

# TELEVISION

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SERVICING · VIDEO · SATELLITE · DEVELOPMENTS

A REED BUSINESS PUBLICATION

## Servicing Matsui/Saisho Post-1990 VCRs

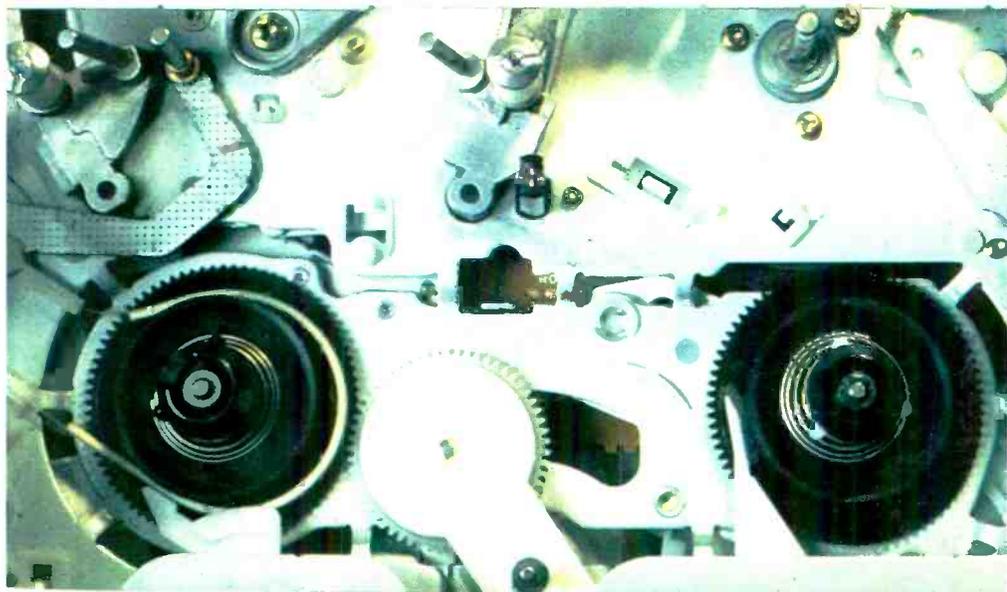
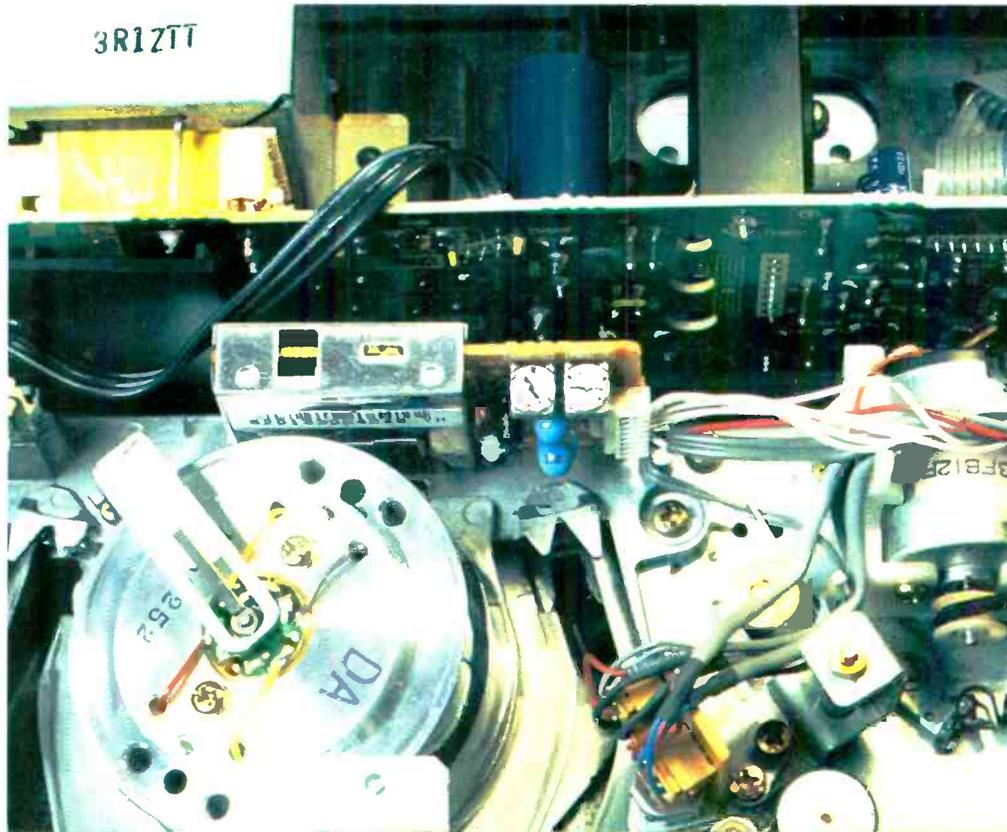
## The Sony Plasmatron

## Design for Reliability

## Test Report: Ozan Teletest Pro

## Satellite TV Servicing

## Servicing Pioneer Multiplayers



**TV Fault Finding Reports**



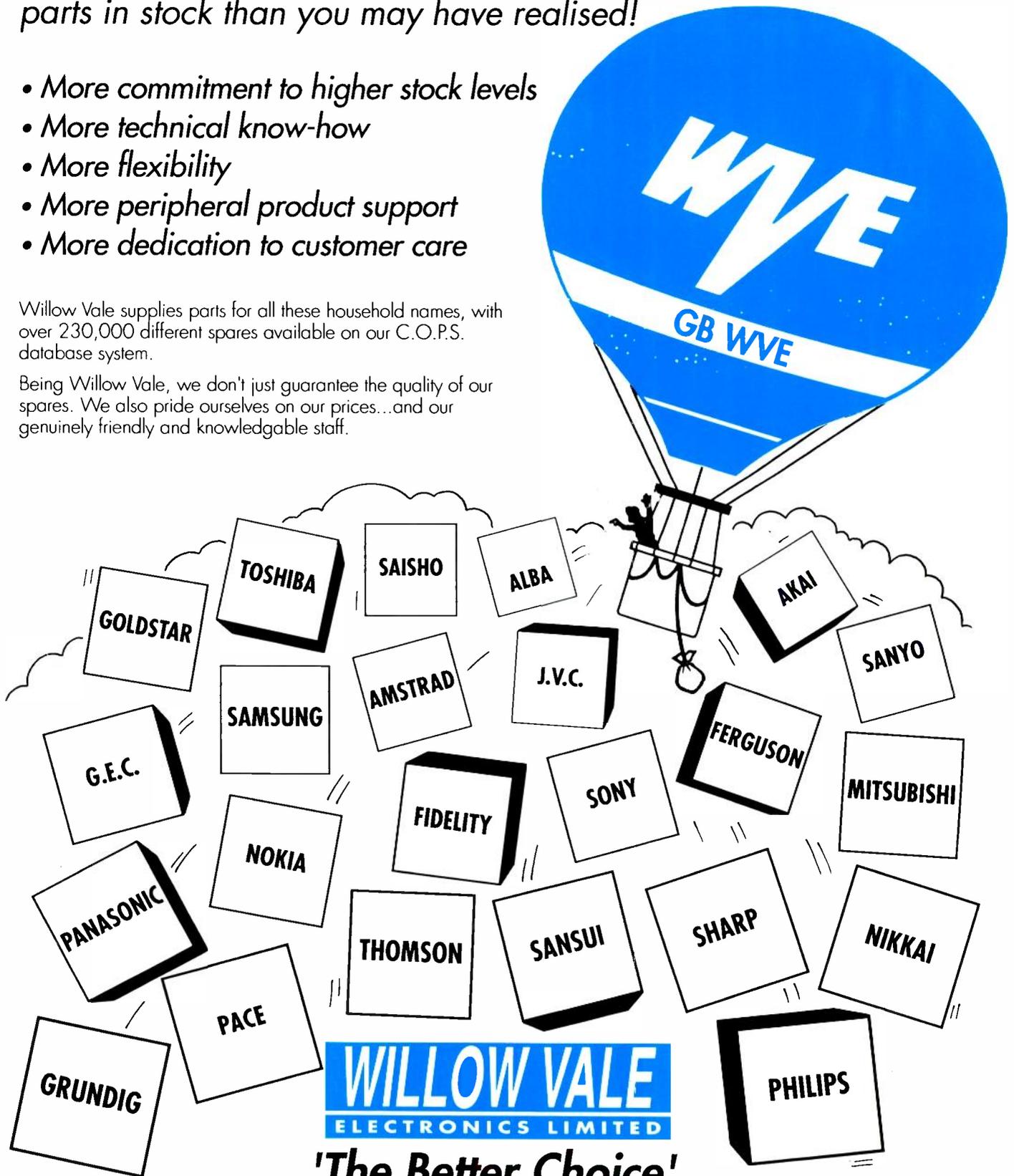
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Notes on servicing Toshiba VCRs.

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Satellite TV reception problems and receiver servicing.

**777 Designing for Reliability** *Martin Pickering, B.Eng.*

Factors that have to be taken into account at the design stage if equipment is to operate reliably in the long-term.

**780 The Sony Plasmatron**

*George Cole*

Sony's solution to the problem of producing a flat display panel for domestic viewing. Sets fitted with the Plasmatron will go on sale in Japan next year.

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*John Coombes*

How to tackle faults experienced with these widely used multi-players.

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*Peter Brough*

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BC109C	10p	BD436	30p	BU112	100p	MPSA93	15p	2N3055H	50p	7824	25p	25A/200V	185p	6840	290p	BA404	60p	KA2414	150p
BC140	20p	BD437	28p	BU126	60p	MPSA93	15p	2N3056	15p	7824	25p	25A/200V	185p	6840	290p	BA405	60p	KA2415	150p
BC141	20p	BD438	28p	BU180	100p	MR510	35p	2N3057	15p	7905	25p	35V/100V	260p	6840	290p	BA406	60p	KA2416	150p
BC142	20p	BD439	28p	BU184	100p	MR556	35p	2N3058	15p	7908	25p	BR256	200p	6840	290p	BA407	60p	KA2417	150p
BC143	20p	BD440	28p	BU204	40p	OC28	350p	2N3059	15p	7912	25p	25A/600V	200p	6840	290p	BA408	60p	KA2418	150p
BC147	8p	BD441	40p	BU205	70p	OC35	350p	2N3060	15p	7915	25p	BR258	240p	6840	290p	BA409	60p	KA2419	150p
BC149	8p	BD453	50p	BU206	100p	OC36	350p	2N3061	15p	7918	25p	25A/800V	185p	6840	290p	BA410	60p	KA2420	150p
BC159	8p	BD534	38p	BU208	70p	OC45	30p	2N3062	15p	7924	25p	BR351	185p	6840	290p	BA411	60p	KA2421	150p
BC160	30p	BD535	38p	BU208A	75p	OC200	180p	2N3063	15p	7924	25p	35V/600V	260p	6840	290p	BA412	60p	KA2422	150p
BC171	10p	BD536	38p	BU208AT	200p	R2009B	100p	2N3064	15p	7924	25p	BR352	200p	6840	290p	BA413	60p	KA2423	150p
BC172	10p	BD537	40p	BU208D	130p	R2010B	100p	2N3065	15p	7924	25p	35V/200V	260p	6840	290p	BA414	60p	KA2424	150p
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BC183	7p	BD575	40p	BU232EA	75p	S2800M	72p	2N3071	15p	7912	25p	35V/800V	260p	6840	290p	BA420	60p	KA2430	150p
BC183L	7p	BD576	40p	BU232EA	75p	S2800M	72p	2N3072	15p	7915	25p	35V/1.5A	40p	6840	290p	BA421	60p	KA2431	150p
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BC239	7p	BD736	50p	BU232EA	75p	S2800M	72p	2N3083	15p	7915	25p			6840	290p	BA432	60p	KA2442	150p
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BC327	7p	BD977	50p	BU232EA	75p	S2800M	72p	2N3089	15p	7915	25p			6840	290p	BA438	60p	KA2448	150p
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BC338	7p	BDW24	55p	BU232EA	75p	S2800M	72p	2N3092	15p	7915	25p			6840	290p	BA441	60p	KA2451	150p
BC441	28p	BDW93	50p	BU232EA	75p	S2800M	72p	2N3093	15p	7915	25p			6840	290p	BA442	60p	KA2452	150p
BC446	8p	BDW94	50p	BU232EA	75p	S2800M	72p	2N3094	15p	7915	25p			6840	290p	BA443	60p	KA2453	150p
BC477	18p	BDY92	100p	BU232EA	75p	S2800M	72p	2N3095	15p	7915	25p			6840	290p	BA444	60p	KA2454	150p
BC516	22p	BF137	35p	BU232EA	75p	S2800M	72p	2N3096	15p	7915	25p			6840	290p	BA445	60p	KA2455	150p
BC537	25p	BF167	30p	BU232EA	75p	S2800M	72p	2N3097	15p	7915	25p			6840	290p	BA446	60p	KA2456	150p
BC546	8p	BF181	18p	BU232EA	75p	S2800M	72p	2N3098	15p	7915	25p			6840	290p	BA447	60p	KA2457	150p
BC547	8p	BF182	18p	BU232EA	75p	S2800M	72p	2N3099	15p	7915	25p			6840	290p	BA448	60p	KA2458	150p
BC548	8p	BF195	7p	BU232EA	75p	S2800M	72p	2N3100	15p	7915	25p			6840	290p	BA449	60p	KA2459	150p
BC549	8p	BF199	8p	BU232EA	75p	S2800M	72p	2N3101	15p	7915	25p			6840	290p	BA450	60p	KA2460	150p
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<b>AKAI</b> VS105, 112, 115, 116, 125, 126, 201, 202, 205, 220, 240, 244, 245, 247, 248, 250, 301, 303, 304, VSP8, VSP82 VP710, VS9300, VS9500, VS9800 VP77, VP88, VP7100, VP7200, VS9700, VS9800 VS1, VS2, VS3, VS4, VS5, VS10, VS11 VS3, VS35, VS37, VS38, VS53, VS55, VS66, VS765, VS767, VS768 VS512, VS515, VS516 VS465 VS11, VS12 VS6, VS8, VS9 VSX9 VSF600, VSF650 VS155, VS165 VS20, 22, 24, 25, 26, 27, 422, 426, 427, VSF10, VSP9 VS99 VS109, VS603, VS606, VS607 VS75	1400p 1350p 2400p 2800p 2600p 1400p 2500p 2500p 1400p 1500p 2500p 2500p	<b>FISHER</b> FVHP420, 510, 520, 530, 615, 618, 620, 622, 710, 711, 715, 720, 721, 722, 730, 830, 903, 906, 910, 911, 915, 916, 918, 5000, 5001, 5005, 5050, 5075 VBS3500, 7100, 7500, 7600, 9900, VBR330 VBS7000, VBS7100, VBS9000 VFP5500, 711, 715, 721, 722, 730, 830, 5100, FVHD720 FVHP725, 830, 980 FVHP990 FVHP975 FVHD40, FVHD140, FVHP1, FVHP10, FVHP20	1150p 2000p 2000p 2000p 1100p 2500p 2700p 2400p 1150p	<b>J.V.C. &amp; FERGUSON</b> HR2200, 3300, 3320, 3330, 3350, 3360, 3660, 3750, 3860, 4100, 3292, 8900, 8901, 8902, 8903, 8906, 8922, 8928, 3V01, 3V06, 3V22 HR3660, 7600, 7610, 7650, 7700, HRD110, 111, 120, 121, 220, 225, HR5100, 8904, 8923, 8924, 8925, 8929, 8935, 8941, 8943, 8944, 3V16, 3V23, 3V24, 3V31, 3V35, 3V36, 3V38, 3V39, 3V49 BR1620, HRD140, 141, 142, 143, 150, 152, 156, 157, 158, 160, 5101, HR510, 8947, 8948, 3V42, 3V44, 3V45, 3V46, 3V47, 3V52, 3V54, 3V55, 3V56, 3V57 HRD154, 170, 171, 210, 211, 217, 320, 321, 352, 521, 522, 525, 526, 527, 550, 8550, 8951, 3V64, 3V65, FV10, FV11, FV20, FV21, FV26 HRD565, HRD566, 3V48 HRD725, HRD755, 3V43, 3V53 8930, 8931, 8933, 8940, 3V29, 3V30 8945 3V00, 8902, 8903, 8909, 8912, 8922 FV37, FV43H, HRD860 BR7000E, BR7000S HR7200, 7300, 7350, 2650, BR6200 HRD455 HRD520 HRD300, 400, 580, 600, 620, 650 HR4100 HRD750, HRD830 HRD750, HRD257 3V32, 8942, HR7655 HRD180, 190, 230, 610, 3V59, FV12L, FV20B, 26, 30, 32, 33, VC141L HRD370, HRD430, HRD470, 3V58, FV13H HRD530, HRD700, FV14T GRC1, GRC2, 3V41 HRD330, 337, 440, 637, 641, 660, HRFC100, FV44L	600p 2000p 600p 1500p 2450p 3150p 700p 2400p 1000p 3500p 2800p 2000p 1400p 2300p 1000p 2300p 2700p 2300p 3100p 2800p 2100p	<b>KENWOOD</b> KV901, KV903, KV905 KV917	650p 2450p	<b>LOGIK</b> VR950 VR950	1500p 1400p	<b>LOEWE</b> OC410, OC420, OC440 OC50, OC55, OC60, OC65	2400p 1500p	<b>LUXOR</b> 9225, 9256 9245, 9251, 9254 9270, 9271, 9273 9272, 928217 9252 928017, 928077, 928097, 929107, 92817 9253 9281 9284, 9295, VR3701, VR3721, VR3731, VR3761	1800p 1225p 1800p 2700p 2500p 1700p 2500p 2700p 2100p	<b>MATSUJI</b> VK500E, 800A, 810A, 820, 80A, 770B, 773B VCR13, VK730, VK750 VK735, VK765, VX990 VK735A, VK765, VX850 VK600	1200p 1450p 1500p 1750p 1100p	<b>MITSUBISHI</b> HS303, HS304, HS320, HS700 HS308, HS318, HS710 HS307 HS319 HS330 HS400 HS349, HSE31, HSE32, HSB31 HS411 HSE30, HSB30 HS338 HSE10, HSE11, HSE20, HSE21, HSE41, HSB10, HSB20 HS300, HS301, HS302, HS310, HS273 HS200 HS337, HS347 HSE12, HSE22, MX1 HS41E2, HS411GZ HSB11, HSB21 HSE50	1500p 1600p 2600p 2500p 2600p 2800p 2400p 2900p 2400p 2200p 1550p 650p 1500p 2900p 2200p 3300p	<b>NATIONAL PANASONIC</b> NV300, 322, 333, 390, 2000, 2010, 3000, 7000, 7500, 7800, 7850, 8170, 8200, 8400, 8600, 8610, 8620 NV777, NV330 NV8050, NV8051 AG1000, AG1050, NV260, NV280, NV460, NV470, NV480 AG6010, AG6015 AG6840 NV100, NV200, NV370, NV380, NV310 NV100, NVH45 NVF65, NVH75 NVF51 NVF19 NVJ30, NVHJ33, NVL20, NVL21, NVG30, 31, 40, 130 NVJ36, NVG46	1500p 1600p 2600p 2500p 2500p 2400p 725p 3900p 3200p 4200p 2300p 1800p 2500p	<b>N.E.C.</b> N9011, 9012, 9013E, 9014E, 9014J, 9015, 9016, 901A, 902A, 9033, 9034, 9040, 9053, 9054, 9055, 9063, 9065, 9066, 906, DX1000, 1600 N911A, 914C, 915A, 916A, 917, 910, 9120 PVC600, 740, 744, 754, 763E, 764, PV2300, 2400, 760, 794, 770, 774 N830, N831, N830, N831, N832, N833, N834, N835, N836 8261, AH1 (for model DX3000), DX4000, N910 N895 N9052, N9530, DX2000 VCP1 PVC2300, 2400, 744, 744, 760, 764 DS5000 3500p	1300p 2400p 1650p 700p 3000p 3150p 3400p 1700p 1400p 700p 700p 1400p 2300p 2300p 3150p	<b>NORDMENDE</b> N80, 9460, V100, 140, 200, 250, 304, 341, 450, 550 V1001, 1005, 1015, 1025, 1035, 1041, 1055, 1065, 1105, 2005 V110, V333 V101, 102, 103, 112, 141, 142, 200, 300, 301, 302, 350, 500, 3005 V1205, V1215, V1235, V1245 V1305 V38 V502, V503, V5005	700p 1250p 2000p 700p 700p 1400p 2300p 2300p	<b>ORION</b> VH3, VH555, VH600, VH700, VH844, VH900, VH1000 (ALL MODELS) VHT, VH2A	1100p 700p	<b>PHILIPS</b> VR6460, VR6520, 64VR60, VR6424 VR6711 4 HEAD 6920, VR6440 VR6441, VR6540, VR6541, VR6644, VR6642	725p 1800p 2500p 1300p	<b>RANK</b> BV6900AS N830EA, RV300, RV310, RV320, RV330, RV340, RV350, RV380	1800p 700p	<b>REDSON</b> MR100	1700p	<b>SABA</b> 2A10, 2A70, 2B20 4A10, 4B20 6A10, 6A70 6A10, VR6038 CVR6083, VR600, 66007, 6008, 6009, 7006, 7007 PVR6068, 6070, 8070, VR2000, 6030, 6010, 6012, 7000, 9010 VHR7000, VR5005 VR6004, 6005, 6011, 6013, 6014, 6020, 6022, 6023, 6024, 7004, 7011, 7014, 7720, 7730, 8011, 8014 VR6018, VR7018 VR6028 VR7016	1400p 2450p 2300p 3150p 1250p 600p 1500p 700p 2450p 2300p 2000p	<b>SAISHO</b> VR100, 605, 705, 805, 905, 1000, 1100, 1200, 1600 VR3300X, VR3600X, VR3650, VR3800 VR3200, VR3500 VR2000, VR3300, VR3600	1200p 1400p 1400p 1400p	<b>SALORA</b> 6500, 6500 SV7300, SV8200, SV8300, SV9200 SV7400, 8400 SV8100	1600p 1500p 1600p 1200p	<b>SAMSUNG</b> SVX301, VB900, 910, VV7510, VT120, 5600, VV610, 511, 520, 616, 626, 627, 717, 614, 619, 629, 710, 712, 720, 730, 970, 971, 972, SV716, 717, SVX303, 305, VV6510, 520, 610, 616, 617, 619, 620, 626, 627, 629, 510, 971, V1520, 616, 621, 626, 900, 910 VB770, V1730, V1770, VK8220, VV750 VK770, VK8225 VM1560, VN1561	2900p 2900p 2200p 3300p 1350p 1900p 2200p	<b>SANYO</b> VTC5000, 5400, 6000, 6500, VPR5000, VTC1000, VTCM10, 11, 20, 21, 25, VTC5000, 5100, 5150, 5300, 5400, 5350, 5370, VTCNX10, VTCNX15, 20, 30, VPR5000 VTC5500, 5550, 9100, 9300, 9350, 9355, 9455, 9500 VHR1110, VHR1150, VHR1300, VHR1700, VHR2300 VHR3200, 3270, 3100, 3150, 3300, 3400, 3310, VHRD500	650p 1500p 1600p 1200p 725p 3900p 3200p 4200p 2300p 1800p 2500p	<b>SIEMENS</b> FM350, FM352, FM355, FM361, FM362, FM363 FM364 FM391, FM392, FM461 FM394, FM464 FM462, FM461 FM468 FM484, FM485, FM602, FM604, FM622, FM624 FM585 FM600	1300p 1350p 1800p 2800p 2800p 1600p 1800p 1425p 2800p	<b>SONY</b> DSR-19R (FOR SLT 9ME) DSR-21R (FOR SLC B C) DSR-35R (FOR C20, C30, C40, SLF1UB, SLF1E) 2 PIN SLC24PS, SLC33E, SLC44PS, SLF30PF, SLF60PS, SLK85, SLT20ME, SLT30ME DSR-43R (FOR SLC7 RANGE, SLC5000, SL5100, SLC3000) 1 PIN SLC6E, SL36ES, SL37E SL3000, 8000, 8080, SLC5E, SLT7ME SLV201, 202 SLK95, SLT550E SLV373VB	3100p 2800p 1500p 1300p 1600p 2000p 2900p 2600p	<b>TOSHIBA</b> V63 V9680 V8600, V8700 V21, V31, V33, V50, V51, V53, V9600 V55, V57 V71, V73, V74, V75, V77, V80, V81, V82, V83, V84, V85, V86, V87 V80, V93 V5470, V5480 V8900 V880MS V700G V500G, V509G V9680 V300G, V301, V305, V309G V61, V63 V110, V120, V130, V140, V210, V220	1500p 3000p 3400p 1450p 700p 1200p 1450p 1800p 1700p 1800p	<b>TRIUMPH</b> VR9500, VR9501, VR9525	1100p	<b>TELEFUNKEN</b> A890 A920, VR1970, 2920, 2925, 2930, 410, 7921, 7926, 7931, 7970, 7970 VR400, 410, 450, 510, 519, 520, 529, 540, 610, 620, 640, 920, 1920 A930, 932, 935, VR2931, 2935, 2941, 3935, 4935, 4940, 4942, 4945, 5935, 7932, 1400P A935, VR3945, VR3950, VR7959, 2450P A940, VR1925, 1930, 1940, 1950, 2960, 440, 449, 530, 535, 539, 549, 550, 630, 650, 925, 930, 940, 950 VR1980, VR7980, VR980 VR2915 VR2970, VR7971, VR975 VR7979	2700p 1250p 700p 700p 2450p 2300p 2000p 1200p 3150p 1100p 2450p 2300p	<b>THOMSON</b> TX8000, V309, 316, 320, 321, 323, 326, 4100, 4200, 4300, VX305T, 306T, 309BL, 3301, 312T, 410T, 411T TX8500, V318, 342, 343, 351, 352, 353, 4210, 4230, 4260 V333 V340 V357, VK309LP V360, V5500 V364, V4400 V368, V6000, V8540 V410, 510, 610, 630, 715, 4240 V430, 530, 4340 V450 VK300T, VK301T, VK302T, VK303T, VK308P VM10, VM20	1250p 1100p 1100p 2300p 2450p 2300p 650p 2700p

