,13	SN29722 SN29723AN SN29764AN SN29767	11.95 8.77 2.38 3.90	TA7093P TA7102P TA7108P TA7109	3.99 5.88 1.61 3.71	TDA1200 TDA1235 TDA1236 TDA1270	1.51 3.88 3.30 3.74	T1P32B T1P32C T1P33 T1P33A	0.46 0.28 0.85 1.02
2N5296 2N5297 2N5298 2N6109	0.48 0.50 0.61 1.58	2SC403C 2SC458 2SC495 2SC515A	0.60 0.34 0.92 1.85	AN7158 AN7218 AN7223 AU107	2.34 BCX34 0.90 BD115 4.56 BD116 5.87 BD124	0.40 0.36 0.70 1.31	8F262 8F263 BF271 BF273	0.57 0.57 0.34 0.20	BY229-600 BY255 BY295-600 BY298	0.92 0.13 1.03 0.20	LA1363 LA1364 LA1365J LA1385	1.05 3.02 1.15 1.53	MPF256C MPS6570 MPSA42 MPSA56	0 60 0 48 0.35 0.08	SN29770BN SN29772BN SN29771BN SN29791	3.69 5.60 4.15 1.67	TA7122B/P TA7124P TA7129P TA7130P	0.87 2.34 1.50 1.27	TDA1327A TDA1412 TDA1420 TDA1440	1.50 1.08 1.52 3.45	TIP33C TIP34 TIP41A TIP41B	0.80 0.75 0.49 0.31
2N6130 2N6133 2N6180 2N6292	0.85 1.25 0.73 1.65	2SC535 2SC536 2SC537 2SC605L	0.79 0.10 0.54 1.16	AU110 AU113 AY105K AY106	5.69 BD131 6.95 BD132 2.08 BD133 1.09 BD135	0.42 0.42 0.53 0.36	BF274 BF324 BF336 BF337	0.20 0.23 0.33 0.45	BY299 BY407 BY409 BY448	0.60 0.90 1.49 1.35	LA1387 LA3350 LA3361 1A3390	5.95 1.43 1.60 5.52	MPSA92 MPSU05 MPSU10 MPSU56	0.45 9.86 1.56 0.60	SN29798N SN2709 SN7400N SN7401N	5.56 0.44 0.61 0.36	TA7136AP TA7137P TA7141AP TA7146P	1.89 0.98 3.87 4.23	TDA1470 TDA1470P TDA1506 TDA1510	2.90 4.25 6.58 4.60	TIP41C TIP42A TIP42B TIP42C	0.68 0.50 0.79 0.82
2SA1006 2SA1011 2SA1015 2SA1012	1.50 1.65 0.49 1.25	2SC620 2SC643A 2SC668 2SC681	1.46 1.54 0.67 4.40	BA524 BA310 BA1310 BA1320	8.94 BD136 0.14 BD137 1.98 BD138 1.38 BD139	0.36 0.26 0.28 0.34	BF338 BF355 BF362 BF363	0.40 0.49 0.60 0.50	8Y713 BYW56 BYX55-600 BYX71-600	0.65 0.14 0.23 0.85	LA4032P ŁA4100 LA4101 LA4102	2.35 1.25 1.30 0.75	MPSU60 MR818 MR854 MR914	1.33 0.33 0.50 1.20	SN7402N SN7404N SN7408N SN7410N	0.65 0.52 0.27 0.27	TA7148P TA7149P TA7152P TA7161P	1.67 3.26 2.72 4.50	TDA1512 TDA1515 TDA1559 TDA1670	2.89 2.89 3.15 4.48	TIP47 TIS43 TIS90 TL011CP	0.65 1.43 0.21 1.56
2SA1020Y 2SA1027R 2SA473 2SA766S	0.80 0.45 0.75 4.95	2SC682 2SC684 2SC693 2SC710	1.88 1.65 0.63 1.15	BA1322 BA1330 BA145 BA148	3.95 BD140 2.75 BD144 0.19 BD150 0.25 BD157	0.32 1.43 0.75 0.67	BF371 8F391 BF417 BF418	0.50 0.25 0.84 1.87	BYX71-350 BYY56 BZY93C30 C106D	0.62 1.20 1.86 0.37	LA4112 LA4125 LA4138 LA4140	0.56 2.25 4.98 0.70	MSM5816RS MSM5840H MVS460-02 NE542	17.35 13.95 #.34 2.65	SN74121 SN7413N SN74141N SN74151AN	1.60 0.37 2.65 1.51	TA7162P TA7172P TA7176P TA7193P	3.61 1.41 1.75 4.80	TDA1770 TDA1905 TDA1908 TDA1940	2.75 1.27 2.98 1.95	TL494CN TL072CP TMP4320 TMS1024NLI	
2SC1173Y 2SC1474 2SC1509 2SA1095	1.25 1.25 1.35 3.00	2SC711A 2SC717 2SC734 2SC783	0.50 1.28 1.43 3.98	BA154 BA155 BA156 BA159	0.40 BD160 0.12 BD163 0.05 BD166 0.09 BD175	1.60 0.71 0.42 0.28	BF422 BF423 BF450 BF451	0.30 0.33 0.35 0.29	C106M CA3046 CA3089 CA3090AQ	0.76 1.55 0.83 3.25	LA4192 LA4220 LA4420 LA4422	1.50 1.25 1.72 1.00	NE555 NE556 NP1106 DA202	R.19 R.65 11.51 R.11	SN74154N SN74190 SN7420N SN7430	1.27 1.35 0.34 0.49	TA7204P TA7206P TA7207P TA7208P	2.16 12.49 1.48 2.15	TDA1950 TDA2005 TDA2006 TDA2004	2.50 1.45 1.55 1.48	TMS1025N TMS3720AN TMS3748NS TMS3755	14.95 13.65
2SA1103 2SA329 2SA489 2SA490	6.00 0.40 1.17 1.32	2SC790Y 2SC828 2SC867A 2SC876 2SC930	1.85 0.28 3.04 0.96 0.54	BA182 BA222 BA302 BA311 BA312	0.19 BD179 1.66 BD181 1.24 BD182 0.65 8D183 1.45 BD184	0.30 0.99 0.99 0.99 1.21	BF457 BF458 BF459 BF460 BF469	0.41 0.49 0.52 0.99 0.28	CA3094 CA3131EM C04001 CD4002	2.20 2.95 0.34 0.27	LA4430 LA4440 LA4445 LA4460	1.29 1.95 1.80 1.75	DA47 DA91 DA95 DC28 DC29	0.16 9.14 #.09 2.52 2.15	SN7440N SN7472 SN7474N SN7490AN SN74US26N	0.27 1.54 0.44 0.93 1.45	TA7210P TA7214P TA7215P TA7217AP TA7222	1.45 3.63 2.58 1.45 1.95	TDA2002 TDA2003 TDA2030 TDA2140	0.90 1.00 1.35 2.14	TMS3894NL TMS5102NLI TUA2000 TY6010B	8.98 2.97
2SA493 2SA562 2SA564 2SA614 2SA628	2.25 0.57 0.62 4.88 0.37	2SC935 2SC940 2SD1128 2SD1138	4.13 4.68 2.90 0.94	BA313 BA317 BA318 BA328	9.76 BD187 9.04 BD189 9.09 BD190 1.65 BD201	0.53 0.69 0.69 0.49	BF470 BF471 BF472 BF479	0.26 0.33 0.33 0.61	CD4008 CD4011 CD4012 CD4013	1.35 0.29 0.24 0.33 0.36	LA4461 LA5112N LA7020 LA7025 LA7027	1.70 1.18 13.86 11.97 10.92	DC36 DC44 DC45 DC72	7.53 4.35 4.18	SN76001N SN76013ND SN76023N SN76023ND	1.65 3.50 2.97 3.91	TA7226 TA7229P TA7230P TA7233P	3.57 4.22 1.35 3.46	TDA2150 TDA2151 TDA2160 TDA2161 TDA2170	6.20 1.30 4.01 2.40 4.50	ULN2204 UPA53C UPC1003 UPC1009C UPC1025H	8.50 4.94 5.95 6.32 2.90
2SA639S 2SA659 2SA673 2SA684	1.75 0.49 1.50 1.20	2SD1273 2SD1453 2SD152K 2SD198	1.30 1.33 2.54 3.87	BA333 BA335 BA5102A BA511	1.37 BD202 6.27 BD203 2.50 BD204 1.96 BD207	0.68 0.46 0.41 1.79	BF480 BF491 BF506 BF532	1.79 0.50 0.43 0.24	CD4016 CD4017 CD4020 CD4021 CD4023	0.40 1.23 0.39 0.28	LA7040 LA7042 LA7800 LA7801	9.20 3.90 1.03 0.90	DC75 DN236 DN782 DT121	0.44 1,06 1.98 1.45	SN76033N SN76110N SN76115AN SN76131	5.54 0.90 1.61 0.82	TA7240AP TA7245P TA7310P TA7313AP	2.55 5.92 2.15 0.65	TDA2270 TDA2520 TDA2522 TDA2524	3.96 2.25 2.50 4.50	UPC1028H UPC1032H UPC1042C UPC1156H	2.00 0.82 8.95 3.94
2SA697 2SA699 2SA715 2SA748	0.80 1.25 0.95 1.95	2SD234 2SD235 2SD24 2SD257	0.47 0.60 2.29 1.98	BA514 BA521 BA524 BA526	1.90 BD208 1.20 BD222 8.94 BD225 7.98 BD228	1.23 0.50 0.46 0.63	BF596 BF597 BF694 BF757	0.18 0.27 0.22 0.59	CD4025 CD4028 CD4040B CD4047	0.64 0.84 0.60 1.06	LB1274 LC7800 LD3120 LD3150	3.61 9.20 1.13 2.75	PT6042 PT8504 R1038 R1039	2.45 4.98 2.19 2.19	SN 76227N SN 76226DN SN 76228N SN 76242	0.85 2.00 3.27 5.23	TA/314 TA/323P TA/325P TA/339P	5.94 3.15 1.15 1.85	TDA2525 TDA2532 TDA2530 TDA2541	3.90 2.50 2.20 1.88	UPC1161C UPC1182H UPC1186H UPC1181H	4.98 1.50 1.05 1.35
2SA817 2SA835 2SA836 2SA844	0.1B 2.50 0.89 0.65	2SD292 2SD313 2SD325D 2SD350	4.09 2.65 2.26 3.05	BA527 BA532 BA536 BA6209	2.98 BD229 1.50 BD232 1.70 BD234 3.10 BD237	1,05 0.49 0.42 0.47	BF759 BF761 BF762 BF869	0.47 1.05 0.34 0.49	CD4049 CD4052 CD4066 CD4069	0.24 0.64 0.21 0.29	LM1017N LM1877 LM2808 LM2877	1.81 3.50 5.94 7.45	R2008B R2009 R2010B R2029	1.33 1.98 2.98 1.33	SN76243 SN76396 SN76533N SN76532N	5.23 2.90 2.47 0.91	TA7340P TA7607AP TA7609 TA7611AP	5.95 2.10 2.65 2.32	TDA2540 TDA25450 TDA2560 TDA2575A	2.15 5.94 2.17 0.50	UPC1185H UPC1188 UPC1212C UPC1Z25H	2.10 8.77 0.80 4.83
2SA872 2SA884 2SA937R 2SA940	0.59 2.15 0.97 2.23	2SD353 2SD389 2SD401 2SD414	7.50 2.41 1.40 1.98	BA656 BA7100 BA841A BA843	1 00 BD238 11.35 BD239 BD240 28.98 BD241 3.96 BD242	0.28 0.45 0.57 0.39 0.50	BF870 BF959 BF960 BF970	0.30 0.42 0.49 0.50	CD4070 CD4081 CD4093 CD4511	0.25 0.14 0.40 1.10	LM317CKC LM324N LM339N LM340K	1.08 0.98 0.41 11.85	R2030 R2257 R2265 R2305	1.33 2.35 1.49 1.18	SN76545 SN76546N SN76549 SN76570	4.87 3.47 2.45 3.08	TA7616P TA7622AP TA7628P TA7629P	5.25 8.94 2.50 7.50	TDA2578A TDA2576A+ TDA2581 TDA2582	2.73	UPC1230 UPC1238 UPC1278H UPC1351C	1.48 2.10 5.95 1.81