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# VCR BELT KITS / REPLACEMENT VIDEO LAMPS

Model	Price	Model	Price	Model	Price	Model	Price
HRD520, 600, 620, 637, 641, 650, 830	95p	VR6010, VR9010	70p	Models & Description	Order Code	Price	
HRD540, 550, 580, 660, 860, 960,	130p	VR6020, VR6022, VR6023, VR6028,	75p	UNIVERSAL VIDEO LAMP 9V	VL01	25p	<b>ON/OFF MAIN SWITCHES</b>  <b>GRUNDIG</b> PART NO: 29703, 29102 USED ON: C7500, C7500TT, C8500, C8502, C8712, C8714, C8894, M68-190, M68-190/99, M70-195, P40-345, ST66-1602, T55-340, V7722  PRICE: £2.25  <b>ITT</b> PART NO: 13/1074 USED ON: CP0200, 0211F, 0323, 0323/1, 0341/14, 0345F, 0351/1, 0361, 0361/1, 9350, CT0500, 0500/1/T, 0500T  PRICE: £3.00 PART NO: LFC 005 USED ON: CVC40 PRICE: £2.00  <b>MATSUI/SAISHO</b> USED ON: MATSUI-2190, SAISHO-PST2130TX PRICE: £2.00  <b>PHILIPS</b> USED ON: K30, K35, K40, KT3, KT4 PRICE: £0.95  <b>SON*</b> PART NO: (POWER SWITCH + REMOTE SWITCH) USED ON: KV1612 MK1, KV1612 MK2, KV1614, KV2052, KV2056, KV2062, KV2068, KV2212, KV2216, KV2252, KV2256, KV2704, KV2705, KV2706, KV2752PE3, KX20PS1, KX20PS2, KX27PS1  PRICE: £2.75 PART NO: (POWER SWITCH + REMOTE SWITCH) USED ON: KV2022, KV2024  USED ON: (POWER SWITCH) PART NO: KV1810 MK1, KV1810 MK2, KV1820, KV1822, KV2000 MK1  PRICE: £8.00 PART NO: (POWER SWITCH 26mm) USED ON: KV1400, KV1440, KV2040, KV2060  PRICE: £2.00 PART NO: (POWER SWITCH 21mm + REMOTE SWITCH) USED ON: KV2020  PRICE: £2.00 PART NO: 2 PIN (FUNCTION SWITCH) USED ON: KV1612 MK1, KV1612 MK2, KV2052, KV2056, KV2212, KV2215, KV2216, KV2252, KV2256, KV2704, KV2705, KV2706, KV2756PE3  PRICE: £0.40 PART NO: (4 PIN FUNCTION SWITCH) USED ON: VARIOUS PRICE: £0.50
<b>KENWOOD</b>		<b>SAISHO</b>		PANASONIC VIDEO LAMPS	VL02	35p	
KV901	70p	VR2000, VHL3	90p	SHARP VIDEO LAMPS	VL02	35p	
KV903	90p	VR3800	75p	HITACHI 5381682 (VT63, VT64)	VL04	135p	
<b>LOEWE</b>		<b>SALORA</b>		VIDEO LAMPS			
OC11, OC40	95p	SV6500	100p	AIWA, AKAI, ALBA, AMSTRAD,	VL05	150p	
OC410, OC420, OC440, OC460	130p	SV6600	150p	BLAUPUNKT, FERGUSON,			
OC50, OC55, OC60, OC65, OC70,	120p	SV8000	150p	FIDELITY, FISHER, FUJITSU,			
OC75		SV8100	60p	FUNAI, G.E.C., GOLDSTAR,			
<b>LOGIK</b>		SV8500, SV8520, SV9500	150p	GRANADA, GRUNDIG, HINARI,			
VR955	180p	SV7400, SV8400, SV8420, SV8550	120p	HITACHI, ITT, JVC (HRD			
<b>LUXOR</b>		SV6700, SV8710, SV8750, SV9700	120p	SERIES), MATSUI, MITSUBISHI,			
9245, 9251	130p	SV6800, 6900, 8810, 8820, 8870, 8910,	95p	NEC, ORION, NATIONAL,			
9252	140p	8920, 8970	95p	PHILIPS, SAISHO, SALORA,			
9253	140p	SV8600, 8620, 8700, 8720, 8830, 9600,	130p	SAMSUNG, SANYO, SHARP,			
9254	100p	9810		SIEMEN, SONY, TELEFUNKEN,			
9255	130p	<b>SAMSUNG</b>		THOMSON, TOSHIBA			
9256	130p	SV716, 717, V1616, V1621, V1626, VK616,	85p	AKAI, GRANADA (VHSTJ2),	VL01	25p	
9270, 9271, 9273, 9274	115p	VX617, VX619, VX626, VX627, VX629	85p	HITACHI (VT3000), ITT (VR3912,			
9272, 9280	140p	VX510, 520	100p	VRP3833), JVC (HR2200, 3300,			
9281, 9284, 9285, 9292, VR3701, 3721,	95p	VX980, 981, 982, SE9001, SV9001,	110p	3330, 3660), MITSUBISHI			
3731, 3761, 3781		SVX307, 319, 322, VB770, 8220, 8225,	150p	(HS200), TELEFUNKEN (VR510,			
<b>MATSUI</b>		V1770, 790, 8220, 8225, VK8220, VPX31,	135p	519, 610), THOMSON (VK300,			
VX850	75p	VX750, VX790, 8220, 8225	135p	305, 306, 3301), FERGUSON			
<b>MITSUBISHI</b>		SXK301, 303, 305, SX7301, VB710, 971,	120p	(3V00, 16, 22, 24, 3292, 8900,			
HS200	200p	V1730, 710, VX712, VX720, 730, 970, 971,	230p	8901, 8902, 8903, 8909, 8912,			
HS300, 301, 302, 307, 310, 337, 338, 347,	150p	972	90p	8922, 8925)			
349, 411, 412, 421, HS810, 20, 30, HSE10,	150p	VX9880	110p	BLAUPUNKT, ORION (VH1, 2A),	VL02	40p	
20, 30, 70	150p	<b>SANYO</b>		NATIONAL (NV200, 2010, 3000,			
HS303, HS304, HS306, HS307, HS330,	150p	VTC5000, 5150, 6000, 6500, VTCM10, 11,	75p	7000, 8150, 8200, 8400, 8600,			
HS400, HS700	150p	20, 21, 30, 31, 50	75p	8610, 8620), SHARP (HR2C300,			
HS318, HS319, HS410	130p	VTC5300, VTC5350, VTC5400,	100p	6000, 6200, 6300, 7300, 7700,			
<b>N.E.C.</b>		VPR5800	100p	8000, 8300)			
N830, N831, N832, N833	100p	VTC5500	95p	AKAI (VS10), GRANADA	VL06	40p	
N895	80p	VTC9300	22p	(VHSXJ3), ITT (VR3993, 3994),			
PVC2300, PVC2400	180p	VTC1100, 1300, 1500, 1100, 1150, 1200,	90p	JVC (HR2650, 7600, 7610, 7650,			
DX1000, 1600, 2000, 3000, N9012, 9013,	95p	VHR2100, VHR2300, VHR2500,	150p	7655), TELEFUNKEN (VR530,			
9014, 9016, 9033, 9034, 9053, 9054, 9055,	95p	VHR2700	150p	535, 539, 550, 630, 650),			
9066, 9110, 9120, 9510, 9520, 9530,	95p	VHR3100, 3300, 3310, 3400, 3700, 3800,	110p	THOMSON (V309, 316, 357,			
9610		VHR4100, 4150, 4200, 4300, 4350, 4770,	110p	VK309, 411, TX8000),			
<b>NATIONAL PANASONIC</b>		5100, 5200, 5300, 5350, 5700, 7100, 7200,	110p	FERGUSON (3V31, 8941, 8942)			
NV300, NV332, NV333, NV340,	125p	7500, 7530, 7540, 7800, 7810, 8100, 8200,	110p				
NV366	100p	8250, 8500, VHR4400, 4410, 4500, 4600,	90p				
NV777, NV788	100p	4610, 4710, 4890, 6700	90p				
NV2000, NV2010, NV3000	130p	<b>SHARP</b>					
NV7000, NV7200, NV7800	95p	VC200, 384, 385, 386, 388, 390, 9300,	100p				
NV8600, NV9610, NV8620	145p	9500, 9700	100p				
NV230, 250, 280, 430, 431, 433, 450, 460,	80p	VC7300, VC7700, VC7750, VC7800,	100p				
465, 470, 730, 770, 810, 870, 890, AG1000,	125p	VC8000	150p				
1050	125p	VC8300	150p				
NV370, NV380, NV480, NV630, NV780,	100p	VC8300	150p				
NV830, NV850	100p	VC8300	150p				
NV860, NV888, AG6010, AG6015	110p	VC8300	150p				
NV87, 10, 12, 14, 15, 18, 30, 130, 400,	70p	VC8300	150p				
NVH70	70p	VC8300	150p				
<b>NORDMENOE</b>		VC8300	150p				
V100, V140	70p	VC8300	150p				
V1000M, 1005M, 1205, 1215, 1235, 1245,	70p	VC8300	150p				
1305, 1403, 1405, V1500P, 1503, 1505K,	70p	VC8300	150p				
1805K, 2000D, 2405, 2500H, 3000H,	65p	VC8300	150p				
V305H, 3105, 4405H, 5000, 8005, 900,	80p	VC8300	150p				
905	80p	VC8300	150p				
V1001, 1005, 1015, 1025, 1035, 1041,	80p	VC8300	150p				
1055, 1065, 1105, 3005, 304, 5005, 502,	80p	VC8300	150p				
503	80p	VC8300	150p				
V101, V102, V103, V112, V141, V142,	90p	VC8300	150p				
V301, V302	110p	VC8300	150p				
V110, V333	95p	VC8300	150p				
V1500T, V2000B, V2000P, V400H	95p	VC8300	150p				
V250, V460, V9460, V20035542,	130p	VC8300	150p				
V20035543	130p	VC8300	150p				
V300, V303, V380	75p	VC8300	150p				
V500	75p	VC8300	150p				
<b>ORION</b>		VC8300	150p				
COMBI15000, 16000, NEVHM, TYP230RC,	140p	VC8300	150p				
900M/VH1012, VH1030, 1040, 1060, 1070,	140p	VC8300	150p				
1100, 1120, 1440, 1500, 1660, 1800, 2150,	165p	VC8300	150p				
2308, 2400, 2500, 2600, 2700, 2960, 300,	175p	VC8300	150p				
358, 360, 362, 4010, 4015, 4016, 4020,	95p	VC8300	150p				
4300, 5010, 5015, 530, 535, 536, 600, 635,	140p	VC8300	150p				
640, 730, 735, VP220, 225, 245, VR1032,	140p	VC8300	150p				
2966, 2980, 821, 925, VXL25	30p	VC8300	150p				
NEVHL, VCP, VH1204, 2004, 2204, 3050,	130p	VC8300	150p				
3060, 4008, 400, 4012, 412, 512, 600, 666,	70p	VC8300	150p				
744, 774, 7905, 800, 820, 900, 974, VP200,	70p	VC8300	150p				
VR2949, 2956, 2957, VXL20	90p	VC8300	150p				
VC150, 180, VH1000, 200, 201, 205, 212,	75p	VC8300	150p				
250, 254, 288, 300, 303, 3030, 312, 33,	90p	VC8300	150p				
3312, 404, 555, 700, 704, 708, 712, 770,	75p	VC8300	150p				
780, 844, 900, VHF2, VH3	80p	VC8300	150p				
VH1, VH2A	150p	VC8300	150p				
<b>PHILIPS</b>		VC8300	150p				
VR6460, VR6920	170p	VC8300	150p				
VR6540	100p	VC8300	150p				
DV186, 286, 291, 292, 468, 471, 562, 571,	100p	VC8300	150p				
761, VR201, 202, VR20DV1, 20DV2,	100p	VC8300	150p				
20RW7, 25B01, 25B02, 302, 303, 305,	100p	VC8300	150p				
VR30DV2, 35B02, 35B03, 635B7, 715B4,	100p	VC8300	150p				
715B5, 715B8, VR865B2, 915B2, 925B3,	100p	VC8300	150p				
VR8180, 6185, 6285, 6290, 6291, 6293,	100p	VC8300	150p				
6367, 6390, 6391, 6393, 6467, 6468, 6470,	100p	VC8300	150p				
6561, 6570, 6581, 6670, 6676, 6760,	100p	VC8300	150p				
VR6442, 865B1, 925B3	85p	VC8300	150p				
VR6442, VR6542	70p	VC8300	150p				
VR2025, VR2580	100p	VC8300	150p				
VR445B9, BR445B920, VR445B922,	100p	VC8300	150p				
BR6843	100p	VC8300	150p				
VR6548, VR6648, VR495B620,	100p	VC8300	150p				
VR6448695	110p	VC8300	150p				
<b>SABA</b>		VC8300	150p				
VR6420, 6435, 6440, 6460, 6480, 6620,	65p	VC8300	150p				
6770, 7200, 8420, 2A10, 70, 2B20, 3B20,	65p	VC8300	150p				
4A10, 4B20, 6A10, 6A70, 6B20, 8B20, 65p	65p	VC8300	150p				
VR6004, 6005, 6011, 6014, 7004, 7011,	90p	VC8300	150p				
7014, 8011, 8014, BERLIN	130p	VC8300	150p				
VR2000, VR6000, VR6012, VR7000,	135p	VC8300	150p				
VR7720, PVR6058	135p	VC8300	150p				
VR9005, VHR7000	135p	VC8300	150p				
VR6006, 6007, 6008, 6009, 6015, 9016,	65p	VC8300	150p				
9018, 6038, 7006, 7007, 7016, 7018,	65p	VC8300	150p				
9006	65p	VC8300	150p				
<b>THOMSON</b>		VC8300	150p				
SV1000, V410, 430, 450, 510, 520, 530,	65p	VC8300	150p				
540, 620, 630, 640, 4240, SV5540	75p	VC8300	150p				
TX8000, V309, V357, VK411	75p	VC8300	150p				
TX8500, V342, 343, 351, 352, 353, 360,	90p	VC8300	150p				

**VIDEO SERVICE KITS**

**AMSTRAD**  
VCR700  
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**FERGUSON & JVC**  
3V42/43  
HRD455/HRD725  
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*Economy Kit Contents*  
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HRD170/180/210/230/300/320/370/400/430/530/700/750  
HR55000  
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3V29/3V30  
HR7200/7300/7350  
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BELT SET PINCH ROLLER TENSION BAND IDLER TYRES  
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3V35/36/38/39/49  
HRD110/111/120/225  
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3V31/3V42  
HR7600/7610/7650/7655  
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BELT SET T.U REEL TABLE TYRE PINCH ROLLER REEL IDLER T.U CLUTCH  
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3V35/36/38/39/49  
HRD110/111/120/121/225  
*Contents*  
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Order Code: SK35 £10.00

*Economy Kit Contents*  
BELT SET T.U REEL TABLE TYRE SUPPLY REEL TABLE TYRE PINCH ROLLER T.U CLUTCH T.U IDLER REEL IDLER TYRE  
Order Code: SK36 £5.50

3V29/3V30  
HR7200/7300/7350  
*Contents*  
BELT SET T.U REEL TABLE TYRE SUPPLY REEL TABLE TYRE PINCH ROLLER REEL IDLER T.U CLUTCH T.U IDLER TENSION BAND VIDEO LAMP  
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HRP50/HRD140/150/158/160  
HRD250/257/565/566/755  
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*Economy Kit Contents*  
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*Economy Kit Contents*  
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Order Code: SK69 £3.00

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VT11/VT33  
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**VIDEO SERVICE KITS (Cont.)**

VT11/VT33  
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BELT SET T.U REEL TABLE TYRE SUPPLY REEL TABLE TYRE PINCH ROLLER FF/REW IDLER CLUTCH PLATE TENSION BAND  
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VT100/110/111/113/115/118/120/125/128/130/135/138/145/150/175/220/225/250/255/258/260/VTL30  
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BELT SET PINCH ROLLER TENSION BAND IDLER TYRE  
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BELT SET PINCH ROLLER IDLER TYRE PULLEY TYRE  
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*Contents*  
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*Economy Kit Contents*  
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*Contents*  
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*Economy Kit Contents*  
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VC381  
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VT65, 85, 86, 88, 330, 640				
VT1000, 110, 111, 113	FF REW ARM	6886792	240p	
VT115, 118, 119, 120, 125, 128, 130, 135, 138, 145, 150				
VT175, 220, 225, 250, 255, 258, 260, VTL30				
VT400, 405, 410, 413	FF-REW ARM	6887094	£1.30	
VT414, 415, 418, 420, 425, 426, 428, 430, 431, 435				
VT438, 450, 498, 510, 518, 520, 525, 526, 530, 535				
VX530, 540, 545, 546, 548, 570, 575, 576, 580, 585				
VX588, VTM625, 626, 630, 635, 636, 640, 645, 646, VTS80, 85				
VT400, 405, 410, 413	CLUTCH BASE	6886951	£3.25	
VT414, 415, 418, 420, 425, 426, 428, 430, 431, 435				
VT438, 450, 498, 510, 518, 520, 525, 526, 530, 535				
VX530, 540, 545, 546, 548, 570, 575, 576, 580, 585				
VX588, VTM625, 626, 630, 635, 636, 640, 645, 646, VTS80, 85				
VT3000	T UP IDLER (LARGE)		£4.50	
VT3000	REW IDLER		£6.00	

VT800, 6500, 6800	FS BRAKE	6861505	230p	
VT9700, 9900				
HTFACHI TV				
OUTPUT MODULE HM 6251			£5.50	
OUTPUT MODULE HM 6232			£8	
JVC				
HR330, 3660, 4100	T UP IDLER SML	PU49280	£5.50	
HR7200, 7300, 7650	T UP CLUTCH	PU53462A	220p	
HR7655, 7300, 7350, 7610				
HR7600, 7610, 7650, 7655, 7700	REEL IDLER	PU48967	175p	
HR7670, 7610, 7650	ROLLER ASSY	PU49042A	350p	
HR7655, 7700				
HR330, 3660, 4100	T UP IDLER LRG	PU47752	£4.50	
HR7200, 7600, 7650	T UP IDLER	PU51402A	100p	
HR7655, HRD110, HRD111, HR7300, 7350, 7610, HRD120, 121, 225				
HRD110, HRD120, 121, 225	T UP CLUTCH	PU55373	150p	
HRD225, HRD111				
HRD110, HRD120, 121, 225	IDLER ARM	PU55374-3-8	200p	
HRD225, HRD111	IDLER ARM			
HRD170, 180, 210, 230	IDLER ARM	PU58466	£2.25	
HRD320, 370, 400, 450, 470, 530, 700, 750, 950, 3000				
HR5600, HRS5500				
HRD455, HRD725	CLUTCH MECH	PU55822	1200p	
HRD140, 150, 157, 158	CLUTCH MECH	PU57658	1050p	
HRD160, 250, 257, 565, 566, 755, HRP50				
HR3300, HR3320	REW IDLER	PU46380	500p	
HR3660, HR4100				
HRD140, 150, 157, 158	TAKE UP CLUTCH	PU56043-1-4	240p	
HRD160, 250, 257, 455, 565, 566, 725, 755, HRP50				
HRD140, 150, 157, 158	TAKE UP CLUTCH	PU56044-1-5	160p	
HRD160, 250, 257, 455, 565, 566, 725, 755, HRP50				
MATSUI				
VX730, 736, 750, 755	CLUTCH	850A00005	420p	
VX910, 820, 850, 890, 990				
VX730, 750, 755	LIMITED POST LEVER		£1.30	
VX770, 800, 810, 880	ASSY			
VX990				
VX800A, VX900	IDLER REEL		£1.50	
VX800A, VX820	REEL UNIT CLUTCH		280p	
MITSUBISHI				
HS306, 307, 318, 319	GEAR ASSY	522B00201	£6.25	
HS400, 410, 710				
HS337, 338, 411, 421	IDLER	562801701	325p	
HS411, 412, 421, HS810, HS820, HS830, HSE10, HSE20, HSE30, HSE70				
HS306, 307, 318, 319	IDLER	641C34301	£2.00	
HS400, 410, 710				
HS337, 338, 411, 421	IDLER	522902002	£3.00	
HS810, HS820, HS830, HSE10, HSE20, HSE30, HSE70				
HS337, 338, 411, 421	IDLER	562801801	320p	
HS200	TAKE UP IDLER (LARGE)		£4.50	
HS200	UNLOADING IDLER		£4.00	
HS200	REWIND IDLER		£5.00	
HS306, 307, 318, 319	SUPPLY REEL	522A00101	£3.20	
HS400, 410, 710	DISK		£3.00	
HS306, 307,				

# REMOTE CONTROLS

Description	Order Code	Price	Description	Order Code	Price
<b>GRUNDIG</b>			<b>PHILIPS (continued)</b>		
TP160E	RC 107	900p	RC38	RC 301	750p
TP200, TP300	RC 380	800p	KT3 TEXT	RC 5301	750p
TP400	RC 401	675p	RC5352	RC 5352	800p
TP590-600	RC 600	850p	RC5375	RC 5375	850p
TP390, TP610	RC 610	850p	RC5 STANDARD	RC 5534	850p
TP621	RC 621	850p	RC5901	RC 5901	850p
TP630, TP650	RC 650	850p	RC5903	RC 5903	700p
TP660	RC 660	850p	<b>SABA</b>		
TP661	RC 661	850p	T6772	RC 149	900p
<b>HITACHI</b>			TC319-320	RC 328	875p
CLE800-CLE830	RC 140M	700p	TC356	RC 356	875p
A617402/655602	RC 192	875p	TC358	RC 358	850p
A512120/230	RC 900	800p	TC360	RC 360	800p
A514790	RC 901	800p	TC365	RC 365	800p
A5088470	RC 902	800p	<b>SALORA</b>		
A518612	RC903	900p	SERIES L	RC 190	875p
SCL002	RC904	850p	86173	RC 882	850p
C2096	RC 905	850p	<b>SANYO</b>		
A511940	RC 906	750p	RC218, RC222, RC228, RC238	RC 140M	700p
655602H	RC 907	800p	JXGE	RC 878	850p
<b>ITT</b>			JXDE	RC 884	850p
IFB13, 14, 15	RC 143	875p	VHR2300	RC 890	850p
FS4	RC 148	850p	RC628	RC 865	900p
RG305	RC 305	675p	<b>SHARP</b>		
RG306	RC 306	825p	G0121CESA, 123CESA, 204, 251	RC 140M	850p
FS9/1-10/1	RC 307	850p	<b>SIEMENS</b>		
VS5 RUK	RC 308	825p	FC616	RC 130	850p
VS4-1	RC 310	850p	FC631	RC 132	850p
MULTICONTROL (17C20)	RC 311	800p	FC742	RC 164	900p
<b>KORTING</b>			<b>SONY</b>		
18279, 18396, 18460, 18521 SE	RC 108	850p	RM604, RM605, RM606	RC 140	700p
40540 VTS	RC 108	900p	32 CHANNEL	RC 140M	700p
<b>LOEWE</b>			RM613	RC 141	750p
DC11	RC 146	850p	RM632, RM636	RC 160	675p
<b>MATSUI</b>			<b>TATUNG</b>		
010270601	RC 889	850p	FXA	RC 877	850p
VX770	RC 892	850p	RC70	RC 883	750p
<b>METZ</b>			FX70 FASTTEXT	RC 894	850p
JAVA COLOR (6890)	RC 166	850p	<b>TELEFUNKEN</b>		
COLOR (7156)	RC 183	850p	FB632	RC 632 ST	850p
JAVA (7180)	RC 184	850p	FB639	RC 639 ST	850p
<b>MITSUBISHI</b>			<b>THORN/FERGUSON</b>		
939P/03607, 939P/03609	RC 140M	850p	3V35-42	RC 342	650p
<b>NOKIA</b>			3V31-32	RC 344	800p
SATELLITE	RC 550	850p	3V57-58	RC 628	800p
<b>NORDMENDE</b>			TX10 TEXT	RC 732	575p
TC2336	RC 351N	850p	TX10 STEREO TEXT	RC 738	575p
CMC1, TC3519	RC 356	875p	TX9-90-100	RC 740	675p
<b>OCEANIC</b>			3V55, FV11	RC 783	800p
390C9500	RC 339	900p	TX100 FASTTEXT	RC 785	650p
<b>ORION</b>			TX100 STEREO FASTTEXT	RC 789	650p
RC53	RC 892	850p	PROFESSIONAL	RC 790	650p
<b>PANASONIC</b>			<b>TOSHIBA</b>		
EUR51200	RC 200	800p	CT937	RC 950	850p
TC2200	RC 201	850p	CT9117	RC 951	800p
VSQ0357/NV730	RC 202	875p	201R4B	RC 952	800p
TNQ1621	RC 203	900p			
<b>PHILCO</b>			<b>UNIVERSAL PROGRAMMABLE REMOTE CONTROL</b>		
CARVEL, CONCORDE,	RC 108	850p	Controls up to 4 different devices which use infra red remote controls including TV, audio, VCR and satellite. (need original remote control TC program)		
MERCURY, TELESTAR	RC 152	900p	Order code: IR100R Price: 1950p		
TC10			<b>We stock Remote Controls for over 5000 different models. Ring for further details on 081-900-2329.</b>		
<b>PHILIPS</b>					
RC5002,5154	RC 134	850p			
KT3 NON TEXT	RC 135	825p			
69117032	RC 178	875p			
69117194	RC 180	875p			
RC5991-UNIV	RC 300	580p			

**VCR ALIGNMENT KIT**

CONTAINS:

- SET OF 7 HEAD & TAPE PATH ALIGNERS
- RCA TYPE AUDIO & CONTROL HEAD POSITIONING TOOL
- RCA ADJUSTMENT TOOL FOR TAPE GUIDE POSTS
- RCA TYPE BACK TENSION TOOL
- TENSION ADJUSTMENT TOOL FOR VARIOUS USES
- VCR ADJUSTMENT TOOL

SET OF 8 ALLEN KEYS

- 0.77mm
- 0.90mm
- 1.27mm
- 1.50mm
- 1.60mm
- 2.00mm
- 2.40mm
- 3.00mm

3 Reversible Screwdrivers  
Spring Hook

Circlip Pliers  
Micro Screwdriver

VCR Head Extractor

**Order Code: TOOL10 Price: 2900p**

**FUSES**

Value	TIME LAG (20mm)		QUICK BLOW (20mm)	
	Order Code	Price	Order Code	Price
160mA	FUSE01	75P	FUSE17	60P
250mA	FUSE02	75P	FUSE18	60P
315mA	FUSE03	75P	FUSE19	60P
400mA	FUSE04	75P	FUSE20	60P
500mA	FUSE05	75P	FUSE21	60P
630mA	FUSE06	75P	FUSE22	60P
800mA	FUSE07	60P	FUSE23	60P
1A	FUSE08	60P	FUSE24	60P
1.25A	FUSE09	60P	FUSE25	60P
1.6A	FUSE10	60P	FUSE26	60P
2A	FUSE11	50P	FUSE27	60P
2.5A	FUSE12	50P	FUSE28	60P
3.15A	FUSE13	55P	FUSE29	50P
4A	FUSE14	55P	FUSE30	50P
5A	FUSE15	60P	FUSE31	50P
6.3A	FUSE16	60P	FUSE32	50P

**FUSES**

CURRENT RATING	ORDER CODE	PRICE
<b>CERAMIC PLUG TOP</b>		
3A	FUSE33	100P
5A	FUSE34	100P
13A	FUSE35	100P
<b>20MM CERAMIC TIME LAG</b>		
3.15A	FUSE41	100P
4A	FUSE42	100P
5A	FUSE43	100P
6.3A	FUSE38	100P
8A	FUSE39	100P
10A	FUSE40	100P
<b>32MM CERAMIC SLOW BLOW</b>		
8A	FUSE44	210P
10A	FUSE45	210P
15A	FUSE46	210P
20A	FUSE47	210P
<b>38MM CERAMIC SLOW BLOW</b>		
10A	FUSE48	875P

ALL THE ABOVE PRICES ARE FOR PACKS OF 10 FUSES

**I.C. PROTECTOR**

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

Price: Only 30p each

**AUDIO CONTROL HEAD**  
Amstrad Original No: 150751  
Used on Amstrad TVR1.2.3, VCR4600, 4600MII, 4700  
Funai V2S, VCR4600, 4800, 5200, 5600, 6600, VIP3000, 5000  
Also fits: Fidelity, Funai, Hinari, Proline, Schneider, Towada, Ultravox

Order Code: AH01 Price: £13.50

**Amstrad Original No: 153154**  
Used on Amstrad 008900, 8904, VCR2000, 6000, 8600, 8602, 8603, VCR8604, 8700, 8704, 8714, 8800, 9005, 9244  
Also fits: Anitech, Boadstec, Casio, Crown, Fidelity, Goldhead, Granada, Hinari, Marguant, Omega, Protex, Schneider, SEG, Sentra, Shiptom, Tashiko, Tatung, Towada, Universum

Order Code: AH02 Price: £14.50

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# JUST ARRIVED!!! NEW ITEMS

## Satellite PSU Repair Kits

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

MAKE & MODEL	ORDER CODE	PRICE
PACE PRD800, PRD900	SATPSU1	650p
PACE SS9000, 9200, 9010, 9020, 9220	SATPSU2	650p
AMSTRAD SRD510, SRD520	SATPSU3	650p
AMSTRAD SRD500	SATPSU4	650p