2SA940-2 2SA950 2SA951 2SA966 Y	2.14 0.72 1.75 0.85	2SD471 2SD560 2SD600 2SD601R	2.13 2.95 2.98 0.65	BA854 BAV18 BAV19 BAV20	0.06 BD2430 0.11 BD244 0.35 BD2440	0.37 0.50 0.31 0.72	BFR39 BFR61 BFR62 BFR79	0.44 0.92 0.50 0.29	CD4528 CD4556 CR02AM 8 CV12E	2.04 1.47 1.70 4.09	LM348N LM380N LM567CN LM6402/011	2.15 2.80 1.71 10.23	R2322 R2323 R2354A R2354B	0.67 0.76 0.64 2.01	SN76611 SN76620 SN76660N SN76666N	2.59 2.59 2.48 1.41	TA7630P TA7640AP TA7672P TA7676P	0.95 2.40 2.55 2.81	TDA2591 TDA2594 TDA2593 TDA2595	2.70 3.40 3.40 5.52	UPC1350C UPC1353 UPC1356C UPC1363	1.40 1.58 2.13 4.20
2SA999 2SB774 2SB185 2SB375	0.75 0.65 1.13 3.87	2SD636 2SD636 2SD639 R 2SD655	1.03 0.40 0.72 0.98	BAV21 BAW62 BAX12 BAX13	0.12 802450 0.11 8D2460 0.11 8D253 0.11 8D278/	0.70 0.80 1.05 0.70 1.29	BFR86 BFR89 BFR90A	0.29 1.08 1.63 0.85	CX095D CX104 CX108 CX109	3.14 8.77 12.48 7.86	LM6402A093 LM748 LM8360 LM8361	10.15 0.69 3.87 3.57	R2443 R2461 R2540 R2540X	1.36 1.50 1.91 3.30	SN 76708 SN 76709N SN 76707N SN 76705N	4.86 5.94 1.23 6.60	TA7726P TAA320A TAA350A TAA570	10.25 1.27 0.80 1.85	TDA2600 TDA2611AC TDA2612Q TDA2611A	4.68 1.25	UPC1362 UPC1365C UPC1366 UPC1360C	4.10 2.50 1.65 4.51
2SB400 2SB405 2SB511 2SB54	0.40 1.03 2.65 1.39 0.56	2SD657 2SD661A 2SD731 2SD773 2SD811	2.80 0.80 2.11 0.60 7.63	BAX16 BC107B BC108B BC109B BC113	0.08 BD318 0.11 BD375 0.15 BD380 0.14 BD410 0.14 BD433	2.72 0.42 0.76 0.49 0.44	8FX29 8FX84 BFX85 BFX86 8FX87	0.34 0.37 0.41 0.36 0.55	CX130 CX134 CX136 CX139	8.76 11.10 11.49 11.83	LR3419 LR3471 LU1141 LU52012	9.37 9.37 7.27 5.95	R2615 RCA2060 RGP01-15 RGP10 RGP30M	0.67 2.00 0.70 0.30 0.28	SN76730 SN76810N SN76832N SN94041	5.54 0.60 1.35 5.54	TAA621AX1 TAA661B TAA691 TAA700 TAA930	4.85 1.00 8.58 2.37 4.87	TDA2610 TDA2620 TDA2630 TDA2631	2.79 1.96 2.50 2.73	UPC1378H UPC141C UPC1458 UPC151C	2.44 4.95 2.00 2.95
2SB546 2SB56 2SB618A 2SB631	2.80 2.22 2.00 0.50	2SD823 2SD837 2SD841	7.63 1.98 1.48 2.00 1.00	BC119 BC126 BC132 BC135	0.36 BD434 0.20 BD435 0.14 BD436 BD437	0.45 0.49 0.60 0.41	BFX88 BFX89 BFY50 BFY51	0.34 0.44 0.30 0.33	CX157 CX158 CX177 CX187	5.52 5.50 8.75 5.26	LU52011 LU63112 M193 M21C	14.95 12.37 6.83 1.30	RT402 RT905A S1299 \$2800D	1.58 2.38 5.34 1.84	SN94042 SPS5384 ST1702L STA401	4.35 1.98 0.99 2.50 3.10	TAA970 TAG626-600 TBA120AS TBA120SB	2.83	TDA2640 TDA2652 TDA2653 TDA2654	3.61 8.25 6.18 4.73	UPC30C UPC30C UPC324C UPC32C	1.48 2.51 4.70 4.95
2SB643 2SB669 2SB681 2SB695 2SB774	3.67 3.96 1.98 0.65	2SD856 2SD857Q 2SD882 2SD894 2SD898	1.84 1.15 1.75 0.82	BC137 BC138 BC139 BC140	0.14 BD438 BD441 0.34 BD442 0.33 BD509 0.45 BD510	0.52 0.59 0.66 1.42 0.75	8FY52 BFY79 BFY90 BLY49 BR100	0.27 0.49 0.42 2.20 0.22	CX755 CX885A E1222 E5024 E5386	12.95 6.85 0.40 0.28 0.25	M23C M293 M51102L M5115P M51203L	1.98 6.71 1.69 5.24 3.15	\$2802 \$2818 \$3702\$ \$40W \$6080B	2.90 4.05 5.21 13.10 9.98	STA441C STA471C STK0029 STK0050 STK016	7.95 5.54 7.72 6.91	TBA120T TBA120U TBA120A TBA1440	0.97 2.50 1.05 1.94	TDA2670 TDA2680 TDA2740 TDA2780AC TDA2795	2.48 3.20 6.00 1 8.84 2.78	UPC339C UPC41C UPC4558C UPC474 UPC564C	4.35 4.10 2.15 5.11 1.85
2SB819 2SC1096 2SC1104 2SC1106	1.13 1.16	2SK105H 7805 T022 7808 7812-T022	2.15 0.63 0.45 0.35	BC141 BC142 BC143 BC147	0.34 BD519 0.23 BD529 0.34 BD530 0.11 BD533	0.98 0.60 0.80 0.67	BR101 BR103 BR303 BRC84	0.70 0.56 1.15 2.08	GD243 GF758 HA11215 HA11211	4.34	M51231P M5134 9341 M51353P M51381P	3.07 4.13 5.25 5.98	SA8063 SAA1006 SAA1020 SAA1025	5.17 1.85 4.76 4.40	STK022 STK031 STK040 STK054	5.25 12.95 13.34 3.95	TBA1441 TBA395 TBA396 TBA400	1.95 1.10 1.20 2.39	TDA2791 TDA2910 TDA33008 TDA3330	1.81 13.25 6.98 2.88	UPC575C2 UPC580C UPC587C2 UPC592H	2.40 6.60 1.34 2.15
2SC1114 2SC1116 2SC1124 2SC1129 2SC1131	454 325 435 126 165 0.64	7815 7905 AD140 AD143	0.64 0.80 1.06 1.93	BC148B BC148C BC149B BC153	0.13 B0535 0.11 B0536 0.13 B0537 0.14 B0538	0.52 0.45 0.50 0.50 0.67	BRX44 BRX49 BRY39 BSS38 BSTBD1400	0.60 0.34 0.69 0.67 4.93	HA11225 HA11229 HA11235 HA11124 HA1125	1.75 2.53 4.29 3.46 1.75 5.25 4.29	M51393AP M51394P M5142P M5144P	9.48 12.50 6.85 3.77	SAA1024 SAA1075 SAA1121 SAA1124 SAA1130	2.81 4.25 7.44 2.45 4.99	STK058 STK077 STK1039 STK2110	27.50 7.67 5.75 7.33	TBA440C TBA480Q TBA510 TBA520	2.34 1.30 1.37 1.84	TDA3506 TDA3501 TDA3500 TDA3510	4.40 12.09 4.25 5.95	UPC595 UPC596 UPD1514C UPD2819C UPD553-164	2.95 1.98 4.76 4.98 19.52
2SC1158 2SC1162 2SC1172 2SC1195	3.33 0.55 2.22 6.09	AD145 AD161 AD162 AF114	1.60 0.30 0.45 2.47	BC154 BC159 BC160 BC161 BC168	0.14 BD5441 0.16 BD677 0.40 BD679 0.28 BD680 0.36 BD681	0.67 0.83 0.40 0.57 0.52	BSTC0246 BSTC0233 BSTCC0143 BSTD1043	8.64 6.12 3.07 2.85 3.91	HA1137W HA1138 HA11414 HA1156	1.38 5.03 5.65 1.16	M51513L M51515BL M51517L M5192	2.55 2.75 2.90 2.20	SAA1174 SAA1250 SAA1251 SAA1351	4.99 7.77 3.95 3.20 8.11 2.55	STK2145 STK2240 STK2250 STK3042	16.95 16.65 18.95 4.95	TBA530 TBA540 TBA560C TBA5700	1.30 1.15 1.40 1.60	TDA3520 TDA3540 TDA3541 TDA3560	9.71 6.99 2.22	UPD8049C-1 X0022CE X0029CE X0031CE	11 50 5.75 7 09 6.32 6.18
2SC1213 2SC1226 2SC1293 2SC1306 2SC1317	9.89 1.46 0.90 1.98 0.50	AF115 AF118 AF127 AF139	1.24 1.20 0.65 0.40	BC169C BC170 BC171 BC172B	0.16 BD696 0.16 BD699 0.11 BD700 0.27 BD707	0.52 1.48 2.47 1.85 3.70 0.60	BSV57B BSW68 BSX19 BSX20 BSY52	0.60 0.34 0.19 0.50	HA1160 HA1166X HA1167 HA11706 HA11705	4.79 6.60 6.45 3.61 8.00	M5194AP M5231L M53274P M54532P	5.74 4.80 1.33 1.50	SAA3027P SAA5000 SAA5010 SAA5012 SAA5020 SAA5030	2.50 3.25 4.40 5.50 5.78 6.33 7.74	STK3044 STK4019 STK433 STK4332 STK435 STK435	5.75 4.50 4.78 6.25 4.95	TBA570A TBA673 TBA700 TBA720	1.71 2.45 1.85 2.30	TDA3576 TDA3576 TDA3590 TDA3591 TDA3650	4.25 2.83 7.48 6.79 6.45 5.90	X00351A X0040TA X0042CE X0043CE X0056CE	4.50 4.35 2.75
2SC1364 2SC1383 2SC1391 2SC1398 2SC1413A	1.98 0.50 0.49 1.20 2.45 0.75 5.00 1.25 2.07 0.60 1.00	AF178 AF179 AF180 AF181 AF186	1.45 0.55 0.55 0.53 0.53	BC173 BC174B BC177 BC178 BC179	0.17 BD709 0.27 BD710 0.35 BD809 0.26 BD810 0.26 BD879	0.60 0.80 0.60 0.69 0.74	BSY79 BT108 BT119 BT120 BT121	0.51 1.45 1.76 2.17 2.48 1.98	HA11703 HA11701 HA11710 HA11713 HA11711	8.00 4.22 4.56 3.45 2.90 2.00	M54544L M58478P M58485P MA06 MA8001	1.22 6.75 12.75 1.07 0.82	SAA5030 SAA5050 SAB1009B SAB3011 SAB3013	5.98 7.34	STK4352 STK436 STK437 STK4372 STK460	6.25 4.95 1.95 7.21 7.50 13.13 7.02	TBA7500 TBA7500 TBA800 TBA800	3.55 2.90 1.71 1.08	TDA3652 TDA3651A0 TDA3651	2.60	X0057GE X0065CE X0074GE X0077GE X0079CE	6.25 6.00 5.77 10.00 15.96 4.95 4.95
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2SC1514 2SC1573Q 2SC1583 2SC1617	1.37 1.53 0.34 3.89	AN 206 AN 208 AN 210 AN 211	2.58 3.55 2.28 3.25	BC184LB BC186 BC187 BC204	0.26 BDW8- 0.25 BDX32 0.28 BDX53 0.16 BDX53	1.88 4.93 3.35		1.03 2.42 2.48 1.50 2.25 5.69 2.48	HA11725MP HA117555P HA11781 HA1180	16.00 6.23 21.15 5.15	MB3730 MC13002 MC1310P MC1327P	1.98 1.85 1.69 2.09 3.90 2.25 1.33	SAF1032P SAF1039 SAS5010 SAS560S	3.58 1.95 8.39 1.86	STK5314 STK5730 STK7216 STK772	12.40 3.20 13.10 3.71	TBA920 TBA940 TBA950	1.65 1.87 1.55	TDA4422 TDA4427S TDA4431		X0195CE X0204CE X0261CE ZPY120	3.25

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SHARP

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VCR Clinic

Reports from Eugene Trundle, Alfred Damp, lan Bowden, E.M. Beddow, Nick Beer, V.W. Cox and John C. Priest

Panasonic NV7200

During the space of a week we've had two of these machines with the same fault. The symptom is that at the beginning or end of a cue or review session the machine appears to enter the still-frame mode for a few seconds then reverts to stop. The mode switch can sometimes be responsible for this. In both of these machines however the cure lay in replacing both loading belts. Slippage of these belts is more often accociated with failure to complete tape loading.

E.T.

Panasonic NV-G25

The complaint with this machine concerned LP recording: there was a poor picture, poor sound and the speed varied. We found that the results in the SP mode were not very different and that the tape was riding high past the audio/control head stack then wrinkling between the capstan and the pinch roller. The problem was caused by a faulty pinch roller – the one that lowers itelf into position. A new one and a clean up restored good results in both the LP and the SP modes.

JVC HRD400

If you come across a case – possibly intermittent – of no E-E sound and no recorded sound check for a hairline crack in the print at the rear of the main PCB (03) adjacent to the left-hand unsoldered lug of the r.f. modulator can. It seems that the modulator "rocks" when the aerial plugs are inserted or withdrawn, stressing the PCB.

E.T.

Panasonic NV2000

This machine had a mixed bag of symptoms: no clock display, the tuner not working, the capstan running slow and erratically and hum bars on the monitor screen. All were cleared at one stroke when C1009 (1,000 μ F, 35V) in the power supply section was replaced. E.T.

Hitachi VT120

The customer's report was that the picture was intermittent. On test the machine displayed a noise bar that rolled through the picture, as though there were no control pulses. Both own recordings and prerecorded tapes were affected. We found that the control pulse input to the servo i.c. was present and correct, but a check on the other waveforms around IC601 revealed that the capstan phase control pulse at pin 11 was missing. As all the inputs were correct the chip was replaced, clearing the fault.

A.D.

Ferguson FV22L

A modification kit for this machine has been produced to deal with intermittent faults in the timer mode. The faults that occur are that the machine will switch out of a timed recording or will not stop at the selected time, the recording continuing until the end of the tape when the cassette is ejected.

This modification also cured an intermittent fault in the "instant record" mode. What would happen was that if the machine was set to record in this mode for over an hour it would turn itself off approximately one hour before the selected time.

A.D.

Philips VR6362

This machine would switch on and off but wouldn't accept a cassette. When a 9V battery was connected across the loading motor the mechanics would thread in and out correctly, thus exonerating the eject rack and differential gear assembly. The fault was being caused by the load motor driver chip which had a short-circuit output pin—the pin that drives the load motor in the threading in direction.

Mitsubishi HSB30

There was no playback picture with this machine. We traced the playback f.m. into and out of IC2A1 and then to transistor Q2B2 where it disappeared. Replacing Q2B2 cleared the fault – it was open-circuit.

A.D.

Panasonic NV-F70

This machine was completely dead. The mains fuse was intact so the fault was in the switch-mode power supply, where the primary side wasn't starting up. C1109 (1 μ F, 400V) should provide a pulse to the chopper transistor within IC1101 (STRD6008X) to get things going but there was no pulse at pin 2. The i.c. was found to have an internal short-circuit between pin 2 and pin 4 (ground), a replacement restoring normal operation. Note that there's an error on the circuit diagram, where the base and emitter of the chopper transistor are shown shorted together.

Panasonic NV-G12

When play was selected the drum motor didn't move so the machine cut out. This was quickly traced to an open-circuit fusible resistor, R2012 (6-8 Ω , 0-5W), which is connected from the unregulated 14V supply to the common connection of the three-phase DD drum motor. The resistance to chassis on the motor side was only 7-5 Ω – this turned out to be the resistance of one phase of the motor.

A check at connection P201 revealed where the short was – on the winding connected to pin 1. When the head amplifier was removed to check the leads the reason for this was found. One of the ten leads was trapped between the right-hand head amplifier support bracket and the main chassis. It must have been like this since the machine was made some eighteen months ago.

I.B.

Ferguson FV10

The reported fault was that this machine wouldn't accept a tape. This was so – if a tape was manually inserted the fast forward and rewind modes would operate but play

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wouldn't, as there was no drum rotation. The tape could also be ejected, but there was no carriage-stop detection and the front loading motor would keep going for a few seconds until the machine switched itself off.

The cause of these problems was loss of the switched +12V and +5V supplies due to a faulty multiregulator chip, IC801 (STK5481). It's mounted on the right-hand side of the main PCB.

Philips VR6460

This machine nearly drove us round the bend. The customer's complaint was that it played back its own recordings quite well but with films from the hire shop there were wow on sound and noise bars on the picture. Our field engineer gave the machine a thorough clean up, paying particular attention to the tape path and the control head, though the machine worked perfectly while he was there.

A week or so later the inevitable repeat call came and the machine was brought back to the workshop, together with a film. Once it was opened up on the bench our first step was to try an MH2 test tape and see whether it would play this back correctly. It did. Several other tapes were tried and seemed to be o.k., but the machine flatly refused to play the film supplied. The capstan servo seemed to lose lock, as if the control pulses were missing. As the tape was suspect it was tried on another machine, which played it back normally. So now we were thoroughly confused!

After a lot of time was wasted scoping the control pulse outputs etc. and setting up the lateral position of the control head as per the manual we discovered that if the back tension was reduced by resting a finger against the tension arm the fault almost cleared. A similar effect could be obtained by increasing the pinch roller pressure. The pinch roller and back-tension band were replaced and, you've guessed it, the fault was still present!

We decided that the back tension was excessive. This was backed by our observation that the tape seemed to be very tight between the exit guide and the pinch roller. At this point the penny dropped. Could the lower drum be too shiny so that the tape was sticking to it? Changing the lower drum completely cleared the fault. The price of this unit was £220 from Philips, £150 from Panasonic. Fortunately the machine was insured!

Ferguson FV11

The temporary field engineer accused the tuner of being the cause of no signals. He ought to have known better! There was no tuning voltage – the regulated 30V supply was being lost across R53 as there was a short from the tuner's BT pin to chassis. We found that the pin hadn't been trimmed and was shorting to the bottom cover. When this was corrected the machine still didn't tune as there was now no load on the BT rail. The control transistor had no drive from the frequency-synthesiser tuning chip IC3 as there was no 5V supply. A break was discovered in the print between IC3 and the 5V regulator IC1.

Sanyo VHR1300/Salora SV6600

The customer had complained about poor pictures and the heads were badly worn. When these were replaced things looked fine. While the machine continued to play the test tape I relocated the PCB that hinges over the mechanism: the drum and capstan servos then began to vary widely. By flexing the board both motors would stop and the machine would unlace. The fault could be provoked by prodding or poking in the servo area of the board to any degree. As the fault was so general I checked the servo d.c. supplies and found that the always 5V and 15V voltages disappeared between CN1003 and CN1004. The tracks that link these two connectors run right at the back of the panel, over the r.f. connection sockets, and were all broken in two places each. A point to note if you have a heavy-handed customer.

Philips VR6462/Pye DV464

For failure to eject fully, failure to rewind a tape fully into the cassette before eject, and sometimes swallowing a cassette when attempting to extract a partially ejected cassette proceed as follows.

Check the alignment of the guide reference holes D and E on the control disc or cam gear (item 247, part no. 4822 466 21014) below the chassis. Operate the mechanism two or three times then recheck the alignment. If it has shifted, examine the V-shaped lever (item 242, part no. 4822 403 52252) and the glide block or cam follower (item 238, part no. 4822 466 813650) which is pivoted on the end of the shorter arm of item 242 and rides in the spiral groove of item 247. Sometimes the pin set into the end of the lever arm on which the guide block pivots becomes loose in its setting, allowing the guide block to float loose and the linkages to go out of sync.

If this is the case item 242 can be replaced. It can also be repaired as follows. Remove lever 242, taking care not to lose the pin if loose. Remove the pin and put it safely to one side. Also remove and take care not to lose the fine spring that surrounds the pin and locates in a small hole in the arm. This spring is not shown in the relevant diagram and doesn't have a part number – if you lose it you will have to order the lever complete.

Take the lever minus spring and pin and lay the end flat on a firm surface, vice jaws or a steel block. Give the pinhole area of the lever two or three light taps on the top and bottom with a small hammer. In this way the hole will be shrunk sufficiently to allow the pin to be pressed firmly and securely back into place. This must be done carefully, for example by lightly gripping the lever and pin between vice jaws, holding the pin in exact register and perpendicular to the surface of the lever with fine-nosed pliers or tweezers, and pressing firmly home by applying pressure from the vice. Warning: before you apply pressure make sure that the pin is on the correct face of the lever – it's possible to insert it from the other side. When the pin and lever have been correctly fitted reassemble the lever, glide block and control disc as described in the manual, paragraph 2.1.19. Finally, after checking the alignment of reference holes D and E as above test the load and eject action a few times and recheck D and E J.C.P. again.

Sanyo VTC5000, VTC5150 etc

For no colour in the record mode but playback of previous recordings being o.k., check whether diode D1008 is open-circuit. When it goes open-circuit the 5·12MHz signal doesn't reach the colour down-converter. Intermittent colour recording and return to the E-E mode is caused by dirty contacts on the record/playback relay RY1001.

V.W.C.

Vintage Scene: The Telectroscope

Chas E. Miller

On an autumn day in 1896 the crowds going about their business in Vienna's Karlsplatz were faintly puzzled to see men placing a mysterious black box on the sidewalk, facing the Karl's Church. After making some adjustments to the siting of the box and to its unrevealed contents the men jumped into a carriage and were driven off at a gallop. Little did the passers-by realise that they were witnessing the setting up of an early demonstration of cable television.