## Replacement Video Heads

MAKE	MODELS	PRICE
HITACHI	VT570, VT575, VT576, VT580, VT585 VT588, VTF70	3100p
I.T.T.	VR3761	3100p
JVC & FERGUSON	HRD950, HRD960, HRD980, FV46	5000p
LUXOR	VR3761	3100p
MITSUBISHI	HSE51	3000p
NATIONAL	NVFS200, NVFS90, NVV8000	4600p
PANASONIC	NVHD100, NVHD101, NVHF100	3100p
	NVSD	1400p
	AG7330, AG7350, AG7355, AG7450	5000p
	NVFS100	5000p
N.E.C.	D5600	3500p
SANYO	TL51000P, TLS1001P, TLS1100	3100p
	VHR7800, VHR7810, VHR8000SP, VHR8801SP, VHRD4800	3100p
SHARP	VCH80, VCH81, VFH815	2800p
	VCA33, VCA36, VCA43, VCA44, VCA46, VCA49	1500p
	VCA55, VCA63	2200p
SONY	SLV656, SLV715, SLV757, SLV777, SLV815, SLV825	4600p
	SLV353UB	3200p
	CCDF340E, CCDF500E, CCDV90E, CCDV95E, CCDSPE	4800p

## Original Video Heads

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

## Audio Control Head

**AMSTRAD ORIGINAL NO: 150751**  
Used on: AMSTRAD TVR1, 2, 3, VCR4600, 4600MKII, 4700, FUNAI VS2, VCR4600, 4800, 5200, 5600, 6600, VIP3000, 5000  
Also fits: FIDELITY, FUNAI, HINARI, PROLINE, SCHNEIDER, TOWADA, UNIVERSUM ORDER CODE: AH01 PRICE: 1350p

**AMSTRAD ORIGINAL NO: 153134**  
Used on: AMSTRAD DD8900, 8904, VCR2000, 6000, 6100, 8600, 8602, 8603, VCR8604, 8700, 8704, 8714, 8800, 9005, 8244  
Also fits: ANITECH, BONDSTEC, CASIO, CROWN, FIDELITY, GOLDHAND, GRANADA, HINARI, MARQUANT, OMEGA, PROFEX, SCHNEIDER, SEG, SENTRA, SHINTOM, TASHIKO, TATUNG, TOWADA, UNIVERSUM ORDER CODE: AH02 PRICE: 1450p

## Replacement Audio Control Video Sound Head for National Panasonic

PART NUMBER	MODELS	PRICE
VBR 0091	NVG7 etc	875p
VBR 0050	NV300, NV340 etc	875p
VBR 0061	NV777 etc	875p
VBR 0103A	NV250, NV450 etc	625p
VBR 0125		625p

## 8 way Preprogrammed Universal Remote Control

A single remote control to operate Televisions, Videos and Satellite Receivers, Plus Auxiliary Options!!  
\* Replaces up to 8 remotes with one \* Simple 4 digit setup routine  
\* Controls 1000s of models \* Teletext functions with Fastext  
\* Clear (large key) layout \* Code Search Facility  
\* Stylish and easy to operate \* Replace broken or lost remotes  
\* Original Remote not required  
Order Code: 8 WAY Price 1450p + VAT

## Replacement Video Cassette Housings

MAKE	MODELS	CODE	PRICE
AKAI	VS35, VS53, VS55, VS56, VS75	CH18	2600p
GRANADA	VHSDP1	CH05	1100p
	VHSYJ2	CH01	2600p
GOLDSTAR	GHV1290P, 1291P, 1295P, 9400, 73401, GSE1295P, GSE1891P, 20001Q, 20051O, VCP4200, 4300, 4301, 4305, VCP4306, 4311, 4315, 4316, 4320, 4321, 4325	CH25	2000p
	GHV51, 1221, 1232, 1240, 1241, 1242, 1244, 1246, 1248, GHV8000, 8200	CH26	2900p
FERGUSON & J.V.C.	3V38, 3V39, 8943, 8944, 8951, 3V35, 3V36, 3V49, HRD 110, 111, 120, 121, 225	CH01	2600p
	3V12, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V57, 8945, 8947, 8948, HRD140, 141, 150, 157, 158, 160, 25D, HRD257, 455, 565, 566, 725, 755	CH02	2600p
	8948, 8950, FV10B, 12L, 15H, 14T, 20B, 21R, 22L, 26, 395, HRC230, 430, 530	CH03	2600p
	3V58, 3V59, 3V64, 3V65, FV11R, 8950, 8951, HRD170, HRD18C, HRD370	CH04	2600p
	FV31R	CH19	4300p
	HRD515, 520, 527, 540, 550, 580, 600, 610, 620, 660, 670, HRD830, 840, 850, 860, 4050, 6600, FV37H	CH20	2400p
	HRD540, 580, 830, 860, 910, 960, HRD970, HRD920, FERGUSON FV57H	CH27	2400p
I.T.T.	VF3605, VR3905	CH01	2600p
	VF3916, 3926, 3946, 3948, 3976, 3986, 3995, 3997, 6948	CH02	2600p
	VF3916, 3926, 3946, 3948, 3976, 3986, 3995, 3997, 6948	CH02	2600p
NATIONAL PANASONIC	NV730	CH06	4300p
N.E.C.	NE30EG, NB31EG, NB32, NB33EG	CH01	2600p
	NE95	CH02	2600p
PHILIPS	CASSETTE LIFT ASSEMBLY (69120366) DV186, 190, 286, 471, 562, 761, VR6180, 6182, 6185, 6285, VR6290, 6291, 6293, 6362, 6367, 6393, 6467, 6468, 6470, VR6561, 6670, 6760, 6761, 6870, 6870	CH05	1100p
	VF6443	CH22	2900p
	VF6448	CH23	2500p
	49SB6	CH24	2500p
SHARP	VCA100, VCH851, VCH852	CH22	2900p
	VCA103, 103GV, 106, 106GV, 254GVM	CH23	2500p
	VCS211, 244, 5055, 605, VCB230, VCD806G, 810G, VCT212, 310, 410G, 610	CH24	2500p
TELEFUNKEN	VF2970	CH02	2600p
THOMSON	V320, 321, 323, 326, 4200, 4300	CH01	2600p
	V342, 343, 352, 353, 360, 364, 368, 4210, 4230, 4260, 4400, V5500, 6000, 8540	CH02	2600p
TOSHIBA	V55, V57	CH01	2600p
	V65, V66	CH02	2600p

## Service Aids

DESCRIPTION	VOLUME	CODE	PRICE
VIDEO HEAD CLEANER	75ML	SP01	140p
SWITCH CLEANER	176ML	SP02	150p
SILICONE GREASE	200ML	SP03	170p
FREEZE IT	170ML	SP04	220p
FREEZE IT	400ML	SP16	350p
FOAM CLEANER	400ML	SP05	170p
ANTI STATIC	150ML	SP06	170p
AEROKLEANE	135ML	SP07	200p
AERO DUSTER	150ML	SP08	220p
AERO DUSTER	400ML	SP17	425p
PLASTIC SEAL	200ML	SP09	200p
GLASS CLEANER	250ML	SP10	160p
COLDKLENE	250ML	SP13	200p
EXCEL POLISH #0	250ML	SP18	150p
ADHESIVE 120	400ML	SP19	190p
LABEL REMOVER 130	200ML	SP20	240p
REFURB 140	400ML	SP21	240p
TUBE SILICON GREASE	50 GRAMMES	SP11	200p
TUBE SILICON SEALANT WHITE	75ML	SP22	280p
TUBE SILICON SEALANT CLEAR	75ML	SP23	280p
TUBE HEAT SINK COMPOUND	25 GRAMMES	SP12	150p
DRIVE CLEANER	200ML	SP24	150p
SCREEN CLEANER	200ML	SP25	150p
COMPUTER CARE KIT		SP26	2100p

All the above items are manufactured by Servisol  
If you purchase more than one Servisol Product, postage & package will be charged as follows:  
300p for 5 cans 450p for more than 5 cans

## CD Pick Ups

SONY OPTICAL PICK UP	PRICE
PART NO: KSS21CA SONY CDPC 301M, CDPC 305M	2200p
Fits most Sony, Akai & J.V.C. Portable Hi-Fi and Midi Systems	
PART NO: KSS21CB	
USED ON MODELS: CFD100, 105L, 120, 300, 440, 454, 455, 50, 500, 55, 58, 60 CFD68, 750, 755, 760, 765, 770, 775, 440S, W100, 100S	2200p

## Cassette DC Motors

MOTOR TYPE	PRICE
6V MOTOR	170p
9V MOTOR	170p
12V CW MOTOR	170p
12V CCW MOTOR	170p
13.2 CCW MOTOR	290p

## Cassette Tape Heads

HEAD TYPE	PRICE
MONO HEAD	90p
STEREO HEAD	110p
MINI HEAD	150p
AUTO REVERSE HEAD	200p

## Soldering Accessories

DESCRIPTION	CODE	PRICE
ANTEX SOLDERING IRONS		
25 WATT 240 VAC (XS25W 240V)	S101	900p
15 WATT 240 VAC (XS15W 240V)	S102	900p
25 WATT SPARE ELEMENT	S103	450p
15 WATT SPARE ELEMENT	S104	450p
SOLDERING STAND & SPONGES		
SOLDERING STAND (MADE BY ANTEX)	S108	350p
SPARE SPONGE	S109	55p
SOLDER		
18 SWG 500 GRAMMES	S110	500p
20 SWG 500 GRAMMES	S111	650p
22 SWG 500 GRAMMES	S112	700p
DESOLDERING AIDS		
SOLDER MOP STANDARD GAUGE 1.2mm x 1.5M	S107	70p
SOLDER MOP 1.2mm x 10M	S113	400p
DESOLDERING PUMP	S105	320p
SPARE NOZZLE	S106	80p

## Transistors & ICS

BU 508A (PHIL)	80p	MJE 13009	100p	2SC 3885A	350p
BU 910	110p	MJE 18004	125p	2SD 633	70p
BUZ 90A	180p	STK 6982H	600p	2SD 1680	225p
CXA 1044P	550p	STK 7253	450p	2SK 793	400p
HA 13408	350p	TDA 2030H	100p	2SK 956	1400p
IRFBC40	400p	TEA 2019	200p	2SK 1023	550p
L272	200p	TMP 47C434N	1250p	2SK 1342	750p
L6210	250p	SAA 1300	200p	2SK 1358	600p
MC 3423P	100p	2SA 1540	55p	68000	500p
MJ 15015	250p	2SC 3788	60p	82S147	450p
MJ 15016	550p	2SC 3885	350p		

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## *An Economy in Trouble*

Not ours for a change but, would you believe it, the Japanese economy. Because of the grossly overvalued yen, it has become very difficult to sell anything produced in Japan abroad. One after another Japanese firm has been announcing plans to either move all production overseas or increase offshore production. Here are just a few recent examples. Toshiba is setting up a TV receiver plant in Jakarta, Indonesia. It will be capable of producing a million sets a year by 1997. Most will be exported: to other Asian countries, North and South America, eastern Europe, the Middle East etc. The company expects world demand for TV receivers to increase steadily over the next few years – but not the demand for receivers produced in Japan. Sony recently announced plans to increase overseas production from 42 to 50 per cent during the current fiscal year. Things appear to be so bad that some head office functions are to be shifted abroad as well. Sanyo has been producing more and more of its output abroad, and recently announced a further increase in overseas VCR production. Akai is to cut its Japanese workforce by 40 per cent as it lifts overseas production from 60 per cent last year to 70-80 per cent. The company, which is now controlled by Semi-Tech Global of Hong Kong, plans to cease production in Japan completely. And so the sad story goes on, not only in the electronics field. The consumer electronics manufacturing capacity that will be left will be used solely for the production of up-market products

for sale to Japanese customers.

This is an extraordinary turnaround from the days when Japanese domestic manufacturers aimed primarily to achieve a greater market share, with reliance on ever more exports to soak up the increased production. The blame for having to drop this policy is in every case placed on the excessive exchange value of the yen.

Economic textbooks would suggest that this can't happen. An overvalued yen would lead to increased imports and, in having to pay for these, the value of the yen would fall. But the Japanese still don't buy overseas products to the extent that most developed countries do. The books also suggest that an exchange rate overvaluation must be self-correcting. Failure to export will lead to currency depreciation. The trouble is that the textbooks don't take into account the strange things that can happen in the real world. During the years when Japan had a massive balance of trade surplus (it still has a positive trade balance), Japan built up huge holdings of overseas assets. What, after all, do you do with all those dollars, pounds and so on you earn by selling abroad? But by bidding up the value of overseas assets, Japan faced a potential danger. What would happen should recessionary conditions overseas result in a decline in the value of these assets? This duly happened, and the Japanese began to think twice about holding overseas assets. It's a mug's game to work to build up investments whose value declines. What to do? Repatriate as much as you can. Result? A further fall in the value of overseas assets,

reflected in an increase in the value of the yen. There is, it seems, at present no way out of this impasse.

In theory, repatriated funds should have increased the value of Japanese domestic assets. But by the late Eighties the value of Japanese stocks, land and other assets had already reached unrealistically high levels. There had been an asset boom of 1929 Wall Street proportions. As in America in the Twenties, it was fuelled by loans. What happens when the selling starts and the loans fall due? A crash, that's what happens. The Japanese banking system is in substantial danger from write-offs and what are euphemistically called non-performing loans.

This has naturally had an effect on the Japanese domestic economy, which has been stagnant for the past four years. There is a massive feel-bad factor in Japan, as asset values fall, jobs are lost and production is curtailed. This time there is no possibility of Japan exporting its way out of trouble.

The textbooks don't take into account the excesses that can and do occur in the real world, and offer no solutions. It has been suggested that Japanese interest rates should be reduced. Short-term rates are already minimal at 0.8 per cent. Not much scope here. Japan should liberalise its trading practices. Yes indeed, but this is a long-term solution to a very real present problem. And just what would the Japanese be buying? Hopefully, for all our sakes, the excesses will gradually unwind in an orderly fashion. But, in the process, the Japanese economy has been severely damaged.

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### COVER PHOTO

This month's cover photograph shows the mechanism in the Matsui VX2000 VCR. See servicing article on pages 810-812.

# Service Briefs from Toshiba

*The following information is based on Toshiba Technical Bulletins CDH50-CDH54 issued between October 1994 and June 1995. This month we cover VCRs.*

## Models V110B/V210B

**Erases prerecorded tapes:** Replace leaky BC548B transistor in position TW56 (REC supply), part no. 70010134.

**Drum speed varies in play, eject operation is slow:** Replace BD435 5V regulator transistor in position TT52 on the main PCB, part no. 70010149.

**Machine locks up when going from fast forward to play or play to stop:** Replace the U2559B servo control reset chip IT46, part no. 70010170

**Playback picture has striation lines, E-E and playback sound is distorted:** Replace the 2.2 $\mu$ F, 50V capacitor CN77 at the base of TN81 (+5V switch).

## Models V204B V254B V404B V454B V804B V854B

Note that these VCRs come with a double-shielded r.f. lead which should be used, otherwise interference patterning may be experienced.

All previous versions of the main microcontroller chip IT001 (CAT1 models) have been superseded by type TMP90CR74DF-7356, part no. 70012290.

**Buzz on sound with only some channels and some transmitters/relays:** Cause is excessive video modulation at the r.f. modulator's output. Adjust the orange potentiometer inside the tuner/modulator.

**Machine dead with pulsating power supply:** Capstan motor B560 could be presenting a short-circuit across the 14V supply. If so replace it – part no. 70031498.

**Tape chewing or erratic capstan motor operation:** Can be caused by poor contact at capstan motor connector BT006 (CAT1) or P502 (CAT2). Replace connector, part no. 70011830. When fitting the motor, ensure that the hole in the motor PCB is aligned with the hole in the mechanism deck.

**Satellite control signal too slow for Pace receivers, i.e. selects only single-digit channels 1-9:** Replace KDB microcontroller chip ICK01 (CAT1) or ICX01 (CAT2) with latest version, TMP87CK70AF-6251, part no. 70012260.

**No eject (CAT1 and 2):** T loading assembly B470 has worn out gear. Replace with improved part kit 70903974.

**Tape damage – cassette may be stuck in unit (CAT1):** Caused by the fact that the capstan motor doesn't stop immediately after rewind or fast forward, hence a loop of tape spills into the machine. Capstan FG not detected. Cure is to add a 100 $\mu$ F, 6.3V capacitor across the Cap +5V supply, on the component side of the PCB with the positive lead to the cathode of DT107 and the negative lead to chassis at jumper JT035.

## Model V210B

**No playback colour, black lines running down screen:**

Replace the 47nF, 63V capacitor in position CV13, connected to pin 12 of IV08.

## Models V211B V411B

**Machine dead with FP01 (630mA) open-circuit, no other fault found:** Replace the fuse and change the value of the r.f. filter capacitor CP01 from 0.1 $\mu$ F to 0.0047 $\mu$ F, part no. 24094916.

## Models V212B V213B V312B V412B V423B V513B

**Field jitter and rolling playback picture; can also go to the play mode with the E-E picture and sound remaining:** Cause is dust build up between the drum flywheel veins – clean.

**Playback picture has interference spots in an almost triangular waveform pattern:** Cause is poor drum spindle static discharge under the plastic flywheel. Clean the brush.

**Tape loop formed when a cassette is ejected:** Replace spring K188, part no. 70050638.

**E-E picture has slight white overloading, playback picture has distorted white with no colour:** Replace leaky 220nF chip capacitor in position CN13, between pins 21 and 22 of IN01.

**Erratic mechanism operation and clock:** Replace CP81 (1,000 $\mu$ F, 16V) in the power supply.

**Machine dead but drum rotating:** Replace leaky MPS750 14V switch transistor TP83 in the power supply, part no. 70010939.

**Machine dead, power supply buzzing:** The L2726 loading motor drive chip IT60 could be faulty. If so, replace it – part no. 70010975.

## Models V213B V423B V513B

**E-E picture and sound pulse on and off:** Replace the TDA5930 video i.f. chip II40 on the main PCB, part no. 70010531.

**Tape loads around the drum but no cue or review action so tape unloads, leaving a loop:** Replace cam sensor (photo-coupler) GT23, part no. 70010961.