Jan Szczepanik

The inventor whose brainchild was about to be shown to a select gathering was a 24 year old Polish emigrant called Jan Szczepanik (pronounced Shtaypanic). Born in the little Galician village of Krosno on July 12th 1872, Szczepanik had been orphaned at an early age and raised by an aunt. He was trained as a schoolteacher and received his diploma in 1892. His first teaching job was at the village school in Korzyna, where he was apparently popular with the pupils but not his employers, who found hat he was devoting a great deal of his time to optical and electrical experiments. These were directed partly towards inventing a weaving machine that would take the timeconsuming drudgery out of the manufacture of large tapestries, and partly towards producing a device that would enable him to see at a distance, i.e. television. The factors behind these twin passions related to his boyhood in Krosno, where he saw men and women working long, ill-paid hours at hand-looms, and to a promise he'd made to a young lady that he would someday construct a machine that would enable him to see her no matter how far away she might be. That's the story, anyway.

By late 1894 Szczepanik believed that he was on the verge of success with what he then called his "distance seer", on paper at least. But he was urgently in need of funds to produce a working model. He wrote to the Austrian Minister of War to the effect that he had an invention of great military importance and that it would be presented to him in return for money with which to develop it. Why Szczepanik chose Austria in preference to his native country is not related by history: maybe it was a second choice after being turned down by Warsaw. Be that as it may, after being invited to bring his drawings to Vienna Szczepanik failed to convince the Austrian authorities that his invention had any future and was soon reduced to hawking it around the capital in an attempt to find a backer. After two months of this he gave up and went back to his teaching job in Poland.

Unknown to Szczepanik at the time however the news of his work had not after all gone unnoticed. A Viennese businessman by the name of Ludwig Kleinberg decided that there might just be something in it, and wrote to Szczepanik inviting him back to Austria. When he returned Kleinberg set him up with a small factory, workmen, materials and capital, and gave him a brief to produce a working example of his revolutionary weaving machine. Kleinberg may well have come to regret his actions, for during the following months he was brought close to bankruptcy by the escalating cost of Szczepanik's experiments. The eventual urgent need to raise additional

capital was met by Kleinberg taking a wealthy German architect called Franz Hagen into partnership with him. From this point on matters seem to have improved rapidly. Patents were soon taken out, and these realised some £100,000 – a vast sum in those days – from licencees in Germany and England. Although an account of how the weaving machine worked may not appear at first sight to have much to do with television, I must ask you to bear with me – it will reveal a surprise.

The Weaving Machine

The basic principle employed was to photograph any desired design using a special giant-sized camera, at that time the largest in the world. A contemporary photograph showing Szczepanik standing alongside this camera suggests that if he was of average height it must have stood over six feet high. When the bellows were at full stretch it was some twenty feet long. It weighed over two tons, and had to be supported by a small railway track. The lens was five inches in diameter. If my rusty knowledge of photography serves me correctly this indicates a maximum aperture of f48, so lengthy exposures must have been. needed with the glass plates used. These were correspondingly massive, being four feet square and weighing in at 65lb. Each plate was ruled into over 800,000 tiny rectangles to produce – and this is the word that leaps from the 90 year old description – a raster.

So here, in the unlikely context of a tapestry factory, we find the first reference to a word known to all of us but whose origin I've never found to be explained in any of the technical books I've read. When the photograph of the desired design was printed on paper the rectangles forming the raster corresponded to the different threads, bindings and so on of the tapestry to be made. It was claimed that this method made it possible to produce in less than an hour a pattern that would previously have taken six to eight months to prepare by hand. This sounds comparable to the kind of time savings made possible in certain jobs nowadays by the use of a computer. With the huge potential savings in costs for textile firms thus made possible, it was a forgone conclusion that the idea would pay off. Soon money was flowing into Szczepanik's hands, enabling him to restart his television experiments.

Television Experiments

Reading the account of Szczepanik's experiment in the Karlsplatz in 1896 one is immediately struck by the preamble. It dealt with the persistence of vision and the need to break pictures up into a large number of elements in terms little different from those to be found in modern textbooks.

The transmitter employed a scanning disc perforated with upwards of 40,000 holes, revolving between a lens and a circular selenium cell. As the scanning disc rotated, successive picture elements reached the selenium cell whose resistance varied in step. Yes it does sound like a description of Baird's apparatus, but at this time Baird was an eight year old schoolboy. Furthermore Szczepanik considered the scanning disc to be a crude way of going

about it and within a short time had abandoned the disc in favour of something better. It did serve however to convince his business partners that his telectroscope was a practical proposition.

The transmitter Szczepanik had set up in the Karlsplatz was connected via the Viennese public telephone network to a receiver in Herr Kleinberg's house, where the selenium cell's output was received as a constantly varying a.f. This was applied to a receiver which had a lightmodulating device consisting of two thin metal plates whose close proximity enabled them to be vibrated electromagnetically by the incoming a.f. As they did so the gap between them varied, and by placing the device in front of a light source - an electric lamp - it acted as a light modulator, in step with the transmitter's output. We don't know the frequency range of the Viennese telephone system at the time, but it seems doubtful whether the modulating frequencies received could have exceeded a few thousand Hz. Another scanning disc that revolved, hopefully at least, at the same speed as the one in the transmitter was placed next to the light modulator. In this particular experiment there was no attempt to view the picture produced directly. Instead it was focused on to a photographic plate. When this was developed it showed a poor but unmistakable image of Karl's Church. It was sufficiently convincing for Szczepanik to be given adequate financial means to embark on improvements.

Improvements

The first of these was the replacement of the clumsy scanning discs with an ingenious system of vibrating mirrors. Each was made of highly polished metal some two inches long by quarter of an inch wide, with most of the reflective surface blacked out to give just a knife-edge strip along its length. Two were employed, arranged at right angles to each other. They were mounted on "sounding boxes" – a type of diaphragm – designed to respond to sounds of around 4kHz produced by an electric bell. The sounding boxes were provided with tuning arrangements to ensure that both responded accurately to the bell and vibrated in perfect unison. When they were vibrating the effect so far as the human eye was concerned was not of knife edges but of a small rectangular mirror.

The image from the lens was focused on the first, horizontal mirror which, as it vibrated, had the effect of scanning the image vertically. Light from this image was focused on to the second mirror which, being vertically mounted, scanned the image horizontally. The overall effect was to reduce the image first to a line and then to a single point which was in turn focused on to the selenium cell. To the eye it would seem that a full picture was being projected on to the cell, but in fact the cell received a rapidly moving modulated light spot. It does sound familiar, doesn't it? But this is not the complete story. A prism

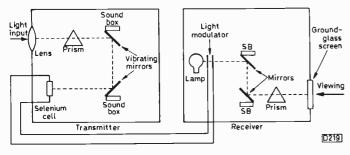


Fig. 1: Basic principle of the telectroscope.

was interposed between the lens and the first mirror to split the incoming light into its component colours. According to the wavelength of each colour, its exit angle from the prism varied very slightly but significantly from that of the other colours. When the final image was focused on the selenium cell the output from this was thus dependent both on the colour and the intensity of each picture element. As before, the signals were carried to the receiver(s) by cable.

The receiver employed a pair of vibrating mirrors arranged in the same way as in the transmitter. Synchronism of movement was achieved by having the sound boxes and actuating bell tuned to the same note as that used at the transmitter. The mirrors reflected light from an electric lamp via an improved modulating device. This had thin metal "lips" which passed a changing band of light as thin as a hair. After deflection by the mirrors the light, now consisting of a series of points, passed through a prism to reverse the colour-splitting process. In this way an image in full natural colour was apparently built up on a ground-glass screen.

Paris Grand Exhibition 1900

According to the writer who provided an account of the telectroscope in 1899 "the ground-glass plate . . . receives (pictures) in their original colours in a perfect vision which moves and changes as the objects or figures at the transmitter move and change". But whether this description was inspired by a practical demonstration or Szczepanik's own explanation is unclear. What may be significant here is that when asked when the telectroscope would be seen in public Szczepanik replied that this would not be until the coming Paris Grand Exhibition in 1900. A French syndicate had deposited to a third party a bond of two million francs for the rights to demonstrate the telectroscope in a special building which would hold between eight and ten thousand people. The syndicate was to take 40 per cent of the profits, Szczepanik and his associates 60 per cent. On the basis of several demonstrations a day over six months, with an admission charge of three francs per head, Szczepanik estimated that the profits would comfortably exceed six million francs. Under the terms of the agreement Szczepanik was forbidden to exhibit the telectroscope prior to the Paris event, on pain of forfeiting his own bond of one million francs.

The reporter next asked whether pictures could be thrown on to a screen for large-scale viewing, to which Szczepanik replied that there would be no difficulty – it would be as simple as operating a magic lantern. As for the distances over which pictures might be transmitted, in theory there was no limit but in practice the cost of the cable would be a determining factor. Up to that date the longest distance that had been achieved was just under forty miles.

Well, those were the somewhat grandiose predictions for Victorian-age cable TV. The reality was probably somewhat less impressive. In one of his books F.J. Camm dismissed Szczepanik's equipment as "little more than a shadowgraph". Its name, and perhaps its principles, were borrowed from an earlier invention by a M. Senlecq of Ardres, France, dating from 1879. Yet there remains that interesting use of the word "raster" and of vibrating mirrors, which have had a recent revival in modern infrared analytical machines. Interestingly enough these also employ a mathematical formula devised by a nineteenth century scientist, Fourier. There's not much new under the sun. . .

Servicing Compact Disc Players

Part 4 Joe Cieszynski

OVER the past three months we've been laying down the foundations on which a sound knowledge of the compact disc system can be based. We have tried to adopt a practical approach, and last month talked about some initial checks and the basic start-up procedure followed by most CD players, i.e. focus search, disc run-up/tracking search and reading the table of contents (TOC). This month we will conclude our "foundations course", after which we'll be able to move on to more involved theory and advanced fault location routines.

The RF Waveform

One thing we mentioned last month was ways of observing the off-disc r.f. waveform to ascertain the performance of the laser. Examination of this waveform can tell you far more than whether or not the laser is working as it should do: I prefer to liken it to the off-tape f.m. waveform in a VCR. Just as you can ascertain the condition of the heads, tape path, servo adjustment and tape from the f.m. envelope in a VCR, examination of a CD player's r.f. waveform will tell you about the condition of the servos, preamplifiers and disc in addition to the state of the laser. First then what exactly is the r.f. waveform?

As we have seen the data is stored on the disc in the form of a series of pits which, for the reasons discussed in Part 1, are proud of the surrounding land area. As the laser's beam approaches a pit the amount of reflected light is progressively reduced. Hence the current in the pick-up detectors falls. This condition is shown at A in Fig. 1. When the beam is over the pit the current remains at a low level, as shown at B. As the beam moves off the pit the current once more rises to a maximum value, see C and D.

The laser beam crosses pits at a rate of millions per second as the disc rotates. Hence the waveform shown in Fig. 1 represents only a very small sample of the actual output signal. In practice when you scope the output you find that the rising and falling pit transitions take on a sinusoidal appearance. Furthermore as the pit rate is not constant the scope will show a number of streams of data, i.e. a multiple number of sinewaves. This is known as the r.f. waveform. Depending on the speed at which you set the scope's timebase you will see one of the waveforms shown in Fig. 2.

RF Signal Processing

Fig. 3 shows in block diagram form the r.f. amplifier section of a typical CD player. This diagram is based on the Sony CX20109 chip, which also contains the focus and tracking signal amplifiers plus other relevant circuitry. We'll come to these later. You'll find this i.c. in many players other than those of Sony manufacture.