## Models V300B V309B V500B V509B

**Patterning on E-E pictures:** Replace L811, part no. 23221817, in the power supply because of shorted turns.

## Models V212B V312B V412B

**Correction:** In the final note under this heading on page 53 of our November 1993 issue the two capacitors should have been

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specified as CQ06 and/or CQ07 (both 4-7nF), not CQ05 and/or CQ06.

### Model V411B

**Poor or no playback colour:** Can be caused by the BC558 transistor in position TV37, part no. 70010137.

**Weak video and bent verticals:** Can be caused by CA09 (10µF) on the OSD PCB. Replace with a 35V type.

**Bent verticals and poor field sync:** Can be caused by CA02 (100µF) on the OSD PCB. Replace with a 16V type.

### Models V703B V813B

**Tape loads, drum twitches then machine goes to standby:** Replace loading motor B630, part no. 70322489. Spikes from the motor get on to the supply and corrupt the logic at the microcontroller chip.

**Tape loads around drum, tape guides unload half way leaving tape around drum, then the machine shuts down:** Replace Z111 mode sensor ABS (photocoupler), part no. 70128691.

**Intermittent linear mono audio track recording and failure to erase old track:** Caused by poor connections to the full-width erase head (FE). Solder the wires directly to the head connections.

**No display:** D.c.-d.c. converter Z832 (DK2A, part no. 23107555) has failed. ICPN10 Z831 (part no. 23118132) will

probably be open-circuit.

**Machine is dead with reset at pin 68 of IC501 low and the 8MHz timer clock not running:** Cause is loss of a.c. pulses from the power supply because the TLP721 photocoupler IC801 has failed. Part no. is A8645130.

### Models V804B V854B

Note that all previous versions of the main microcontroller chip IC501 have been superseded by type TMP90CR74DF-7329, part no. 70903981. When replacing this chip also replace C539 with the 8pF capacitor supplied.

**Warning:** The initial surge can cause failure of IC803 (STR-D6802) when the machine is connected to the power supply. In this event a piece of its encapsulation can be discharged. When servicing the machine, take care if you plug it in with the cover removed. The part no. is 70903964: fit the modification kit that comes with it. The chip does not fail during normal operation.

**Intermittent poor playback picture with no colour:** Cause is probably missed solder connections at pins 1 to 15 of the TA8894AF chip IC101, which is a surface-mounted device. Resolder as necessary.

**No video, blank screen:** Refit rear terminal PCB connector PF01 if this has separated from the main PCB connector P201. In later production this end of the terminal PCB is glued to the main PCB. This prevents the fault but means that care is required when removing the terminal PCB for other repairs.

# Teletopics

## GoldStar Takes Over Zenith

Control of Zenith, the last remaining indigenous US TV setmaker, has passed to Korean manufacturer LG Electronics, which is better known under its brand name GoldStar. LG Electronics is paying \$350m (about £220m) to increase its holding in Zenith, one of the oldest and best known US consumer electronics brands, from 4.97 to 57.7 per cent. In taking control, LG with Zenith expects to form the largest consumer electronics group in N. America. There is a strong possibility that GoldStar may start to use the Zenith brand name in the UK.

Zenith, based at Glenview, Illinois, has had a hard time in recent years. It has not managed to make a net profit since 1988. Manufacture of its TV sets in the USA stopped in 1991, when production was moved to Mexico. The move was not sufficient to restore profitability – last year a loss of \$14.2m was made on revenues of \$1.5bn.

GoldStar's relationship with Zenith started twenty years ago, when LG Electronics began to make radio sets for Zenith. Subsequently Zenith supplied picture tubes and other components to LG Electronics while the latter supplied Zenith with VCRs. The 4.97 per cent stake in Zenith dates from 1991, when the two companies entered into a range of technology agreements.

## Satellite TV

*Eutelsat's board has given the go-ahead to the purchase of five more satellites. They will include Hot Bird 4, which will be the fifth satellite at 13°E. The others, which will be stationed at Eutelsat's 7, 10 and 16°E positions, will be used principally for telecommunications services.*

*Pace Micro Technology has started volume production, at a rate of 15,000 units per week, of digital pay-TV receivers to the MPEG-2, DVB standard. Orders for the DVR500 digital IRD have been received from Australia, the Far East, South America, Mexico and Africa. The receivers use Thomson ST13500A MPEG-2 chip sets.*

*Hyundai claims to be the first chip manufacturer to introduce a single MPEG-2 decoder chip for the set-top*

*box market. The chip, type HDM8211M, is available in sample quantities for manufacturers to evaluate. Pre-production chips should be available by the end of September, with volume production scheduled to start in Korea this October. Once in production the chip is expected to sell to manufacturers for less than \$55 in 100,000 unit quantities.*

*A European Commission directive on TV standards, recently approved by EU ministers, lays down that consumers should be able to receive all digital TV channels via a single decoder box. Under this conditional access requirement, all TV manufacturers have to incorporate in sets with screen sizes larger than 42cm an open interface socket. The directive is mainly concerned with pay TV, which is expected to develop rapidly once digital TV technology comes into use.*

## Sony's Widescreen TVs

Sony recently unveiled its widescreen TV plans and demonstrated some clever new TV technology. Sales of widescreen TV sets in Japan rose from 400,000 in 1993 to 1.75m in 1994: this year 3-4m widescreen sets are expected to be sold, accounting for a third of TV sales. Sony expects sales of widescreen sets in Europe to increase from 380,000 this year to some 10m in the year 2000, when sales should overtake those of 4:3 aspect ratio sets.

One problem at present, particularly in the UK, is a lack of software – prerecorded tapes and discs and broadcast transmissions. In Europe the major widescreen format is PALplus, an enhanced version of PAL which transmits 432 lines plus a helper signal, in the field blanking interval, to expand the picture to produce a 576-line 16:9 display. Sets without a PALplus decoder produce large black bands at the top and bottom of the picture.

Sony is about to introduce a range of new widescreen models fitted with Super Trinitron Wide tubes. Models will include the KV16WT1 with a 16in. screen. This might seem to be rather small for a wide screen set, but Sony suggests that it's ideal for computer games. The KV16WT1 has a games button that automatically switches to widescreen presentation, and a Smart Mode that expands 4:3 pictures to 16:9 electronically. It's claimed that this system reduces distortion by using algorithms that compress the top and bottom of the picture, leaving the central portion undisturbed. This works quite well, though much depends on the type of material being shown. Suggested price of the KV16WT1 is £400.

The KV24WS1 and KV28WS1 are 24 and 28in. widescreen sets with Nicam, teletext, Smart Mode and scart, RGB-in, S video and phono audio sockets. A digital zoom mode enables 432-line letterbox pictures to be expanded to full-screen 576-line pictures. This system works by converting

the video signal to digital form then using interpolation to generate extra lines. It works on the same lines as Philips' Widescreen Plus. Suggested prices are £900 and £1,000 respectively.

Models KV28WS3 and KV32WS3, with 28 and 32in. widescreens, incorporate the following features: a PALplus decoder, Dolby Pro Logic, 100Hz scanning, digital zoom, digital noise reduction and picture-and-picture (PAP rather than PIP). This latter feature uses twin tuners so that two different transmissions can be displayed on the screen simultaneously, each using half the screen. Sony suggested that parents could watch a TV programme on one side of the screen while a child used the other side to play a video game! The sound output relates to the left-hand picture, the right-hand picture audio being available via headphones. A clipboard facility enables half the screen to be frozen while the programme continues normally on the other half. Suggested prices of these sets are £2,000 and £2,800 respectively.

# Exhibitions

Trade visitors to the UK's top consumer electronics show, LIVE '95, can apply to our sister magazine ERT for free exhibition passes which also give access to the Trade Village, a visitor lounge and a trade-only exhibition being sponsored by ERT. The exhibition is being held at Earls Court, London, between September 19-24th.

Note that free entry will be by photo ID pass only. To obtain a trade visitor pass and beat the queue, send two passport sized photos together with a business

card and an application request written on company letterhead paper to Jane Sparkes, ERT Magazine, Quadrant House, The Quadrant, Surrey SM2 5AS. A free photo machine will be available for visitors registering for a trade pass at Earls Court, but proof of identity and credentials will be required. Make sure you have them with you.

Connect 96, the National Consumer Electronics Show, is scheduled for October 18-27th 1996 at the NEC Birmingham.

## VASA

Efforts are at present being made to set up VASA, the Video and Audio Service Association. It's basic aim will be to bring together professional, independent service departments for mutual help and communication. It will be for manufacturers' service agents, authorised or regional. There are already some links between prospective members, established at various seminars and conferences - over (and under) the table. Thus some of us already help each other out with technical difficulties and the problems that can occur with contractors or manufacturers. The intention is not to establish a 'Union', and the Association should not be used as a means of forcing manufacturers to

increase labour claim rates. The idea is to facilitate liaison between manufacturers, contractors, dealers and customers, particularly when technical problems arise. Another aim is to encourage better communication and improve the quality of fault reports and hence the quality of repairs.

All members will agree to abide by a Code of Practice and be equipped to a minimum technical standard for the products they service. The Association, once established, will provide manufacturers with the support of a professional service network second to none. Those interested in participating in the formation of VASA should contact Steve Beeching, Grove Farm, Long Lane, Barnby in the Willows, Newark, Notts NG24 2SG.

## 3D TV Goes on Sale

Sanyo has started to sell, in Japan, the world's first 3D TV sets for domestic use. The company has no plans to sell the sets in other markets. Viewers have to wear battery-operated glasses to see the 3D images. The system produces a 3D effect from a standard two-dimensional signal by creating two separate signals, one with a slight time lag, for the left and right eyes. The glasses, which are relatively heavy (100g), switch the left and right eye lenses on and off in time with the TV signal.

The 3D effect is greatest with objects

that move across the screen at moderate speed. Stationary objects appear to have only a little more depth, while blurring can occur with fast-moving objects. The system can be used to add a 3D effect to standard TV broadcasts, signals from VCRs and computer software. It sells for about £2,840, with one pair of glasses. Extra pairs cost around £185 each. The 3D effect can be increased or decreased somewhat by using the system's remote control handset.

Sanyo has developed 3D technology that doesn't require glasses to be worn, but this is at present too expensive for the consumer electronics market.

## Video News

Gemstar, which brought us VideoPlus, is to introduce a new feature called ShowList to make the use of TV sets and VCRs easier. The VCR version will provide an archiving system, while the TV version will combine teletext-style on-screen TV listings and an information guide with point-and-shoot selection via a remote control handset. The system is to be demonstrated at the next Berlin Radio Show.

RCA, JVC, Panasonic, Hitachi and Sharp will be launching the VCR version this year in the USA. Sharp aims to be the first manufacturer to introduce UK models, early next year. The TV system will follow later. It involves Gemstar sending out two

sets of encrypted data via a broadcaster. This data will be downloaded into ShowList equipped sets and VCRs, where it's decoded and stored. ShowList for TV is described as a cross between a navigation tool and a TV listings magazine. Basic information (up to 120 characters) on all programmes will be available eight days in advance: more detailed information (up to 500 characters) will be available two days ahead of the transmission date. Access to the system is via an IR handset. Test transmissions in the UK started in March: it's hoped that a full service will start in October.

A couple of developments have been announced by Sony. First an optical pickup for use with digital video discs. It can work

with dual or single-layer discs without any additional hardware. This makes it backwards compatible with existing CD players. Secondly a 659 x 494 pixel progressive-scan CCD sensor in 1/3rd inch (8mm) format. This resolution has previously been available in only 0.5in. format. The resolution of the 0.5in. format CCD sensor may be increased to 782 x 582.

Nokia has announced its support for the Sony/Philips HDCD format, which has been renamed MMCD (MultiMedia CD).

Motorola has joined the PixTech alliance, which is developing flat-screen displays based on field emission technology. Other members of the alliance include Texas Instruments, Raytheon and Futaba.

## Rosy Outlook

A report from Market Assessment Publications suggests that the consumer electronics market is poised for strong growth

over the next five years as the economy improves and sales of new products, such as home cinema systems and widescreen TV sets, take off. A 26 per cent growth, in

real terms, in the market for video equipment is envisaged to the year 2000. Over the same period sales of audio equipment are expected to grow by 39 per cent.

# Satellite Notes

**Reports from Philip Blundell, AMIEEIE,  
Christopher Nunn and Hugh Cocks**

## **Pace SS9200**

There was intermittent loss of sync which could be restored by flexing the board. Tests around the TEA2629 chip showed that the video signal was reaching the input to the sync separator at pin 27, but the oscillator was running slightly off speed. Close examination with a magnifier revealed that the 1.5nF surface-mounted capacitor C180 was cracked. A replacement cleared the fault. **P.B.**

## **Pace PRD800 Plus**

This receiver produced a blank raster. Checks showed that the video signal was present at pin 10 of i.c. U10 but not at pin 4 of U7. Further checks between these points brought me to the BC846B chip transistor Q105, where there was video at the base but not at the emitter. A new BC846B cured the fault. **C.N.**

## **Pace PRD900 Plus**

The same programme appeared on every channel – the receiver wouldn't tune. Replacing the Nicky chip (apparently named after a lady who works at Pace!) cured the fault. There have been reports of this fault before. Three days later however the receiver came back with the complaint that the channels sometimes wandered slightly. This unusual problem was cured by putting the receiver into the factory reset mode. **C.N.**

## **Pace SS9200**

The standby light was pulsing. Before you start to think about shorts across the outputs on the secondary side of the power supply, check the 0.22Ω fusible resistor R13. This one had risen in value to 2.6Ω. It's an awkward fault to trace if your multimeter isn't spot on. I know that there are power supply kits which would have cured the fault, but replacing twenty components when only one is faulty is to my mind a bit boring! **C.N.**

## **LNB Trouble**

We've come across several cases, particularly with Continental Microwave (CMW) LNBs, where the F connector socket pin has never been properly soldered to the PCB inside. The symptom is usually intermittent loss of the signal. Just recently we had a CMW LNB which had been working for a year, giving perfect results, then became intermittent. When it was opened up we found that the pin had virtually no solder on it.

Touching the LNB's F plug usually restores the signals, the LNB refusing to go off again while you are still at the house. Beware of blaming the plug or cable: open the LNB and check whether the connector is properly soldered to the PCB. Sometimes the problem is obvious to the eye. On other occasions however there can be a tiny solder joint fracture that's difficult to see. On a couple of occasions I've noticed that the socket has felt quite warm, obviously

because of the voltage drop at the pin/PCB junction.

Ensure that the diameter of the coaxial cable's inner conductor isn't too wide. If it has to be forced in or out of the socket this will add to the strain.

While you have the LNB open, check that the inner screening cover is well tightened down. If it isn't, the result can be poor reception accompanied by intermittent patterning. What happens is that the low-noise amplifier section starts to oscillate because of the poor screening cover earthing. But be careful not to overtighten the screening cover screws. **H.C.**

## **Pace SS9000**

Just had another Hitachi tuner fail, producing the 'low gain' symptom, after a long absence of this fault. It's possibly because the summer heat has arrived. It might be an idea to glue a small heatsink on top of IC401 in the tuner to try to remove some of the heat from the board. **H.C.**

## **Pace SS9200**

This receiver appeared in the workshop with a note that simply said "poor picture". The owner had also brought along the TV set he used with it. When we switched on, poor pictures were indeed present. The effect was like ringing, over-driven whites on screen graphics, and there was ghastly reception of Sky News. The sound was o.k. Connection to the TV set was at r.f.: although the set was fairly new, it had no AV facilities. Having come across this fault before, we were inclined to blame the set – a 14in. model called a Kennedy, believe it or not! But the results were the same when we connected the receiver to the workshop TV set. This exonerated the Kennedy receiver, and we found that scart reception was good. Oh dear, modulator trouble!

The modulator was set to near the top of its range, at around ch. 39-40. As there was some patterning, because of a local station on an adjacent channel, we tuned down to ch. 29 to get a clearer view of the picture (channels 31-42 are very full here). Lo and behold, the picture was now o.k., with no trace of poor whites or anything else amiss. Tuning the modulator slowly back up the band resulted in rapid degradation of the picture above ch. 35. Very strange!

Apparently the fault had appeared suddenly. As the TV set and the satellite receiver were in a house that was rented out to holidaymakers, the owner was quite happy for the receiver to be left with its output at ch. 29. If further trouble occurs, we'll need to replace the modulator. **H.C.**

## **Pace SS9200**

Now that the summer temperatures have arrived here in the Algarve, a fair number of these receivers are coming in with dead power supplies. If, after replacing the usual faulty chopper transistor and the 1μF capacitor in its base circuit, the transformer is o.k. and is a pink one we make a point of telling the customer that it's quite likely to fail within a short period, though not worth changing till the problem actually arises. This saves bad feeling should a second repair be required within a short time.

An owner rang up the other day to say I was quite right. "The alternator's gone" he announced triumphantly, "like you said it would."

While on the subject of what people say, an electronic dabbler told me the other day in all seriousness that Pace makes the PCB the way it does to prevent people like him repairing them. That's one way of looking at it, anyway. **H.C.**

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LA7520	£2.80	STK5342	£4.80	TDA1180	£2.20	TDA3510	£9.80	TDA9513	£4.80
LA7530	£8.50	STK5372H	£7.80	TDA1185A	£3.20	TDA3540	£2.50	TEA1009	£2.20
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# CAMCORNER

*Reports from David C. Woodnott*

## **Panasonic NVG202B**

This is a later version of the popular G1/2. The complaint was that it played back at high speed, producing pictures as if fast-forward search had been selected. The cause was failure of the capstan motor FG sensor, which is available separately for these models. It's interesting that the machine continued to operate with this fault present: most would quickly go to emergency shut-down. In fact we have been surprised in the past at how quickly some machines shut down when an FG malfunction is detected. **D.C.W.**

## **Chinnon VC1600**

This and certain Orion and some Hitachi E series models use a similar lens block with an infra-red auto-focus system that generally works well. This one didn't however. The focusing lens had jammed, though the zoom lever operated normally. The main focusing lens in these optical assemblies is held in position with adhesive – there are no screws or sticky tape, as is usually the case. So to refit the lens correctly the old adhesive has to be removed. The assembly can then be adjusted. A quick-drying epoxy resin is the best adhesive to use – definitely no superglue! **D.C.W.**

## **Sony CCDV50E**

The zoom buttons failed to rotate the lens. Otherwise all functions worked normally. We found that Q120 on board RZ1 was open-circuit. A replacement put matters right. **D.C.W.**

## **Hitachi VM3280**

This full-size VHS machine came in for a general service and a check on the playback colour, which was thought to be "not quite right". Indeed it wasn't! The vectorscope display looked distinctly odd. The cause of the trouble was spotted when the underside case screws were being removed: a switch, labelled PAL/MESECAM, was incorrectly set. It's in the position normally occupied by the mic. mix switch – in Model VM2300 for example. The customer later told us that the camcorder had been purchased abroad. **D.C.W.**

## **Sony CCDF330E**

The customer complained that there were no functions except for the camera picture and that the dew symbol was present in the viewfinder. Failure of the capstan motor to operate, because of lack of drive, was the cause. We found that the ribbon cable connection between the motor and the VS PCB had been punctured by one edge of the tripod bush plate, which was bent inwards. A new cable and attention to the tripod plate restored normal service. **D.C.W.**

## **JVC GRC11**

These early record-only units can catch you out if you are not aware of their foibles. For example they won't power up unless a tape is loaded: it's worth remembering this when looking for the cause of certain types of fault. This machine's cassette door was permanently open, and it didn't

seem to power up or provide any functions.

A quick check on the circuit protectors and power supplies failed to reveal anything amiss, but when a tape was inserted the machine would attempt to eject it and the power LED would come on briefly – the cassette compartment remained stubbornly open. We then realised that the machine was in a state of permanent eject! The cause of the fault was traced to a leaky eject switch. This was removed, cleaned and refitted, after which the rather confusing fault symptom had cleared. **D.C.W.**

## **Canon UC10**

The report that came with this machine said that the tape would jam and shut down the mechanism, and that when it was working the picture would fluctuate. The mechanism problem is becoming quite common with Canon units that use this deck. The trouble occurs when a cassette is inserted in the housing and the lid is closed: if any force is applied it's likely that either one or both of the reel spindles will be bent, thus jamming the mechanism. The problem can usually be overcome by removing the LS assembly and carefully straightening the spindles. In a severe case however a replacement LS unit may be required.

The second fault, playback picture fluctuations, was caused by dry-joints on the connectors between the main camera and the digital title PCBs. **D.C.W.**

## **Sony CCDV50E**

A 'pink' tinge to highlights on outdoor shots, sometimes, was the reported fault with this machine. Fortunately the tape provided by the customer showed the effect. It seemed that under the conditions described – certain views, usually with a bright sky background – the iris would malfunction, remaining slightly more open than required. Under similar test conditions the effect could be seen and corrected temporarily by means of a gentle tap on the lens unit. An inspection of the lens unit was called for.

As anyone who has worked on any of these models knows, getting to the interior of the lens is a bit of a challenge – it's surrounded by a metal frame and various PCBs. They all fit together quite snugly, at least until you've had them apart! To curtail a rather long story, after inspecting and cleaning the iris assembly we came to the conclusion that it was not the cause of the trouble. This proved, after further tests and much reassembling, to be the case. So we had to dismantle everything again to get to the iris drive circuitry.

As checks on PCB 1A-1 were inconclusive we ordered a replacement iris drive chip (IC721). This wasn't the cause of the fault either! The problem was an elusive one because it was intermittent and hard to simulate. Cold tests on the components on panel 1A-1 eventually revealed the cause of the trouble – a PCB through link was making intermittent and high resistance contact. The connection concerned was between the slider of the iris set control and the junction of R752 and R760, a composite unit that feeds pins 12 and 10 of IC721. We fitted a wire link, set up the controls on the panel and then, after final reassembly of the camera head unit, gave the camcorder a long soak test. This proved that at last everything was in order. **D.C.W.**

## **Correction**

**Panasonic Model NVMS4: In the May camcorder column we referred to the systems and servo chip in this machine as IC6001. It should of course have been referred to as IC6004. Sorry.** **B.S.**

# Designing for Reliability

*Martin Pickering, B.Eng.*

I began to design circuits using transistors at the age of ten, back in 1961. At that time everyone 'knew' that germanium transistors were susceptible to damage by heat, also excessive voltages. This had to be true, because so many publications said that you had to use medical clamps or something similar to remove the soldering iron heat at transistor lead-out wires when soldering the devices. I never bothered to do this however, and my transistors survived.

A similarly cavalier attitude seems to be current today with respect to devices that use MOS technology. Static electricity is widely misunderstood, and tends to be ignored because of difficulty in attributing failures to it directly. In fact failures are fortunately quite rare. But this is more often due to luck rather than good practice. The damage caused by an electrostatic discharge is often insidious: it weakens a device's internal structure, lowering its tolerance to surges or high voltages or currents. Failure can occur much later.

Information on this sort of thing is widely available, and many manufacturers do well by selling electrostatic dissipative or shielding materials. Where there's money to be made, the message tends to get through.

Unfortunately the message is less often passed on between designers. I've seen successive generations of designers making the same mistakes that I made thirty years ago. It seems that there is no central reference source on failure modes, no matter how well known they are, and no relevant training within companies. As a result, the same lessons are learnt the hard way time after time. In particular, the sort of information required doesn't seem to be fed back to educational establishments.

For this reason I decided to put together the present article. It's basically a collection of notes. Much of the information comes from my head – some is based on experiences long ago, so please don't ask for proof. Accept that a problem can arise, and if necessary go do the research required.

Forewarned is forearmed. Don't simply accept a manufacturer's word that a problem was solved years ago. This may not be the case. Arrange tests to prove the point. But, equally, don't accept my word either. The problem may well have been solved.

Anyway, to the nitty-gritty.

## **Electrolytic Capacitors**

My first experience of problems with capacitors occurred when a large electrolytic exploded in my father's face! I'd built a superhet valve radio from plans published in a magazine, but I'd connected a 32 $\mu$ F electrolytic capacitor in the 350V power supply the wrong way round. It didn't survive. Fortunately my father did.

That was an extreme example. The usual problem occurs when the circuit designer doesn't do his sums and/or doesn't make measurements to confirm them. I've come across several examples of circuit design where an electrolytic capacitor is the right way round but can nevertheless experience a reverse bias voltage. The more often this occurs, the sooner the capacitor fails. Designers often don't check this.

I've also seen circuits where an electrolytic capacitor is expected to pass a pulse current of several hundred

milliamps. It will – for a while. Electrolytic capacitors with a low ESR (Electrical Series Resistance) are available and are better suited to pulse applications. They are widely used in switch-mode power supplies and are sometimes needed elsewhere. But there's a limit to the rate of current change that an electrolytic will tolerate: the capacitor's internal impedance, which is inherent in the design, is simply too great. Should this be the case a different type of capacitor would be more appropriate.

An obvious example of the use of the wrong type of capacitor can be found in the car electronic ignition system designs published in some old magazines. They were invariably based on charging a 1 $\mu$ F capacitor then discharging it through the coil. A wound polyester capacitor was often specified. No one checked the component's dV/dt specification, and as a result the capacitor would suffer punch-through. The effect was self-healing for a while, but misfiring would occur, followed eventually by failure. The answer was to use a sandwich-construction capacitor made by Siemens: it was rated at around 7V/ $\mu$ sec.

Tantalum capacitors have a higher capacitance to volume ratio and a lower impedance than aluminium electrolytics. An old Post Office (now British Telecom) design rule however stated that a tantalum capacitor must never be used unless its voltage rating is at least twice the average supply voltage. Tantalum capacitors fail when their working voltage is exceeded: this rule provides a good safety margin.

It is better to operate aluminium electrolytics closer to their rated voltage. Otherwise there can be a fall in the capacitance value, since the value depends on the applied voltage. In the days of valve radios we used to 'rejuvenate' old electrolytics by applying a high 'proof' voltage to 'wake them up'.

The other problem with electrolytics is their leakage current. A certain amount of d.c. will always flow. Low-leakage types are available, but they cost more. Leakage current is a problem that's often overlooked by designers. Unfortunately it can become worse with age and temperature. It doesn't present a problem with the prototype.

Temperature is something else to consider. An electrolytic may be rated at 85°C for 20,000 hours: this is a typical value, beyond which you can expect problems. Twenty thousand hours is just over two years. If the capacitor is operated at a lower temperature, it will last longer: if the operating temperature is higher, it will fail sooner. Try blocking the vents in your prototype, as the typical consumer is likely to do with a magazine or book. Then measure each capacitor's temperature rise. This will reveal the local hot spots.

## **Aluminium Electrolytic Construction**

The design of an aluminium electrolytic capacitor is ingenious. It consists of two thin layers of aluminium foil with an insulator between. The whole assembly is coiled to form a tube shape, and a wire is attached to each layer of foil. Etching the aluminium increases its effective surface area, while the insulator is impregnated with the electrolyte. This all serves to give the maximum capacitance value in the smallest volume.

Unfortunately the complex design gives plenty of scope

for failure. The wires have to be bonded to the aluminium, which is not the easiest material for welding. The whole thing has to be sealed to prevent the liquid electrolyte from escaping. It has to be squeezed into a tiny can. Failure is often mechanical. It's not unusual to find that an electrolytic has parted company with one of its legs. They can also be damaged by component insertion machines.

### **Tolerance**

The tolerance in the value of an electrolytic capacitor is usually quite wide. It used to be +80 per cent, -20 per cent. Manufacturing control is nowadays better, so you can get much narrower tolerances (at a price). Don't expect anything better than about  $\pm 10$  per cent however. If accuracy is required, forget electrolytics.

### **Multilayer Ceramic Capacitors**

These ingenious devices are widely used but seldom understood. Let's start with the manufacturing process. There are two principal methods of construction.

The more common one is to make a sandwich that consists of alternate layers of ceramic paste and silver. This sandwich is then raised to a high temperature to 'fire' the ceramic, as in making pottery. It's then cut into little oblongs. The odd silver layers are bonded together at one end, the even layers being bonded together at the other end. This is done by deposition of a metal alloy such as silver palladium. A layer of nickel may be added to increase resistance to leaching when the device is soldered.

The other method is to make a sandwich of ceramic paste layered with plastic film. After the firing process the plastic will have burnt away: molten lead is forced into the interstices at high pressure, forming a lead-ceramic sandwich.

This type of capacitor has a medium capacitance to volume ratio - higher than that of the old ceramic disc capacitor, lower than that of an electrolytic. It also has a low impedance at high frequencies, making it ideal for passing fast rise-time pulses.

Its drawback is that although the apparent tolerance can be close there can be a wide change of capacitance value with temperature. Better ceramic materials are used to combat this effect, but they cost more. In addition, their capacitance to volume ratio is not as good as that of the cheaper materials.

Some manufacturers were experiencing problems with these capacitors as little as ten years ago. The fault would occur with capacitors of 47nF or 100nF used to decouple a 5V rail: the capacitor would glow white hot or even burst into flames. I have seen boards so badly burnt that there was a hole right through them. Plastic housings also caught fire. The precise failure mechanism was never fully explained so far as I know. For the fault to occur the 5V supply had to be providing at least 8mA while the capacitor would have a measurable d.c. resistance of around  $8\Omega$  as the failure began.

The causes of the problem may have been micro fractures in the ceramic and silver migration (under certain conditions silver can grow dendrites, or whiskers). We were able to cause failure by connecting one of these capacitors across a 5V d.c. supply then applying a brief 2kV pulse. We used a test that employed methanol to weed out faulty batches of capacitors. I haven't come across this problem for years, so the manufacturers may have solved it.

### **Surface-mounted Components**

There has been a long debate as to whether or not it's necessary to nickel plate the end terminations of surface-

mounted capacitors. Doing so provides resistance to silver leaching when the component is soldered. If you have nickel-plated terminations, don't waste money on silver-loaded solder. Some authorities blame the nickel for capacitor cracking however. I disagree with this hypothesis, and did some tests to investigate.

The problem with surface-mounted capacitors and resistors is that they are brittle and can crack under stress. The simplest way to prove this is to bend a PCB and listen! Paper-phenolic board material flexes more easily and may make the problem worse, but this need not be so if you follow simple design rules.

I set up a series of test boards roughly 75 x 50mm. Capacitors were soldered between pairs of pads of varying sizes along the length of the boards. The capacitors were then heated by the crude method of holding the board above a soldering iron. After this the board was plunged into cold water. The capacitors could be heard to crack as they entered the water.

A jig was set up to apply pressure along the central axis of a fresh board to make it bow. As the pressure was increased, the capacitors could be heard cracking.

In both cases the damage was confirmed by measurement. It's worth noting however that most of the capacitors measured all right until they had been subjected to humidity.

There was no damage with one board. The difference was that on this board the capacitors were soldered directly to the copper tracks, without wide solder pads.

Further tests proved that no failures occurred when the width of the solder pad was no greater than 75 per cent of the width of the capacitor's end termination. It's likely that under these conditions the solder joint is narrow enough to flex, so that tension forces are no longer exerted on the ceramic component's end terminations. In military and aircraft use, where vibration is a problem, it could be that this type of joint would be prone to stress fracturing. But it gives much greater reliability with domestic equipment.

Designers will throw up their hands in horror at this suggestion, which is in defiance of all the design rules ever invented. Interestingly, such pad widths present no problems with wave soldering and use only half the amount of solder otherwise required. Another advantage is that there is less track obstruction, making the layout easier. You can carry out these tests yourself at very little cost.

Obvious though it might seem, you should never mount a surface-mounted ceramic component in line with the longest axis of a board. Flexing is far more likely to crack a component aligned in this way than if it's aligned with the shortest axis. It's amazing how few designers think of this. I've seen several boards with the capacitors close to the long edge of the board. Worse, one board was designed to be mounted on plastic pillars and finger pressure had to be applied directly above the capacitors to fit the board!

### **Resistors**

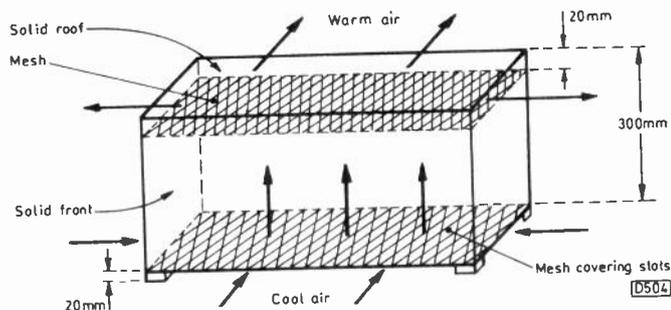
A problem that's appeared recently is the use, in switch-mode power supplies, of resistors which need to have a high-voltage rating but don't. The conventional type of spiral-cut resistor is prone to arcing between the spirals. If a resistor is to be subject to a high voltage it's sensible to specify a non-spiral type. But, with the demise of valve-based equipment, these have become quite rare. I notice that Welwyn still make them however. Beware, when replacing a resistor in the power supply, that it might be safety critical and have a specified voltage rating.

I've recently had, for the first time ever, equipment that has failed because tiny resistors have gone high in value. The

equipment is imported from the Far East. The resistors concerned carry negligible current and die without any apparent cause. This is probably a case of equipment being 'built to a price'.

## Heat

I've left the best bit till last! Earlier I mentioned the susceptibility of electrolytic capacitors to failure caused by heat. In fact all components fail if they become too hot. Yet in many equipment designs heat is the last thing to be considered: often a few narrow slots are made in the lid as a token



**Fig. 1: A cabinet designed to provide adequate ventilation and thus reliable operation of the equipment within.**

gesture, in the hope that the heat will get out. The problem is that modern equipment has very little room inside. Everything has been miniaturised as far as possible.

There's a simple rule to remember when dealing with heat: air movement is required to get the heat to escape. Theorists may argue that heat can be lost by direct radiation, but the effect of this is quite small. Air movement is essential.

As hot air expands, a little of it will escape from a hot box. For more hot air to come out, cold air must go in. In many designs this can't happen. Thus the only cooling effect is that of cold air moving across the surface of the box and extracting heat by conduction. This is not very effective, especially if the box is a plastic one.

In the old days of rack-mounted equipment use was sometimes made of the 'chimney effect' to provide cooling. Cold air was allowed in at the bottom and hot air was released at the top. The effect is self-sustaining, to an extent, only with a box that exceeds one metre in height! So you can't rely on it for cooling modern units.

I worked long and hard on this problem back in my design days and ended up with a box just 30cm high. The entire base was slotted and covered with mesh, providing a 60 per cent effective air-flow area. The top was similarly designed, but had a false roof supported by 20mm pillars: it was open at the sides and back but, for cosmetic reasons, was closed at the front. The boards inside were all mounted vertically. Although the false roof prevented air release at the top, smoke tests showed that air went in at the bottom and came out of the side and rear slots at the top. The idea is shown in Fig. 1.

We fitted thermocouples inside the box and connected them to a chart recorder. The resultant graphs were extraordinary. During the day, when the central heating was on, the temperature rose less than at night! The reason for this was that nothing moved at night: no doors were opened, and no one walked by. We proved this by experiment. For the cooling to be most effective, there had to be sideways air movement in the room. This wafted through the top side slots, shifting the hot air and thus enabling cool air to rise

from the base. If the gap beneath the base was less than 20mm, the cooling effect was less efficient.

The design was considered to be satisfactory: despite the fact that the power supply generated 300W, the temperature rise was less than 15°C even in a closed room. There was no need for a fan. As the false roof didn't have slots, it didn't matter if newspapers were laid on it. The entire inside top and bottom was covered with an insect-proof mesh which also kept fingers out. Cosmetically, the box looked good.

Television cabinets can be designed in a similar fashion. VCRs can have fans at little extra cost, though these make the dust problem worse. There are still problems with satellite receivers however. They tend to be small in size and incorporate a tuner, a power supply and a decoder unit, which together dissipate a lot of heat. In addition the circuitry is usually laid out on one large PCB that covers the entire base. The box is not high, and any slots in the top get covered by magazines – or cats! To make matters worse, the receiver is often right on top of the TV set or the VCR and/or put inside a 'hi-fi' cabinet with the doors closed!

I have no answer for this, which is probably as well since I now make my living by repairing satellite receivers.

Manufacturers may well wish to respond to these notes and comments. I hope there will be a lively discussion!

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# The Sony Plasmatron

George Cole

Consumer electronics manufacturing companies have for years dreamt of replacing the cathode-ray tube with a flat-screen system. This has proved to be very difficult however. It's easy to see why: the c.r.t. provides excellent colour, brightness, contrast ratio and resolution. It has a wide viewing angle and is relatively cheap to produce. The c.r.t.'s main drawbacks are its size, weight and high power consumption. These make it unsuitable for portable applications such as pocket TV sets and notebook computers.

## Flat-screen Display Systems

There are many possible forms of flat-screen display, including the now well-established liquid-crystal display. Canon estimates the present world market for LCDs at around £53 billion: this is expected to double by the turn of the century. The largest market for LCD screens is in notebook PCs. An active-matrix system is used in the best LCDs currently available – a matrix of transistors built into the panel is used to switch on each pixel individually in sequence. LCDs are small, light and use little power. But they are expensive to manufacture, typically costing around 30-40 per cent of the cost of a notebook computer. Production of large-screen LCDs is particularly difficult, though Sharp has 14-16in. versions and has demonstrated a 21in. prototype.