The four main pickup detectors are connected in two parallel pairs. The current that flows through these is proportional to the reflected light and is fed to separate operational amplifiers. These are used as current-to-voltage converters. The outputs from these two amplifiers are known as the A + C and B + D signals. They are fed

to the focus error amplifiers and are also added together at the junction of R1 and R2. The test point at the summing amplifier's output is the point that gives you access to the r.f. waveforms shown in Fig. 2. Due to their small amplitude it's not possible to observe the signals at the photodetectors.

Now that the signal is large enough it can be squared in order to reconstitute the original binary data. This is done in the auto asymmetry control section. Here amplifier 1 acts as a slicing amplifier whose slicing level is set by amplifier 2. The combined operation of these two amplifiers in conjunction with the phase locked loop oscillator is complex, but we'll keep to a simple approach.

The oscillator is free-running and generates a constant squarewave at the bit rate of 4.3218MHz. When the squared data from amplifier 1 is applied to the PLL the oscillator swings in sympathy with the data and becomes locked to it. If you refer back to Fig. 8 in Part 1 you will see that the point at which the r.f. signal (C) is squared is at the centre of the sloping edges (D). But an examination of Fig. 2(a) shows that not all the sinewaves in the r.f. waveform are of the same amplitude. Thus a fixed slice level is no good. Amplifier 1's slicing level has to be variable so that the centre of each sinusoidal excursion can be noted and the correct squarewave extracted. This is

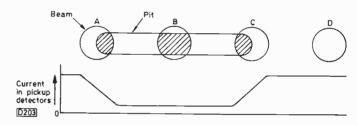


Fig. 1: Laser beam traversing a pit, showing the effect of the pit on the output current waveform.

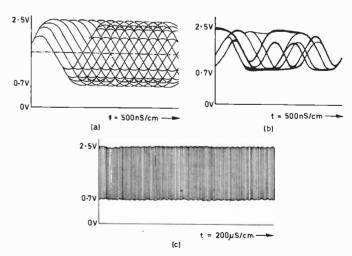


Fig. 2: Off-disc r.f. waveforms. (a) Observed during a passage of music. The d.c. level and peak voltage may differ from model to model. (b) Observed while reading the table of contents or between tracks. (c) Observed during a passage of music, but this time at a slower timebase speed. Instead of seeing the individual increase/decrease of the reflected beam intensity you can see a much larger sample of data.

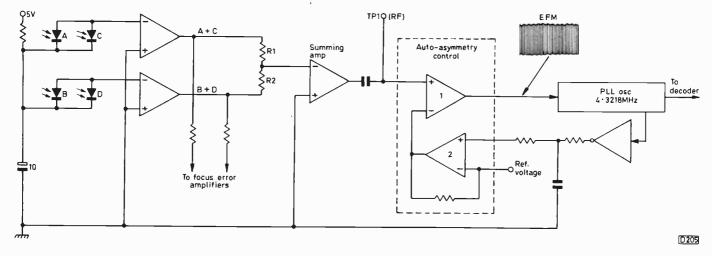


Fig. 3: Block diagram of a typical r.f. processing circuit, based on the Sony CX20109 chip.

illustrated in Fig. 4, which shows the resultant of the multiple sinewaves as a solid line and the variable slice level as a broken line. At the centre of each transition the output from amplifier 1 toggles and a squarewave relating to the pit information is thus produced. The way in which this is actually done is quite involved, but basically it relies on the comparison of the output signal from amplifier 1, via the PLL oscillator, with a d.c. reference.

The squarewave extracted from this circuit is fed to the main decoder where, after much processing, binary data containing left/right audio information is recovered.

The signal obtained at amplifier 1 is referred to as the EFM (eight to fourteen modulated) signal, which is the name given to the data stream on the disc. This waveform is of limited use for servicing. Note that it is present even when the disc has stopped, because the PLL oscillator should always be running. If you have a player with the disc running correctly but no audio output and you wish to confirm that the data is getting as far as the EFM output the best approach is first to scope the EFM signal with the player in the stop mode, noting the waveform, then to put the player into the play mode. You should then see the EFM jitter rapidly as the PLL becomes locked to the incoming signal. It is most unlikely however that you will come across a player where the disc speed is correct but the EFM signal is not present. This is because the disc servo relies on the EFM data as a reference: when this is missing the servo will generally run the disc up to full speed, which is well above the normal 200-500 r.p.m.

Scoping the RF

When using an oscilloscope for servicing, no matter what the equipment is, it's important that the scope is correctly triggered and that the waveform is stable. Many hours can be saved by ensuring that the timebase speed bears a relation to the waveform being checked and that

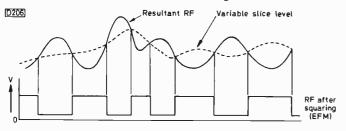


Fig. 4: The waveform squaring process carried out by the auto asymmetry control section of the circuit.

the triggering is adjusted to give a stable trace. Consider the f.m. signal in a VCR: when adjusting the guide rollers you want the timebase to be set so that you can see the outputs from both heads. Use of the drum flip-flop for triggering is ideal to keep the trace stable. When observing a CD player's r.f. waveform it's particularly important that the trace remains stable and that the timebase is set so that you can observe the portion of r.f. you need to, see. We'll describe a means of doing this, but before we do so a word about oscilloscopes in general would be appropriate.

When VCRs started to sell in large numbers in the late Seventies service personnel were told that unless they had a scope with a bandwidth of at least 20MHz many of the waveforms they would need to see would be inaccessible and adjustments would be difficult. The service department where I worked boasted a 10MHz antique, and I was soon made well aware of what this meant when I attempted to set the capstan discriminator of a Ferguson 3V00 with the trace racing across the screen! Thankfully a 30MHz scope was purchased soon afterwards.

The situation with CD players is similar. Only 20MHz won't do! If you look at the adjustment procedures given in most manuals you will find that they often read something like "using your 100MHz storage scope . . ." Well, I know what you're thinking, but let me try to ease the pain. Although you may have difficulty in obtaining a stable trace with a 20MHz scope you don't have to go to the other extreme before you attempt to repair CD players. I've worked on CD players using a variety of oscilloscopes and must confess that some of the tests I'm about to outline are not always possible unless the scope has a bandwidth of at least 30MHz. But it also depends on the manufacture and condition of the scope. The one I normally use is a 35MHz Cossor D61. Although ex-RAF it produces nearly all the results I require. Clearly however the wider the bandwidth the better. Bear this in mind if you attempt the techniques I'm about to outline.

Triggering

The trick in obtaining a stable display is to get the scope to trigger on a set point in the r.f. waveform. The problem of course is that there isn't one! So you have to put one there. If you are the proud owner of a test disc all you need do is to play the passage with a simulated scratch (dropout): the scope can be triggered by this. The cost of test discs makes them something of a rarity however, so

let me suggest a different approach which I learnt during a training course run by Hitachi.

Take a good disc with a playing time of one hour minimum. The one hour playing time is necessary because discs with shorter recordings may not have data stamped all the way to the outer edge. Thus you wouldn't be able to check a player's performance with the laser at this point, where disc eccentricity and wobble are at their greatest. Place on the disc a simulated scratch of 0.6mm width. This is easily done using 0.6mm PCB artwork tape which is available from a number of suppliers – I obtained mine from RS Components, and at £1.20 for a 20m roll it worked out far cheaper than a test disc set, not that it entirely replaces one. The only precaution you must take is to ensure that the tape runs across the disc diametrically, as shown in Fig. 5.

The principle involved is very simple. When the disc is played there will be a regular dropout between 200-500Hz. A good scope can be triggered by this, not the 1.5MHz r.f. signal. Once this has been done you can adjust the timebase speed so that the portion of r.f. waveform you want to see can be observed. Let's look at some examples.

Waveforms Obtained

Fig. 6(a) shows the display whilst playing the centre portion of the track of the dropout disc. The disc speed will be around 400 r.p.m. Adjust the timebase speed to 200µsec/cm and set the triggering to the negative-going slopes. What you see therefore is the tail end of the r.f. before the laser scans the tape, the 0-6mm dropout period, then the return of r.f. as the laser comes off the tape. A good machine should be able to play this without any audible disturbance. The waveform shown in Fig. 6(a) is what you will see when the laser is o.k. and the focus and tracking servos are properly adjusted and working correctly.

The conditions illustrated in Figs. 6(b-d) indicate that there is a fault or misadjustment in the focus and/or tracking servos. You can now see why I liken the CD player's r.f. waveform to a VCR's f.m. waveform, because you can instantly see whether there seems to be a problem in the servo sections of the player. The portion of the waveform we're interested in is the area immediately after the dropout. I've called this the servo recovery period. When the laser is scanning the tape on the disc the servos lose their references. They will react in an attempt to find their references once more. In the meantime the servo loop will be open. As soon as data begins to come through again the loops will be closed and the servos will settle down. This should happen very rapidly, as shown in Fig. 6(a). In the case of a fault or misadjustment the time taken to lock up will be longer, producing the effects shown in Figs. 6(b-d).

You will now be hoping that I'm going to describe a way of deciding which servo is defective by looking at the shape of the recovery period. Unfortunately I must disappoint you. I've spent a lot of time experimenting with this, but until now even players of the same type have

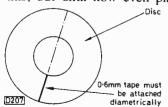


Fig. 5: A simple test disc can be made from a one-hour commercial recording and PCB artwork tape (RS Components order code 555 370 for example).

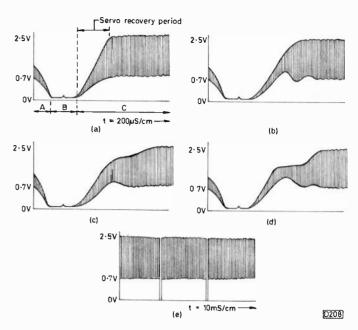


Fig. 6: R.F. waveforms obtained when playing the dropout disc. (a) With a correctly adjusted player. A is the end of r.f. before the dropout, B the dropout period and C the restored r.f. (b) The recovery period shown here is slow. This effect is commonly seen with players where the complaint is of very intermittent problems. (c) A more serious effect. Could be due to multiple misadjustments in both the focus and the tracking servos, though this would not necessarily be the case. (d) A serious error. The fault is more likely to be in the tracking rather than the focus servo. (e) Overall view of the r.f. waveform. A similar effect appears when playing a disc with multiple scratches — they show up as random dropouts in the waveform.

given different effects when a particular adjustment has been offset. In the captions to the waveforms I've given some ideas, based on my experience, to serve as a guide, but these must not be taken too literally. If it's any consolation to you, it was a disappointment to me as well when I found that I couldn't tie down a particular waveform to a specific fault. Nevertheless this test is very useful when trying to establish the whereabouts of those niggling intermittent faults like "it won't play some discs" or "it jumps a few tracks every few hours".

Fig. 6(e) shows the waveform obtained when the dropout disc is played with the scope's timebase set to 10msec/cm. This gives you an overall view of the r.f. waveform and is useful when carrying out some adjustments. It's also useful when checking those awkward discs that customers say will not play with their own machine but work with their friends' players. If there are any blemishes on or in the disc they will show up just as the black tape does. It's then for you to decide whether the player requires attention or whether the disc's blemishes are just on the limits of tolerance. It may be interesting to compare the servo recovery time when playing the complained about disc with that when playing your dropout disc. If the servo recovers quickly on your good disc it's likely that the complained about disc is too badly damaged to be played without problems.

When we come to discuss the servos in a CD player we'll be referring back to the waveform shown in Fig. 6. It will then become clearer why they take the form they do when a dropout occurs. Before we can do this however we must take a closer look at the data streams on the disc, i.e. CD encoding, which is what we'll start to do next month.

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £2 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.