The principle of the plasma display is to use a pulse voltage to ionize a gaseous mixture, the discharge producing a glow. Fujitsu has developed plasma panels up to 50in. in size. Plasma displays can be less than half an inch thick, but they are very expensive – typically ten times the cost of a c.r.t. display with the same screen size.

Electroluminescent displays operate on a similar principle, though using solid material rather than gases.

Matsushita's beam matrix (FlatVision) display is a hybrid c.r.t./LCD system. Phosphors are arranged in a flat matrix, like liquid crystals, streams of electrons being used to activate them.

Canon and Central Research Laboratories have both produced large-screen displays (24in.) using ferroelectric LCD cells. Ferroelectric materials exhibit a bistable characteristic: application of an electric field changes the state. FLCs offer a number of advantages in comparison with conventional LCD systems, including a wider viewing angle and a better contrast ratio, but they are still in the research stage.

Because of their cost, flat-screen systems are at present confined to niche applications where the c.r.t. is too bulky and users are prepared to pay a premium. The computing, defence and aeronautics markets are examples.

Sony is about to aim at the consumer electronics market with a system known as the Phased Addressed Liquid Crystal Display (PALC) however. The device has been labelled the Plasmatron.

## The PALC

As its name suggests, the PALC display uses a variation on conventional LCD technology. It has been developed by Sony in conjunction with the US company Tektronix.

Work on the system began as recently as 1992. As mentioned above, in an active-matrix LCD system an array of transistors is used to switch the pixels on and off. The system works well, but active-matrix displays are costly to produce, requiring clean room conditions for manufacture.

The PALC system uses a plasma discharge instead of a transistor to provide the switching action. Fig. 1 shows the basic principle. The plasma switch operates like a transistor – its action is in fact akin to that of a field-effect transistor. Two electrodes, the cathode and anode, are placed in a tube that's filled with gas under low pressure, see Fig. 1 (a). The discharge occurs when a pulse voltage of around  $-300\text{V}$  is applied to the cathode. In a conven-

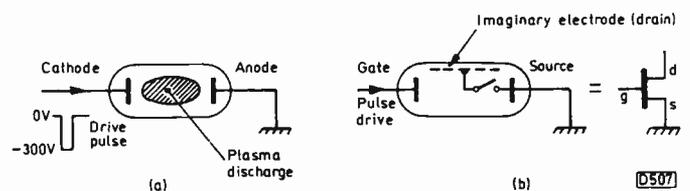


Fig. 1: Basic principle of the PALC display, (a) discharge, (b) f.e.t. analogy.

tional plasma display the discharge is used as the light source: in the PALC display it's used as a switch. When the switch 'closes', signal data passes to the LCD cell section.

The operation of the device is close to that of a field-effect transistor, as shown in Fig. 1(b), where the anode is the source, the cathode is the gate and an imaginary electrode acts as the drain to activate the LCD cell. When a drive pulse is applied to the gate, the video signal, which is applied between the imaginary electrode and the source, sets the illumination produced by the LCD section. Fig. 2 shows the construction of a single pixel cell, a transparent electrode in the LCD section providing the signal connection (imaginary electrode/drain).

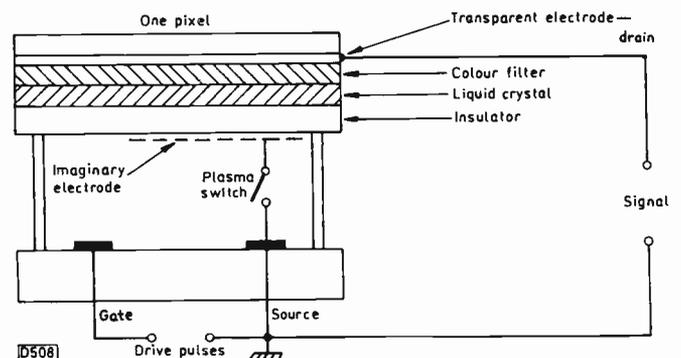


Fig. 2: Basic construction of a single pixel cell.

Each scanning line is controlled by a single plasma channel, the whole display having around 450 channels. As Fig. 2 shows, the LCD pixel cell has several layers. These include the transparent electrode just mentioned, a colour filter, a liquid-crystal layer and an insulating layer.

When the discharge pulse is applied to the plasma channel a complete line is switched on and the video signals are applied to the individual pixel cells. Thus signals equivalent to a single c.r.t. display line are fed to the PALC device simultaneously. The plasma channels are switched on sequentially, with each pixel retaining its state until the next frame of video information is fed to the device.

According to Sony the production cost of a PALC panel is much lower than that of a conventional LCD screen because only low-grade clean rooms are required for the processing involved. The plasma address board is made by using a screen printing process to apply a metal powder paste, which forms the discharge electrodes, to a glass board. Partition ribs, which separate the picture lines, are printed in multiple layers.

Further details of the PALC panel are as follows. The liquid crystal is the 90° TN type. The colour filter consists of vertical RGB stripes. Scanning is non-interlaced, the aspect ratio being 16:9. There are 768 trio pixels and 448

lines. The brightness is quoted as 250cd/square metre and the contrast ratio as 50:1. with 260,000 possible colours.

## The Sets

Sony plans to launch sets fitted with the new display next year, in Japan initially. They will be marketed under the Plasmatron name. Sony says that wall-hanging sets with displays between 20-50in. (diagonal) are possible, though the first set will have a 25in. screen. Its dimensions are given as 602 x 380 x 3.7mm (width x height x thickness including the deflection section of the panel), weight 1.7kg. The new sets are likely to cost around twice the price of a comparable c.r.t. model.

It will be a remarkable achievement if Sony can market large, flat-screen sets at this sort of price level. The present intention is to demonstrate the sets at this year's IFA. It will be interesting to see what the pictures are like, particularly from a wide viewing angle.

# Help Wanted

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

**Wanted:** GL3201 i.c. for the GoldStar BIR2050 monochrome TV receiver. Steve, 0181 908 4572.

**Wanted:** Complete chassis for the Pioneer SV2801 28in. colour set, with Nicam panels. Complete set would be considered. J. Cooper, 3 Downsvie, Chatham, Kent ME5 0AR. 01634 847 422.

**Wanted:** Two new or second-hand LOPTs for the GEC single-standard hybrid 2040/2100 series colour sets, also PL802 and PL509/519 valves, for economical repair of OAP receivers. A.F. Sheen, 132 Heol Llanishen Fach, Rhiwbina, Cardiff CF4 6RG. 01222 624 101.

**For Disposal:** I have for disposal twelve consecutive volumes of *Newnes' Radio and Television Servicing* – the original six volumes covering pre-1953 to 1956-57 models and the rest covering models up to and including 1962-63. Apart from the fourth volume, which is slightly grubby, the books are in almost mint condition. They are available for a nominal sum plus carriage. K.A. Brook, 6 John Street, Bollington, Macclesfield SK10 5PE. Phone/fax 01625 572 518.

**Wanted:** A source of spares for the

Datsura Model CDR9009 television receiver. John Clarke, 27 Northumbria Close, Prospect Hill Estate, Worksop, Notts S81 0SU. 01909 486 438.

**Wanted:** Record/playback head for an Akai GXC325D cassette deck, or a scrap machine. Sandy Hewat, 30 Fullarton Drive, Troon, Ayrshire KA10 6LE. 01292 314 190.

**Wanted:** A service manual and a diagnostic disc for the Atari PC3 IBM-compatible PC. Also an 11-button keypad and foil for the Philips Model 22CE2020/05T (2A chassis). Martin Staunton, 61 Adderley Gardens, Saltley, Birmingham B8 1LB.

**Wanted:** A service sheet for the Osume Model CTV2094R. J. Arnold, 21 Rowan Avenue, Lowton, Warrington WA3 2DD.

**Wanted:** Copies of *Television* for the years 1986, 1987 and 1988, also the March and June 1989, May 1990 and March 1992 issues. D. Naylor, Marrick House, Coulton Terrace, Kirk Merrington, Spennymoor. County Durham DL16 7HN. 01388 812 456.

**Wanted:** Circuit diagram for a Canon Model 270 copy and fax machine, or a replacement switch-mode power supply. Leon Electronics, 11 Woodend Close, Three Bridges, Crawley, West Sussex. 01293 20 536.

**Wanted:** LA1461 sync and timebase generator chip for the Sanyo CVP9110/1 video projector. J.L. Figures, 3 Fairleigh Road, Clevedon, Avon BS21 7XA. 01275 875 624.

**Wanted:** Circuit diagram/general information (photocopies will do) for the Akai GX4000D reel-to-reel tape deck. Stuart Tyler, 10 Bridgemill Way, Maidstone, Kent ME15 6FD. 01622 759 990.

**Wanted:** ITT Compact 80R 110° chassis to drive a 22in. tube, possibly working. Plug-in modules not required. Bill Millar, 109 Charlottter Road, High-

fields, Sheffield S2 4Q. 01142 752 604.

**Wanted:** Philips Matchline satellite tuner type 22AV1150 for spares. David R. Dunmall, 6 Brandon Road, Dartford, Kent DA1 1SD. 01322 224 975.

**Wanted:** Electrical and mechanical manuals (photo copies would do) for the Grundig 2 x 4 Super VCR (System V2000). Donald Gordon, 54 Burt House, Aske Street, London N1 6LE.

**Wanted:** Circuit diagram (photocopy would do) for the teletext board in the Matsui Model 2180TTA, or a dead/scrap board. Chris Laudan, 235 Holt Road, Horsford, Norwich, Norfolk NR10 3EB. 01603 897 638.

**Wanted:** Circuit diagram or any identifying information for the Protech Model CTV200RT. The chassis is coded PB2101VS-P-M and was apparently produced in the UK in 1993. R.N. Wainwright, 2 Minsterley Avenue, Shepperton, Middx TW17 8QT. 01932 784 912.

**Wanted:** Circuit diagrams/constructional plans for a TV audio only receiver (BBC1/2, ITV Ch. 4), or details of a kit supplier for such a receiver. Andy Knowles, 24-28 William IV Street, London WC2N 4DL.

**Wanted:** Instruction book for the Akai Model VS301EK VCR. R. Sharp, 77 Cloche Way, Swindon, Wilts SN2 6JN. 01793 826 325.

**Wanted:** LOPT for the ITT Model CT1600/1 (CVC823P chassis). Part no. is TFAT 909 F501/47. Martin Abbott, Flat 7, The Highlands, Ludlow Road, Leominster, Herefordshire HR6 0DH. 01568 61 4725.

**Wanted:** MAB8420PC047 microcontroller chip, used in the Philips VR6463 VCR and its clones. It's mounted on the back panel. A used but serviceable panel would be welcome. F. Jackson, 54 Gagewell Drive, Wakefield WF4 6BS. 01924 279 688.

# TV Fault Finding

*Fault reports from Philip Blundell, AMIEE, Chris Watton, Brian Storm, David A. Chaplin, John Edwards, Tony Ashworth, Chris Avis, Michael Dranfield, John Pitt-Francis and Roger F. White*

## Philips Anubis A-AC Chassis

This set was apparently dead, with only 20V at the 95V output from the power supply. When the feed to the line output stage removed, by disconnecting plug M5, the voltage on the 95V line rose to the correct figure. With M5 reconnected, the voltage at the base of transistor Tr7555 could be seen to pulse at switch on. This showed that the over-voltage protection circuit was being activated. As this happened only when the line output stage was operative, the problem was clearly associated with a line output stage derived supply. We found that zener diode D6555, which monitors the +5V B supply, was leaky. **P.B.**

## Grundig CUC3800 Chassis

This set produced a shaded picture – dark on the left-hand side, bright on the right-hand side. Checks around the TDA3505 video control chip on the RGB module showed that the video signal was sitting on a ramp. We found that C2582 (1 $\mu$ F), which couples the luminance signal to pin 15, had dried up. **P.B.**

## Philips G90 Chassis

If there's no line oscillator operation, check the voltage at pin 16 of the TDA2579 timebase generator chip IC7470. With a normally operating set the reading should be 9V. If the voltage is low, check the voltage across the 5.6V zener diode D6455. If this is low, replace D6455 (BZX55F5V6). If it's correct, replace transistor Tr7455 (BC858). **P.B.**

## Philips 4CM4270 Monitor

If the set is apparently dead with the voltage on the 190V +B line very low, try replacing the horizontal centring transformer T5612 before you change the line output transformer. I was glad I did! My thanks to the nice man at Philips Technical for the tip. **P.B.**

## Philips 2A Chassis

For intermittent loss of sound and vision with a buzzing noise coming from the power supply, check whether the protection circuit is being activated – by monitoring the voltage at the gate of thyristor Thy6698. If the thyristor is being triggered it's possible that one or other of the series-connected zener diodes D6699 or D6700 is leaky. They are both type RD6.8V. **P.B.**

## Salora M Chassis

We've had three of these sets in recently. The first one had no picture: occasionally a two-inch wide band of illumination would appear on the screen. The cause was traced to the BS208 transistor TB526 in the EW modulator drive circuit. It's a field-effect transistor.

The second delight for us was a set that came on with

high volume. When the sound was turned down it went higher then muted, then we had only one channel and after that the other. When the cursor reached the minimum setting the sound muted and could then be turned up in the normal manner. Turning it down produced the odd effect. All this was caused by the X2404P memory chip playing tricks.

The final set had a blown line output transistor (TB525, 2SD1577). There are several causes of this, commonly dry-joints around the LF0070 hybrid chip HB701 in the power supply, often C523, C624 (both 220 $\mu$ F, 16V) and C622 (470 $\mu$ F, 16V). It's advisable to uprate these electrolytics to 25V types. **C.W.**

## NEC FS4620

A fault you can get with these sets is ripple on the verticals with bright scenes. The cure is to replace the h.t. smoothing capacitor C609 (100 $\mu$ F, 160V). **C.W.**

## NEI 2131 (Indiana 100 Chassis)

The complaint with this set was loss of the picture. We soon found that there was no field scanning, hence no picture as a result of the action of the sandcastle pulse system. The supply to the field output stage was o.k., and a new chip made no difference. Many other components in this area were replaced before we turned our attention to the TDA8305 jungle chip IC100. Replacing this made no difference either. We eventually found that the TAA550 33V stabiliser D001 was the cause of the trouble. It also provides a feed to IC100. Curiously, we found that a meter probe applied to the linearity feedback line would occasionally open up the field a little. Oh well! **C.W.**

## Philips G11 Chassis

As this antique set was in such good condition, with the tube as good as new, we decided to have a go. At switch on the set worked normally. When it warmed up however there was cramping at the bottom of the screen, then the picture would roll a few times. A slight tap on the timebase panel would restore correct field timebase operation. "Dry-joint", "TDA2600 holder" I hear you saying. Well, after replacing the holder and resoldering every joint the problem remained. Potentiometer, electrolytics and resistors were changed, all to no avail. We eventually cured the fault by replacing the field output filter coil L2092. When we ripped it apart we found that a connection to the windings was as black as your hat. Perhaps we should have scrapped the set at the outset. **C.W.**

## Nikkai Baby 10

There was only an inch of field scan, with a bright line across the screen. When we checked at the pins of the field output chip with our meter the scan opened up. If the service

switch was operated a couple of times you might get full scan or a blanking fault with flyback lines. There was no on-screen display. The cause of the fault turned out to be the AN5512 field output chip. Why it caused loss of the on-screen display I can't say. C.W.

### Ferguson TX10 Chassis

When this set was switched on, No. 1 showed in the channel display. But the No. 1 preset couldn't be used to tune in a channel – it had no effect. Instead, controls 3 and 7 would tune position 1 while controls 3 and 6 worked with position 2. Position 8 couldn't be tuned at all. Replacing the SL430 chip IC105 on the remote control panel restored correct operation of the tuning system. C.W.

### Philips NC3 Chassis

If the mains fuse T400 (2AT) is open-circuit and the BUT11AF chopper transistor Q401 is short-circuit, check the latter's 560k $\Omega$  bias resistor R407. If this is high in value or open-circuit there will be no start-up. C.W.

### Matsui 2580

If the supplies are all present and correct, the tube's heaters are lit, the sound is o.k. but there's no raster, a quick scope check at the field scan coil plug can save time. There should be a huge sawtooth waveform here. If this is missing, check for 24V at pin 2 of the TDA8175 field output chip IC401. If this is o.k., check at the input (pin 7) for a sawtooth at about 2.5V peak-to-peak. The TDA8175 chip is the usual cause of the fault however. As with most sets nowadays, loss of the field scan produces the no raster symptom. In this case a guard circuit operates in the codec chip. C.W.

### Panasonic TX24T1 (Alpha 2W Chassis)

This set came in dead. It's not usually a problem to sort this one out. Hardly worth going to get the service manual I thought. There was no bias voltage at pin 2 of the chopper chip IC801. The reading here should normally be about 0.4V. R803 supplies the bias, from the unregulated supply on the primary side of the circuit. In this instance R803 was all right, but R827 which was in series with it was open-circuit. This resistor is not shown on the circuit diagram. A new 220k $\Omega$  resistor brought the set back to life. B.S.

### Panasonic TXC78 (Alpha 1W Chassis)

The channel indicator was illuminated: other than that, all this set produced was a plaintive whistle. Voltages were present on the main power lines, but there was no line drive. We first suspected the line trip circuit (Q542/Q541 etc.) but this proved to be innocent. So we traced the line drive signal path back to the TDA4505-M1 jungle chip IC101. There was very little activity here. After checking the capacitors in the relevant area we replaced the chip. This brought the set back to life and quietened the whistle. B.S.

### Panasonic TX24A1 (Alpha 2W Chassis)

There were complaints of intermittent loss of line hold. But the fault took almost three days to put in an appearance. Strangely, when the fault was present the sharpness control varied the amount of line slip. Inevitably, removal of the back cover cleared the fault for another few days and restored the sharpness control to its usual function.

Many days later we found that resoldering the connections to the line output transformer (T551) seemed to cure the fault. B.S.

### Ferguson TX10 Chassis (PC1500/1550 Versions)

This set could be switched on from cold but after about a quarter of an hour it would trip on and off a few times then remain off. The line output transistor's protection diode D831 turned out to be the cause. Different types were used in this position (in the transistor's base circuit) in different versions of the chassis. In this one it's a BY188B. It tested o.k. out of circuit but a replacement cured the fault. D.A.C.