ITT CVC1204 CHASSIS

A few seconds or minutes after switching on the picture and sound go, leaving a blank screen with either a snow effect or lines of snow moving up and down. This condition lasts from around five minutes to up to twenty minutes, then the picture suddenly returns and the set works normally until switch off.

This problem is often caused by dry-joints in the r.f./i.f. module CMR800/1. Unplug and carefully dismantle it, checking for bad joints and connections at the tuner end. Make sure that the correct tuning voltage enters the module at pin T27.

SANYO VTC5300

On three occasions the cassette has locked down but not loaded, the function keys having no effect. Normal functions can be restored by easing the lock lever (item 31) forward. The machine usually works satisfactorily, the fault occurring at irregular intervals.

Pin 16 of the syscon chip Q3003 (LC7800) should go low when the cassette cradle is lowered. If it doesn't, check the cassette switch and its connections. If necessary also check the eject switch – at pin 2 of S3006.

HITACHI CBP260

This set tends to get stuck in the standby mode. Usually changing C909, C915, C916 or C919, or all of these capacitors, provides a cure but the fault will return at a later date. The standby mode is rarely used and could be made inoperative by removing the components associated with Q902.

An official modification for this problem is to change C919 to 220μ F. Also if necessary replace C906 and C918, and check the joints on CP901, T901 and T703.

FERGUSON 3V22

The tape remains stationary in all modes. If the play button is held down – the mechanism will not latch – a chattering noise is heard, like a solenoid not holding in. The play/record buttons will latch when the timer is used, but return to the off position when the timer switches on.

This is a very common problem and is almost always due to failure of the cassette lamp, which is mounted in a black holder just in front of the reel idler assembly.

PHILIPS K30 CHASSIS

There seems to be a purity problem with this set. The picture has a blue haze about three inches wide on each

side. There's dark blue towards the edge of the picture and a reddish colour in the centre.

The double posistor R6292 is often responsible for this. A good check is to run the set for about half an hour then feel this component. It should be quite warm. If not replace it. If it is warm, degauss the tube screen manually. If the effect is still present after this the tube itself is suspect.

SHARP VC581

The head switching phase is incorrect in the record mode. Both channels can be adjusted correctly in playback but in record (no adjustment available) the switching point locks in about twenty lines early. The phase becomes correct when pause is entered, but on returning to record the fault reappears. IC704 has been replaced and the voltages around this chip seem to be normal.

We suggest that you first check C731 and R753 which are associated with pin 25 of IC704, and also check with a scope that the V-sync signal from the Y/C board is good. If these points are in order it's possible that the positioning of the Hall element or magnet (PG parts) is incorrect.

ITT CVC20/2 CHASSIS

There's a ticking noise when this set is switched on. The power LED stays on but the other LED goes on and off with the ticks. A new line output transformer has been fitted and the transistor checks o.k. Diodes D23 and D24 on the power supply sub-panel have been replaced.

The ticking effect indicates that the set is tripping. Since you get no bursts of sound or picture on each trip cycle the problem is probably due to (1) an incorrectly set current trip potentiometer (R810) or (2) an overload that causes the current trip in IC801 to operate. In the latter case try disconnecting the tripler then check D18, T14, D21 and D22 – it might be worth rechecking D23 and D24. The power supply section can be checked and set up independently of the line timebase by disconnecting L14 and wiring a 240V, 60W bulb across C50.

FERGUSON 3V23

We've had the same intermittent fault on several of these machines but because of its infrequent nature – it might not occur for hours or even days during a soak test – we've been unable to deal with it. Occasionally in the play mode the machine will switch off and eject the tape. The cassette can be reinserted immediately and the machine will then play normally.

We suggest that you try disconnecting the input from the IR remote control receiver. If the problem no longer occurs it's likely that the f.e.t. (X1, type 2SK105H) in the IR preamplifier can is noisy.

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HITACHI NP8C CHASSIS

When the channel is changed the colour disappears, leaving a monochrome picture. Colour can be restored by retuning. A high-gain, 21-element aerial is in use and the picture gain is o.k. most of the time here at Clackmannan, but the picture goes to monochrome when the gain is low – this occurs when low rain clouds come over.

First ensure that the aerial connections within and outside the set are good, with no looseness, corrosion or dry-joints. Check also that the a.g.c. control R203 is set to the full gain position. If these things are in order it's likely that the colour decoder subcarrier oscillator has drifted and needs resetting. You could go through the setting-up procedure in the manual but you will probably find that careful adjustment of R515 with the fault present will restore colour permanently.



318

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.

Spring had sprung and, as is usually the case at this time of the year, many members of our workshop staff were away for one reason or another: manufacturers' service courses, days off in lieu (of what?), nasty coughs and so on. The upshot was that the service manager didn't want too many sets brought in for repair. So each job card issued to the field engineers came with a nutshell diagnosis – and a hint of nemesis if the set was uplifted.

With this threat hanging over him Philbert found himself in front of a customer's Sanyo TV set, Model CPB2146, chassis type E2. With teletext, picture-in-picture and all the bells and whistles! Fortunately the service manager had armed him with a service manual.

Green faces the customer had said. On inspection he found that the faces and all other picture content that should contain an element of red or pink was a ghastly, sickly (but not bright) green. The same applied to the little PIP picture when this was called up, and to the teletext display. Not a chroma decoder fault then thought Philbert as he removed the back of the set.

His first action was to turn down the colour and check the grey-scale. The monochrome picture didn't look too bad - a bit on the "cold" side maybe. Next the colour setting was restored to normal and the output from a colour-bar generator was fed in. Yuk! The red bar was missing, the yellow bar was green, the magenta bar blue. The green, blue and white bars were o.k., but again the latter had a cold look about it. Servicing beginners stop here: what does this display tell you about the fault?

Philbert realised that the picture tube's red gun was not

contributing much. A look at the circuit diagram showed him that the three RGB output transistors are combined into a "module" (A602) on the c.r.t.'s base panel. All nine leadouts are available separately however, so Philbert started by comparing the collector voltages in the simple class A RGB output stages. There was no disparity between that of the red output transistor and the other two. Similarly the base and emitter voltages of the three transistors were virtually identical.

Philbert came to the conclusion that since the *standing* voltages at the collectors of the three RGB output transistors were the same the likelihood was that the red output transistor wasn't getting any signal *drive*. To check this he interchanged the red and blue drive input leads to terminals 4 and 5 on the tube's base panel. This altered the screen positions of the colour bars, putting a blue bar in the position normally occupied by the red one. The drive circuitry was thus eliminated from the search and attention was turned to the red output stage.

Having restored the correct connections, Philbert brought in his oscilloscope and confirmed that the R and B signals were indeed reaching the bases of the respective output transistors. Maybe the preset potentiometers in the red output stage were faulty? Twiddling VR612 (red bias) and VR611 (red drive) had no effect on the picture, though the red output transistor's emitter voltage changed as VR612 was adjusted. The potentiometers themselves and the associated fixed resistors were all checked with an ohmmeter and found to be o.k.

Where was the cause of the trouble? Not far away! For the answer see next month's issue.

ANSWER TO TEST CASE 317 – page 525 last month –

Our elderly Bang and Olufsen 20AX chassis receiver last month had a fault that used to be very familiar to TV engineers – a travelling hum bar at mains rate traversed the screen. It was plain that mains-rate ripple had invaded the internal supply lines and was modulating the scan and the signal waveforms, but how was it getting in? Finding the solution would have been made very much easier had the technican studied the symptom (and the circuit) more closely!

A single hum bar indicates a disturbance at a 50Hz rate, i.e. once per TV field. This chassis uses a full-wave rectifier/regulator circuit, so any fault downstream of the two thyristors would have produced a 100Hz ripple with two hum bars on the screen. Clearly one of the thyristors wasn't working, though both had been changed and both were being driven at their gates. When the scope was hooked to the anodes of the two thyristors in turn all became plain. The mains feed to one of them was missing because one section of choke 5L1 (a device we long ago christened Beobuzz . . .) had gone open-circuit. The other section of the choke was, naturally, very hot and bothered.

This once again illustrates the need to analyse the symptoms carefully, whether the circuit involved consists of a microprocessor or a throbbing thyristor!

Published on approximately the 22nd of each month by IPC Magazines Limited, King's Reach Tower, Stamford Street, London SE1 9LS. Filmsetting by Trutape Setting Systems, 220-228 Northdown Road, Margate, Kent. Printed in England by the The Riverside Press Ltd., Thanet Way Whitstable, Kent. Sole Agents for Australia and New Zealand – Gordon and Gotch (A/sia) Ltd.; South Africa – Central News Agency Ltd. Subscriptions: Inland £18, overseas (surface mail) £21 per annum, payable to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex RH16 3DH. "Television" is sold subject to the following conditions, namely that it shall not, without the written consent of the Publishers first having been given, be lent, resold, hired out or otherwise disposed by way of Trade at more than the recommended selling price shown on the cover, excluding Eire where the selling price is subject to currency exchange fluctuations and VAT, and that it shall not be lent, resold, hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever. ISSN 0032-647X.

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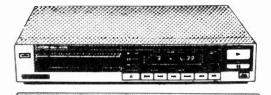
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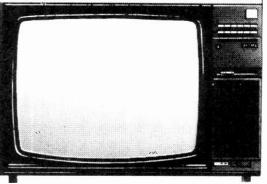


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April 1989 25 15 15 15 15 15 15 15	2SA-571 500p 2SA-634 50p	2SC-1921 60p 2SC-1923 25p	35A/600V 230p 35A/800V 260p	40101 78p 40102 150p	74HC195 476 74HC221 1006	74LS136 32p 74LS138 31p	745189 210p U341 500p	Aerokleane 90p Aero Duster 115p	ANTEX XS25W 240V Soldering Iron
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Second Text	2SA-952 50p 2SA-953 60p	2SC-2073 70p 2SC-2075 80p	8A/600V 79p 12A/400V 75p 12A/600V 90p	40194 58p 40208 240p	74HC356 45p 74HC365 34p	74LS174 36p 74LS175 38p	NV-3000 6 belts/kit 180p NV-7000 5 belts/kit 100p	12V. 60mA (3@mm Wires)	COLDED
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Section 1906	2SA-992 30p 2SA-1012 130p	2SC-2229 25p 2SC-2233 125p	BT116 80p BT119 100p BT120 100p	7402 18p 7403 20p	74HC375 60 p 74HC377 55 p	74LS195 50p 74LS196 55p	SL-T7ME/T7MER 6 belts/kit 170p SL-T9/P7/J9 7 belts/ki: 210p	FLOPPY DISCS	25 ST
Section 280 100 260	2SA-1103 200p 2SA 11 04 200p	2SC-2236 60p 2SC-2238 70p	TIC44 22p TIC45 27p	7405 10p 7406 40p	74HC390 55p 74HC393 50p	74LS221 50p 74LS240 50p	SANYO VTC-5300 5 belts/kit 190p	Name £12.50	
250 250	2SA-1106 250 p 2SB-022 80 p	2SC-2259 80p 2SC-2271 60p 2SC-2275 50p	17088 200p 17089 200p	7408 25p 7409 20p 7413 35p	74HC533 68p 74HC534 65p 74HC540 73p	74LS242 50p 74LS243 55p 74LS244 45p	VTC-9300 4 belts/kit 240p	31/2 inch DSDD (10 in box) Branded	Soldering Stand 200p
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September Sept	2SB-566 130p 2SB-595 80p	2SC-2334 240p 2SC-2335 120p 2SC-2335 120p	4000B SERIES CMOS IC's	7421 25 p 7425 15 p 7430 25 p	74HC574 70 p 74HC583 90 p 74HC595 85 p	74LS251 28p 74LS253 40p 74LS256 58p	VBS-7000 6 belts/kit 245p		
Sept	2SB-600 500p 2SB-600 500p	2SC-2371 45p 2SC-2373 210 p	4001 13p 4002 13p	7438 35p 7442 45p	74HC620 110p 74HC623 110p	74LS258 40p 74LS259 55p	V-5250/5280 5 belts/kit 230p	RADIAL LEAD	UNBEATABLE
286 88 409 25C 248 2409 4010 219 747 247 250 250 250 250 250 250 250 250 250 250	2SB-621 85p 2SB-646A 90p 2SB-647 30p	2SC-2408 120p 2SC-2470 65p 2SC-2482 40p	4007 13p 4008 38p 4009 20p	7450 22p 7451 10p	74HC643 90p 74HC646 150p	74LS266 26p 74LS273 50p	V-5475 6 belts/kit 190p V-7540 5 belts/kit 190p	22 MF 15p 10 MF 15p	JVC/AKAI/FERGUSON 3HSS £15.50
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258 256 256 256 257 256 256 257 256 256 257 256 256 257 256	2SB-707 200p 2SB-716 30p	2SC-2550 70p 2SC-2551 70p	4014 32p 4015 32p	7481 90p 7482 70p	74HC690 120p 74HC691 120p	74LS365 30p 74LS366 35p	VC-8300 5 belts/kit 175p VC-9300 5 belts/kit 155p	1000 MF 35p 220 MF 30p 16 Volts 470 MF 35p	SONY DSR-43R £20.00 HITACHI VT11/33 £20.50
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258 992 700	2SB-772 45p 2SB-775 160p	2SC 2578 220p 2SC 2579 200p	4021 36p 4022 36p	7493 35p 7495 48p	74HC4020 50p 74HC4022 40p 74HC4024 34p	74LS390 46p 74LS393 41p	13.2VCW 290p 13.2VCCW 290p	220 MF 18p 2.2 MF 15p	VCR 7000 £20.50
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288 895 1 120p 25C 298 2100b 4031 50p 30c 34 50p 30c 34 50p 30c 35	2SB-882 180p 2SB-884 120p	2SC-2611 65p 2SC-2625 380p 2SC-2681 270p	4028 29 p 4029 34 p	74119 85p 74122 40p 74123 20p	74HC4051 95p 74HC4052 95p 74HC4053 95p	74LS644 140p 74LS645 140p 74LS670 68p	Auto Reverse Head 260p VIDEO MOTORS	25 Volts 0.47 MF 15p	******
258-1007 100 25C-281 360 4035 42p 41153 45p 7414609 35p 25144 200p 25C-281 360 4036 42p 41153 45p 7414609 35p 25C-281 360 4036 42p 41153 45p 7414609 35p 25C-281 360 4037 75p 74157 45p 7414609 45p 27722 20p 25C-281 360 4038 46p 74160 50p 7414609 5	2SB-895 120p 2SB-950 180p	2SC-2688 70p 2SC-2695 2100p 2SC-2719 80p	4031 90p 4032 52p	74125 40p 74126 45p 74132 42p	74HC4059 85p 74HC4050 33p 74HC4066 33p	74LS674 320p 74LS687 260p COMPUTER	Reel Motor (RM11) P/N 4-529V- 10800 790p	47 MF 15p 2.2 MF 15p 100 MF 18p 4.7 MF 15p	# ENGINEERS SERVICE #
285-1091 100p SC-29/2 810p 4038 46p 74160 50p 7416(35) 110p 7732A 300p 25C-39/3 320p 50c 4039 4040 405p 74160 50p 7416(35) 110p 7732A 300p 25C-39/3 50p 4040 405p 74160 50p 7416(45) 110p 7732A 300p 25C-39/3 50p 4040 40	2SB-1009 110p 2SB-1037 110p 2SB-1077 180p	2SC-2785 60p 2SC-2810 360p 2SC-2837 360p	4034 76p 4035 42p 4036 180p	74145 70p 74153 45p	74HC4075 26p 74HC4078 32p	2114 200 p 2532 330 p	Sony Capstan Motor BHF-1100D 2500p Sharp	220 MF 18p 10 MF 15p 470 MF 25p 22 MF 20p 1000 MF 50p 47 MF 25p	* TOOL KIT *
25C-488 19p (25C-303) 140p 40H 36p 74173 50p 7416C451 85p 74175 85p 85p 7	2SC-97A 380p 2SC-454 45p	2SC-2922 610p 2SC-2979 320p 2SC-2988 280p	4037 75p 4038 46p 4039 180p	74157 45p 74160 50p 74164 50p	74HC4316 100p 74HC4351 110p 74HC4352 160p	2732 280p 2732A 300p	Reel Motor RMOTB 1007 Gezz 1750p Reel Motor RMOTM 1008 Gezz 1750p Loading Motor RMOTM 1017 1000p	2200 MF 70p 100 MF 30p 35 Volts 220 MF 35p 470 MF 50p	CONTAINING:
2SC 681 3400 58C 396 8000 8004 436 7416 896 7416	2SC-461 30p 2SC-495 60p	2SC-3039 140p 2SC-3040 260p	4041 36p 4042 30p	74173 50p 74174 70p	74HC4310 120p 74HC4511 85p 74HC4514 140p	27C64 550p 27128 350p 26256-25 400p	JVC Capstan Motor PU-55371V 2200p Capstan Motor PU-45979 2260p	10 MF 15p 1000 MF 100p 22 MF 15p 100 Volts	* TOP CUTTER * * MULTI TESTER, *
2SC 790 125p 2SC 315 2SOp 4048 27p 74195 40p 74HC4538 360p 2SC 315 2Sop 4048 27p 74195 40p 74HC4538 360p 2SC 315 350p 4048 27p 74196 40p 74HC4634 120p 650p 2SC 315 350p 4048 27p 74195 40p 74HC4643 120p 650p 2SC 315 350p 4049 18p 74197 45p 74HC4643 120p 650p 2SC 315 350p 4049 18p 74197 45p 74HC4643 120p 650p 2SC 315 40p 405 40p 74HC4643 120p 650p 2SC 315 40p 405 40p 74HC40104 190p 74HC40104 190p 74HC40104 190p 74HC40104 190p 74HC40105 2SOp 6503 570p 550r 74HC40105 2SOp 6503 570p 2SC 1050 300p 2SC 3178 30p 4054 4054 4054 4054 4054 4054 4054 40		200-3042 300p	4044 36p	74176 45 p	74HC4516 130 p 74HC4518 70 p	41256-15 450p 256DRAM 450p 4116 75p	VIDEO PINCH ROLLERS National	100 MF 20p 0.47 MF 15p 220 MF 25p 1.0 MF 15p	* TWEEZER *
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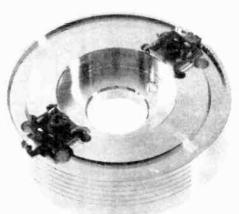
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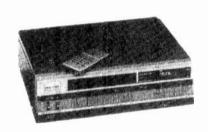
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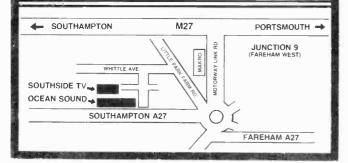
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ANGS27 C4.76 AS54 C1.90 HA11703 C4.50 AS417 C1.95 MB3732 C2.90 STK576 C5.75 TOA1515 C4.50 25A1104 C2.50 CASSETTE HEADS								CA 50 2007/3		12-13 2 Valte C C W	
ANG328 G 42 0 BA516 C 1.9 0 HA11704 C 52 0 LA140 C 9.9 0 MB3730 C 2.9 9 SK5720 C 65.8 0 T0A505 T 5 285.36 T0A505 T 5 285	AN6327		£1.90 HA11703		£1 95 id83722	C3 50 STK5476				72 10 2 VOIG 0.0.77	₩.40
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AN6340 C7.8 BAS24 C2.75 HA11706 C4.75 LA4180 E2.40 MB3759 E2.60 ISTRV216 C5.50 ITDA2003 C9.80 2SB545A C1.50 MVIII £1.50 AUIO Nev. £2.75 AN6342N C2.50 BAS26 C3.50 HA11710 C9.50 LA4178 C2.50 MB3759 E2.60 ISTRV304 C5.95 ITDA2003 C9.90 2SC436 C9.35 ITDA2003 C9.90 2SC436 C9.35 ITDA2004 C7.75 ITDA2005 C7.75 ITD	AN6330	£2.95 BA521	£1.80 HA11705	£6.95 LA4145	£1.70 MB3731	£3.50 STK5730	£4.25 TDA1908A	£1.75 2SB536			00.00
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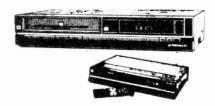
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VT9300:9500 etc. Play Idler 23.65 VT9300:9500 FF Idler 15.50 VT8000:8300:8500:8700 F/F Rew Idler 21.50 VT8000:8500 etc. Play Idler Assembly 22.85 VT8000:8500 etc. FF/Rew Pulley 20.70	REMOTE CONTROLS Ferguson, Grundig, ITT, Phillips, Pye, Sony and Hitach: Various models TV & Video From £13.50 Sony remote control rubber pads. State model. LINE OUTPUT TRANSFORMERS	INTEGRATED CIRCUITS AN305 E3.10 HA11715 E3.20 AN3821K E6.75 LA4460 E1.70 AN3822 C7.50 LA4461 E1.80 AN6310 E4.25 LA7801 E1.25	moulding \$0.75
Ferguson £4.95 Take up Clutch (Mechanical models) £4.95 3V29/30 Take up Idler £1.20 3V29/30 Take up Clutch £2.10 3V29/30 Reel Idler £2.50 3V35 Reel Idler £2.40 3V35/86/38/39 Take up Clutch £2.00	TRANSFORMERS Control Control	ANG326 E4.00 M5454 C1.85 ANG360 E3.75 M51393 .C4.25 ANG362 24.25 M54543 C1.75 ANG387 E5.50 MC1458 use UPC1458 AN6671K E5.50 STA401A 23.75	Video Tage Splicing Kri. Hilach TV Frame Module HM6251 Cassette Housing Assembley for Ferguson 3V35:66 88 394:2/ 324.444/3 SERVICE AIDS — SWITCH CLEANERS, HEAD CLEANERS, FOAM CLEANERS, SILICON GREASE, DESOLDERING BRAID ETC. NOW AVAILABLE. ASK FOR PRICES.
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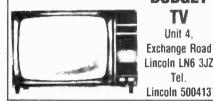
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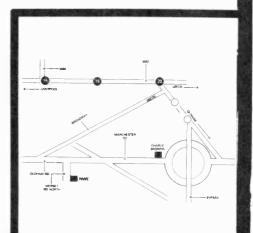
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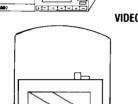
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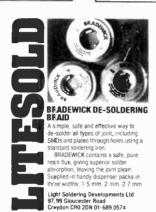
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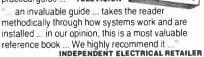
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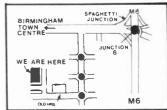
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4 Push button unit preh 6 Push button VHF/UHF for Veap. GLC-Decca type £7.00	CVC800 Line Trans £6.00 CVC825 Split Diode £10.00 CVC 15 £5.00	CVC 40 PUSH BUTTON ASSY with sliders; complete with lamp assy ± pots	32/300 4.350	20p 5p	Handset Tester with LLD	€4.50
7 Push button for CVC5 ITT £8.00 KT3 12 Push button unit £2.00 KT3 (Export) 12 P.B.u £2	GFC Portable G1OT2041 £3,00 GFC Portable G1OT2046 £3,00	8 britton units £9.001 Universal I/veus, Fits Pve, Thorn and	8/350 4 7M 350k 33 350	8p 10p 20p	Repaired Handsets Philips K4-K35, RC5350-RC5300 RC5370, RC5375, repaired same	0.
6 Push button Unit Thorn £1.00 6 Push button GRC £6.00	LOPT Rank Z763 £5.00	Deeca Units, F147 Rank tube base on panel £1,00 Z718 Focus Unit £1,50	220 350 300 350 400 350	30p 40p	RC4001 Full Remote K I 3 K 30	Feletext
6 Push button PYE 731 £6,00 Hearing aid unit £3,00 Rank Z718 4 P/B/Unit MECH £4,00	Universal Astronom	T20 Focus Unit	22/375 220 385 (ETT)	50p 15p 75p	NFW Type RC4001 9 CD not 13	£15.00 £6.00
7 Button Unit GFC with Lamps £7,00 697 Push Button Unit £6.00	with small focus por Green type £7.00	Decca Small 75p KT3 Focus Unit 75p K30 Focus Pot 75p	330 385 CVC 820HT 0 1/400 KT3 E.W., 39/400	60n ±	GLC Full Remote Intra-red, 198	G models £15.00
Z916B panel £5.00 T513AP panel £5.00	Black Triplers KT3 Triplers STC Universal Tripler £6.00	K30 Tube base on panel E1.00 TX10 Focus Units E8.50	.56K-4005 47(0)pt-400 22-400	20p 10p	Limers, 60 mins, small	100.13
Video Tuner V:6100/05 1/V and Tel/Text unit and	11 117 £2.50 11 1 GA £2.00	CV C 32 Focus Unit 75p Fedility Focus Unit 14R-14S 30p 3500 Thorn Focus Unit £1.00	8/400 33 400	10p 15p 20p	FOSHBA HAND SLIS 24 Button CT938 Fullremote	£5.00
hand set £90,00 Send for data.	Rank T25LF Tripler £2,00 Rank HTCP A823 £3.50	FFI Small for use with Split Z718 Bush Focus €2.00	400 400 394K 400V 220/450	40p 20p 40n	32 Button C 1983 Videotext	€6.00
Mains Droppers Pvc 731 3+56+27R €1,00	11 H Z Rank £3.00 G9 Philips £4.00	Diode 50p Remo_LV12SP 50p 1600 Thorn EHT Rec and Lead 50p	47/500 0.1 600 0.1/1200V wire end	25p 15p	VCR Front Display Panel Large type LTL LV and V C R	€7.00
PHILIPS	3500 Thorn £3,00 8500 Thorn £4,00	IV14 50p IV20 £1.00	0.1.450 A/C wire end .22.1000	20p	Handset GLC Ultrasonie 8CH Full Remo	£15.00
K40 Text Panel £8,00 CP90 Chassis 14", 17" and 21" NEW £20,00	9000 Thorn £7.00 9500 Thorn £4.50 9600 Thorn £4.00	TV45 50p	047/600 0 047/[000 0 01 1000	10p	G11 Full Remote Ultrasonic	£32 00
KT3-K30	2040 GEC	TX9 8 Button Unit £6.00	0.11.1600s 0.1/1000 .47/1000s	10p	G11 Ultrasome Teletext Handset 8 C.H. Ultrasome GI C.Full Ren C2014H/C2219H New Replacement for G11 Ultra	note £15.00
OF-425 OF-550 F.W. 10p	OS Tripler £5.00 CVC20-32 £5.00 Deca 80 100 £4.50		47/250V A.C. 001K 1250	65p 10p 10p	Full Remote Thorn 4000 insert with 7 buttons Decca RC 11	£12.00 £5.00 £14.00
OF-513 correction 10p OF-557 50p	Grundig TVK 52 £2,50 11TBQ Pvc 731 £3,00	TX100 8 Button Unit £6.00	0.0047_1500 .005/1500 .0105/1500	10p 10p	Decea RC 12 GD Infra-red full teletext Dynatron-Full remote CFV 62-6	£14,00 £20.00
BY 126 DIODES 10p	11111Y D22 for Pve 18" colour portable £4,00 LP 1193.63 £4,00	TX10 8 Button Unit £10.00	InS-1500 2n2-1500 .01/1600	15p	Hitache infra red bandset Philips full remote K.13, 16C9280 7228/7324, K.12 26C 797 LS1 66K	£19.00
BY 127 10p BY 133 10p BY 134 10p	BG 100.41 £3.25 FRO Tripler print type with foacs PO7 E5		G11 8200 2KV 0 1/2KV	20p	1826 GTF Full remote too button asset	£12.00
BY 176 BY 179 25p HOP	I text ultrasonic rec'r panel £14,00 12 14V 20 for £5,00 200 for £25,00 GFC 8 rouch unit assy complete with all	1X1071X100 16 Button £10.00	3n9/2KV 0.0015.2KV 0n2/2KV	10p	G11, Full remote repair service (cunit) G1 C infra red full remote 8 chin	E18.00
BY 187 10p BY 190 40p	1 C 's + pots	G11 drawer ASS 3 pots Mains switch	2n2 2KV 470pt 4KV 7500pt 2KV	15p	(LC SAA1250) Philips mfra red full remote 9 cha 60 CP2605	£14,00 innel for £6,00
BY 196 30p BY 198 10p BY 204/4 8p	G11 Transfert Suppressors 245V 20p G11 Scan Coils £5,00 G11 100K tuner pots 12 for £1	and lead £2.00	3000P= 3000X 4n7/2KV 6n2/2KV	15p	oo C (23005 Philips intra red tall remote 12 ch toj 60 C (23005 K35 KT3/K30 T Text	£12.00
BY 206 - BY 407 Eqx. 8p BY 208-800 8p BY 210/400 5p	KT3 II panel £6 00 KT3 line OSC transformer KT3 K30 infta-red receiver	K30 Drawer Ass with pots cable	7n1/1500V 8n2/1500V	10p 10p	K L3/K30 Full remote KT3 Power supply GLC infra-red 2236-2026	£15,00 £4,00 £4,00
BY 210/800 10p	head £1 K30 drawer unit with IC's	forme £1.00	9n1/2000V 8n2/2KV 0,0082/2500	15p	GEC push pad handset button bl	£14.00 obs 10p
BY 224/600, 4.8A/600k bridge BY 226 BY 227 BY 228 1500k	(home) £10 K30 drawer unit with IC's (export) £10	TX10 Drawer with 8 way pots ass. £2,50	150/3500 1800/4KV 4.7nt/5KV	10p 5p	Pve & Philips handser K13-K30 c No RC5150-RC5176-RC5171-RC Special Price	£13.00
Flat BY 229 black 15p BY 200 Rod 20a	K 13 AE Sockets 50p K 13 receiver panel E8 K 13 line driver transformer 50p		170/8KV 180/8KV	10p	FRC4001 K13 and Teletex FI CVC 32 handset repaired CVC 32 Hand Set	£14.00 £15.00 £15.00
BY 229/400 30p BY 299/60p Tag 30p	Pve K30, GLC, etc. Pre-mains standsby switch £1 Decca 80/100 IF-panel £5	TX10 Ex port with band switch (drawer) £2.50	210/8KV 1000/10KV 47/100V	P	CVC 45.3 and 2 Pm FX10 Hand Set Text FX9 with Text FX9 & FX10 button print	£12.50 £12.50
BY 254 10p BY 255 30p	NPN PNP 80V 6 Amp TO66 O P Trans pair 25p 5 bifton fouch tuner BBC 12 ITV1/2		Tube Thermpath 167 Rank Secam Decoder Panel UI- VIII: 1115A	£1.00	IX10 Focus Pots	£2.00 £5.50
BY 298 10p BY 299 10p BY 405 8p	video with ic SAS 5601 570" £7,00 Control panel 5 sliders + mains lead £1,50		10 off - 91 CAP G11 Philips K4 CAP 150M 385V		TV & Video Processor 1200 Type	
BY 527 BY 407a 10p	G11-8 touch button unit replaces old 6 PB-U €24 Tube base + base unit for 820 Euro	CVC 20-25-30 Mains Switches Infra Red and Ultrasonic G11 Feletext Deci RANK & ITI Mains Remote On-Off Switch	oder Panel	60p £30	PHILIPS UNIVERSAL HAND SET £12.0 K 13 = K45	0 RC5
BY 527 BY 602 10p	chassis £4,00 GFC Line O P Trans & Rec Stick for Portable £3,00	RANK & ITT Remote Switch 2800 ohm G11 Mains Switch	(7/±0K)	£1.50 £1.50 50p	We have all parts for Philips Ha	
BYV 26C 10p Γ 247 10p GP20G 5p	CVC 20.25 30/35 40 decoder panel CVC 20/25 30/35 40 decoder panel (untested) £5	4 amp Mains Switch GEC Mains Switch 4 amp KT3 Mainswitch		25p	2C 5353 2C5300 Palips RC5	£15.00 £12.00 £15.00
GRP80G (TX10) 30p XK 3102 50p BY V 28/200 20p	CVC-40-45 IF panel	G8 Mains Switch G11 Preh Red LED P/Button for C.H. Char RANK TOSHIBA Transductors TPC-2011	nge	75p	TEXT-TYPE Replace Hand Set for Philips K F3-K30, K4 etc	
Bridge TX10 800/3 amps 30p KBPC35-02 Bridge £1.50	1 M337M Reg 30p 20 GEC Black Spark Gaps €1.00 KT3 Front Panel Control	Mains Switch IT'l Long Type Print		75p	THORN HAND SETS	£12.30
Bridge Rec D35B40 40p	ASSV £2.50 BTW 30/50 50p	Mains Switch Philip Long Type TAG Mains Switch GEC Long Type TAG 2000 Chassis Eidelity Mains Switch (4 TAG) 250V-4A White Lorlin Mains Switch		75n	9000 9600 FX9 FX10 - I lext and Non-Text	X100 £10.00
International Rectifier EHT Diodes G75 6A/600V Stud Diodes 20p 6A/1000V Stud Diodes 20p	70/HV34 6KV 3 for 8p BTW 92/800R £3 25A473 PNP C/P 10p	KT3-K30-K35 Full Remote Mains Switch (6 Feletext Adaptor Kit TY-500 Panasonic Philips Battery Tester All Types and charger			CS171 PHILIPS	£12.00
		Philips K4 Mains Switch with standby		80p	K35-K4 HAND SET Repaired for £5,00	

Funer Units	SW450 SW15 3A SUp SW150 C1 SW154 S0p SW173 S0p SW173 S0p SV2153 S0p F1045A S0p SV2153 S0p F1045A S0p SV2153 SV2	Inton, EX SS3 8AF RVICE rechnical Information by s : No Credit Cards with order £1 Postage pverseas 2 London Rd., L Fax 0702 338805 rders accepted on official	Deep Mil 28 C4.00 Mil 29 C2.00 Mil 29 Mil	TBAS-50 IBAS-50 IBAS-70 IBAS-70 IBAS-70 IBAS-70 IBAS-70 IBAS-70 IBAS-70 IBAS-73 IBA	12.00
BRX-43	C100	LPT37P Fits Pve A. PT34	8.867288 11 1059 (00) Large or small 50p each Antistatic Isolators Disc Type Black 10p Filters CSA 3 97M 15p 6.81Hz SFF 15p 6.81Hz SFF 15p	11C A 270 11C A 270	April