### Bush 2155T

This set came in completely dead. The mains fuse was open-circuit and very black. I was unfamiliar with this chassis, had lots of work in and didn't need burnt out power supply jobs! As a quick meter check around the semiconductor devices in the power supply failed to reveal any dead shorts I whipped out the posistor in the degaussing circuit and gave it a shake. The sound of maracas was most welcome. After fitting a new fuse and posistor the set could be switched on and a focus control tweak produced a good, sharp picture. D.A.C.

### GEC C1658H

The field had collapsed to about two inches, with the usual bright line. The cause was traced to C603 which had fallen in value from 47 $\mu$ F to 10 $\mu$ F. Its voltage rating is 160V D.A.C.

### Sony KVX2521U

There was a stretched field scan from the centre to the top of the screen and no field scan from the centre to the bottom. We found that C531 (680 $\mu$ F) had fallen in value to about 300 $\mu$ F. J.E.

### Matsui 2074/2086

Failure of the line output transistor or ZD401, which stabilises the 12V supply, is becoming very common. The cause is C911 (47 $\mu$ F, 50V) in the power supply: when it dries up, the h.t. voltage rises. For increased reliability a high-temperature electrolytic should be fitted. T.A.

### Philips CM11342/25G Games Monitor

This monitor would cut out at random, going into the trip mode. The cause was a poorly crimped connection on the plug for the line scan coils. I've since had this problem with another of these monitors. T.A.

### Matsui 1424 (Tatung 190/195 Chassis)

This well made portable is very reliable. There is one stock fault however, failure of the power supply to start up because R802 and/or R803 (both 16k $\Omega$ ) has gone high in value or open-circuit. T.A.

### Sony AE1/AE1B Chassis

Poor purity is becoming quite a common problem with some older Sony sets. It seems that the line scan coils move slightly with age. A complete cure can be achieved by

releasing the screw that secures the coils and sliding them forwards slightly. T.A.

### Sharp C3720H

This set would come on for a few seconds then go into standby. We traced the cause to R521 (3.9 $\Omega$  fusible) in the feed to the field output stage. To prevent tube damage the protection circuit puts the set into the standby mode in the event of field collapse. T.A.

### Mitsubishi CT21A3STX

The problem with this set was intermittent sound muting. We traced the cause to the JC501Q transistor Q1A1 on the DET PCB. The part no. is 260P543050. T.A.

### Sanyo CBP2580 (EB1 Chassis)

After several hours' use the colour would drop out and the picture would shift slightly to the right. We found that the 17.734MHz master clock was changing frequency. Crystal X403 turned out to be the cause, part no. 610 217 1037. T.A.

### Matsui 2076R

There were hum bars on the picture. The cause turned out to be ripple on the a.g.c. feed to the tuner because C004 was dry-jointed. T.A.

### Alba CTV1

There was what looked like a blanking fault with this set. A one-inch strip on the left-hand side of the screen contained video information, the rest of the screen being blanked out. The cause was traced to R72 (390k $\Omega$ ) being open-circuit. As a result there was no line pulse feed to the TDA3565 and TDA4505 chips. M.Dr.

### Amstrad CTV2200

If the problem with one of these sets is field jitter/picture rolling, possibly intermittently, replace C814 (470 $\mu$ F, 35V). It dries out because of the heat from a nearby wirewound resistor. M.Dr.

### Ferguson ICC5 Chassis

Apart from '88' showing in the LED display this set appeared to be dead. We traced the cause of the fault to RP42 (1 $\Omega$ , safety) in the power supply being open-circuit. This resistor provides a kick-start supply for the line driver stage: once the set gets going the supply for the driver stage comes from the line output stage. M.Dr.

### GEC C1653

For field bounce when changing channels, replace C610 (220 $\mu$ F, 50V). In the set we had in its value had dropped to 90 $\mu$ F. M.Dr.

### Sanyo CTP7132

The fault with this set, for which we didn't have a service manual, was no sound. Scope checks around the audio output chip revealed the presence of a 40V peak-to-peak pulse at pin 2. We traced the source back to C321 (1,000 $\mu$ F,

35V), which fell from the board after unsoldering one leg – the other one had rotted away. A replacement restored the sound. M.Dr.

### Samsung CI5012Z

If the set is dead it's worth checking C816, which is connected in parallel with the chopper transistor. We quite often find that it's leaky. You will also find that the 5.6 $\Omega$ , 7W surge limiter resistor R801 is open-circuit.

Another common fault with this chassis is failure of the mains rectifier diodes, again blowing R801. I wonder why a fuse is included: it never seems to fail! M.Dr.

### Sanyo CBP2145 (E2-B21 Chassis)

For partial field collapse, no sound and a shaky picture replace C364 and C398 in the power supply. They are both 100 $\mu$ F capacitors rated at 25V. M.Dr.

### Philips NC3 Chassis

If there's no sound and the picture lacks contrast, check the 10 $\Omega$  safety resistor R416 in the 22V feed to the audio output stage. This resistor also feeds a d.c. offset to the beam limiter circuit, via R637. Hence the lack of contrast. M.Dr.

### Bush 2620

This set produced random flashes across the picture. The search for the cause was a frustrating one! After suspecting the tuner, the i.f./jungle chip, the SAW filter and various 10nF ceramic capacitors we eventually discovered that the a.g.c. preset VR101 had erratic high-resistance track rivets. It had obviously escaped from a TX9 chroma delay line circuit! C.A.

### Sharp CV3707HD (5PSR1 Chassis)

Although the h.t. and l.t. supplies were present and correct this set was stuck in standby. We found that the line drive wasn't reaching the driver transistor Q601 because Q605 in its base was being told by the microcontroller chip to switch on and short out the drive. A small switch, S1011, in Q605's base circuit can be used to bypass the action of this transistor and allow the drive to reach Q601. When we used this switch the set sprang to life, but no remote or manual control functions worked. Eventually we put our money on a tentative diagnosis and ordered, nervously, an IX0714CE microcontroller chip from Willow Vale (at £21.60). This time we were right! C.A.

### ITT CP3125 (Pico S3 Chassis)

Signs of life could be restored to this dead set by disconnecting the line scan coils, on top of which there is a width control that's not shown on the circuit diagram. It consists of two windings on top of each other, a series-connected coil on the outside and a shunt coil beneath. The latter had shorted turns. An identical coil from a scrap set did the trick. C.A.

### Grundig CUC4400 Chassis

A very garbled picture with severe ringing was cured by replacing the TDA5931 chip IC2210 on the i.f. amplifier/sync board. After giving the set a good soak test we returned it to its owner. Two days later he was back. "It



# JOULE A-400

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flickers after five minutes” he complained. We found that the lines started to break up, with erratic horizontal shifting. We replaced the TDA2579A sync/timebase generator chip IC2260 and checked all the associated electrolytics, but the fault persisted – with freezer having no apparent effect anywhere. The culprit eventually turned out to be C2257 in the line oscillator circuit. It’s a small 100nF 63V polyester capacitor and on test measured 95nF with no leakage.

C.A.

### Osaki P142/Akura CX4

No picture, no sound and a quiet raster were explained by the fact that there was no i.f. input at IC101. Moving back we found that Q101 was faulty, with a base-emitter short-circuit.

J.P-F.

### Sony KVX2121U

This set was stuck on channel 11 and wouldn’t respond to either the front controls or the remote control unit. Everything in the remote control receiver section was o.k. and I felt that the chip simply needed a reset, which occurred after removing the front panel then replacing it because nothing amiss had been found. One of the buttons had perhaps jammed?

J.P-F.

### Luxor 5134 (B3-1 Chassis)

On selecting text we were presented with a blank raster. Checks showed that composite video was reaching pin 16 of IZ01, and that this chip was delivering sync to pin 5 of

the SAA5020 logic decoder chip. As this i.c. was otherwise quiet we changed it. Bull’s-eye! Keep your wrists and the foil connected to chassis with this NMOS device as you unpack and fit it, and don’t worry about RN35 being open-circuit as it is only used in non-text sets, as a dummy load.

J.P-F.

### Seleco 21SM427UK

This set, which uses an unknown (to me) Italian chassis, produced an excellent picture and sound. But it would shut down to standby. The cause of the trouble turned out to be dry-joints on the output side of the chopper transformer TR401. Many other joints nearby were resoldered as they were less than perfect.

J.P-F.

### Ferguson IKC2 Chassis

This set would come out of standby for about a second then go back again. The cause of the trouble was that the TL082 field timebase generator chip IF01 was short-circuit, dragging down the line output stage derived U5 (13V) supply. While tracing this short-circuit I found that DF16 (BY398), which is in parallel with the field output thyristor, measured a bit odd. So I changed that as well.

R.F.W.

### Panasonic TC1485T (Z3 Chassis)

This set came to us because it wouldn’t tune in any stations. The tuning voltage input to the tuner was found to be very low at about 5V. The cause was C17, an 0.01µF disc ceramic capacitor, which was leaky.

R.F.W.

# Long-distance Television

Roger Bunney

After a very late start, Sporadic E conditions really opened up in June, some reception periods comparing with the heady days of the mid Sixties. TVE (Spanish) signals were present at overloading strength, giving smeary, ghosting pictures that lasted for hours. Thirty years on, older, wiser and impoverished, it still gives me a thrill to see those pictures jamming Band I.

Going back to the end of the previous month, Iran chs. E2 and E3 and Syria (test pattern identification ORTAS DAMAS) were received in the Netherlands on the 30th, while on the 31st an unidentified Arabic signal was received. This was followed, at 1058 CET, by a ch. R1 Russian logo and clock at plus four hours (1458). There was a massive opening on June 2nd. Both Dutch and UK DXers logged Saudi Arabia ch. E3 (HZ22 at Dhahran), Iran ch. E2, JTV (Jordan) ch. E3 and Syria ch. E3. It's interesting that there has been a tendency for Arabic reception to occur in the early morning period, typically before 0700 hours. Many European transmitters are then off air, and local interference levels are much lower.

Now to this month's extensive SpE log. Reception conditions have favoured the Iberian peninsula and Italy. Sadly, signals from Scandinavia have been lacking.

5/6/95	TVE (Spain) chs. E2, 3, 4; RAI (Italy) ch. IA; ITPR (Italy) ch. E2; LTV (Lithuania) ch. R2; C+ (Canal Plus) ch. L2; TVP-1 (Poland) ch. R2.
6/6/95	C+ L2, 3; RAI IA, B; TVP R3; OK1 (Russia) R2; MTV (Moldova) R2, 3; LTV R2; ITPR E2; TVE E2; BTB (Byelorussia) R1; RUV (Iceland) E4; HZ22 (Saudi Arabia) E3.
7/6/95	TVE E2, 3, 4; ARD (Germany) E2; +PTT (Switzerland) E2, 3; SVT-1 (Sweden) E2, 3, 4.
9/6/95	RAI IA, B; TVE E2, 3, 4; DR (Denmark) E3; ITPR E2; C+ L2, 4; TVP R2; SLO (Slovenia) E3.
10/6/95	TVE E2, 3, 4; RAI IA, B; ITPR E2; DR E3; C+ L2, 4; LTV R2; TVR (Romania) R2; SLO E3; HRT (Croatia) E4; NRK (Norway) E4; RTP (Portugal) E2, 3.
11/6/95	TVE E2, 4; RAI IA, B; SVT E2, 3; HRT E4; Arabic signals in ch. E3 from 1100-1115.
12/6/95	TVE E2, 3, 4; Serbia E3; RAI IA, B; ITPR E2, 3; SVT E2, 3, 4; ETV (Estonia) R2; HZ22 E3 0720-0800.
13/6/95	JRT (Beograd, Serbia) E3; RAI IA; TVE E2, 3, 4; RTP E3; RUV E3; NRK E2, 3.
14/6/95	RTP E3; TVE E2, 3, 4.
16/6/95	ITPR E3; TVE E3.
17/6/95	TVE E3; RTP E3.
18/6/95	TVE E2, 3, 4.
19/6/95	ITPR E2; RAI IA; C+ L2; TVR R2; RTP E3; TVE E2, 3, 4.
20/6/95	RAI IA, B; ITPR E2; TVE E4; OK1 R2;

SLO E3; NRK E2, 3; DR E3; Serbia E3; unidentified PM5534 pattern on chs. E2, 3, 4 with identification NORDLAND.

Also a mid-morning Russian signal at an odd frequency - 58MHz!

21/6/95	RAI IA, B; ITPR E2; C+ L2, 4; OK1 R2; DR E3; SLO E3; MTV-1 (Hungary) R1.
22/6/95	RAI IA, B; ITPR E2.
23/6/95	MTV R1, 2; Serbia E3; SLO E3; TVE E4; a ghostly long-hop programme signal was seen at 1030 from the SE.
24/6/95	TVE E2, 3, 4; RTP E3, 4 (the latter a 35W relay!).
25/6/95	ITPR E2; TVE E2, 3, 4; RTP E2; RAI IA, B; HRT E4; SLO E3; +PTT E2, 3; ARD E2; C+ L2; MTV R1, 2.
26/6/95	TVE E2, 3, 4; TVE-2 E2; ITPR E2; RAI IA; SVT E2, 3.
27/6/95	C+ L3; NRK E2; YLE (Finland) E3; SVT E2, 3, 4; TVP-2 R2.
28/6/95	UKR (Ukraine) R1, 2.
30/6/95	RAI IA, B; C+ L2; TVE E2, 3, 4.
1/7/95	TVE E2, 3, 4; RTP E3; C+ L3; RAI IA.
2/7/95	TVE E2, 3, 4; RAI IA.
3/7/95	TVE E3, 4; also unidentified signals.

To summarise, it was a very active period. My thanks to all those who sent in logs. In late June a stable and extensive high-pressure system produced very hot weather in the UK. Tropospheric propagation conditions improved, bringing Band III and u.h.f. signals from the nearer Continental stations, but unfortunately there was nothing for the record books. Congratulations to Ryn Muntjewerff (the Netherlands) and Garry Smith (Derby) on their reception of Arabic stations.

## Satellite Sightings

June was relatively quiet for satellite reception. The Conservative Party leadership election produced a flurry of activity at the end of the month, when numerous SNG and OB links were seen, from both London and the provinces. There were also the two summit meetings. The G7 meeting in Nova Scotia, Canada used technical facilities provided by CBC, with links to Europe via Orion 1 Atlantic at 37.5°W. The subsequent Cannes meeting produced numerous live SNG reports via the Eutelsat craft at 7, 13 and 16°E and French Telecom 1C at 3°E.

A dramatic event occurred on the night of the 18th when a tank station at Eynatten, Belgium exploded. The VTM BEL005 SNG truck was soon on the scene, relaying via Eutelsat II F3 at 16°E (12.538GHz vertical). The same satellite produced test transmissions for Arabic Radio and Television (ART) at 11.095GHz. The captions mentioned a central European boresight, a power of 47dBW and 6.6MHz, J17 sound.

John Locker comments on confusion about the satellite actually doing the downloading with NBC feeds from New York to Europe for the NBC Super Channel service. David Thorpe (*Transponder Bulletin*) has analysed several reports and concludes that the feed uses Intelsat 506 at 32.4°W: it has an inclined orbit that seems to move during a twelve-hour cycle. As a result the signal peaks and then falls away during the daytime.

On June 26th I monitored an OB feed uplinked to Orion 1 at 237.5°W, using the 12.664GHz vertical transponder. To start with there were colour bars with the identification UKI 40 LIVE TV SOHO. During the evening there were

live inserts from a restaurant, with customers being asked about their meals. I've no idea what the transmission was intended for and suspect that it won't feature in next year's BAFTA awards!

Intelsat K was very busy with transatlantic feeds in both directions. The Le Mans 24-hour race was broadcast live on the 17th via the 11.499GHz horizontal transponder. Other sports links included the US Open tournament. And of course there was the OJ court show.

One 'mystery' has been partially cleared up: the VTV programming via Eutelsat II F2 (10°E) at 10.973GHz vertical is uplinked from Bratislava, Slovakia.

Colin Paton tells us that satellite TV enthusiast programme Telesatellit TV (TSTV) is to be broadcast on the second Sunday of each month at 2000 GMT, via DFS-2 Kopernikus. The frequency is not known at present but it shouldn't be too hard to find the programme.

Julian Redwood, who is active in Band C, mentions that RTP International is available via the Express 2 satellite at 14°W. The satellite also carries the APNA TV Hindi programmes at 11.525GHz, with circular polarisation. Asianet, another Hindi channel, has been seen at 11.616GHz horizontal via Orion 1 at 37.5°W. The signal is very strong.

Roy Carman has sent a very long reception listing. An RTL OB feed from Osnabruek, Germany via DFS-2 featured armed police, balaclava-clad specials, a rammed Opel and a surveillance helicopter: there had been a shoot-out. This was at 11.474GHz vertical, with 6.6MHz audio. Two days later Roy monitored an OB feed ex Coronation Street, via Orion 1 Atlantic. On the 9th he received a video programme on a UN fire-fighting unit via Eutelsat II F3 (16°E), at 12.546GHz vertical. It was uplinked from a UK base in Sarajevo.

We're always pleased to hear from sat-zappers about their reception and equipment.

## News Items

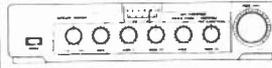
**France:** The Canal Plus digital TV service is to be launched this November, with 24 channels initially and up to forty other services such as text, pay TV and downloadable software. Decoders will be available for sale or hire in conjunction with a subscription package. Almost a quarter of a million decoders have been ordered.

**Luxembourg:** Talks between CLT and News Corporation on a common digital decoder/encryption standard are at an advanced stage. Canal Plus had earlier been involved but pulled out.

**The Netherlands:** Scandinavian Broadcasting Systems is to launch the SBS-6 channel on August 28th, offering

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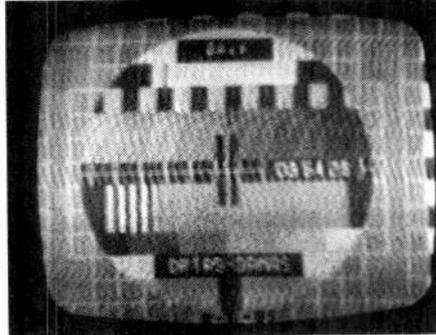
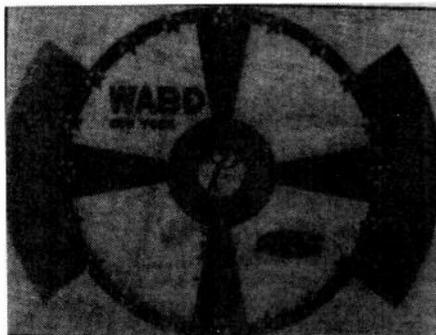
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Aerial Techniques

'infotainment' with a 45 per cent Dutch content. Veronica leaves the public system on September 1st to join with RTL-4/Endemol. There will be seven commercial channels in operation in the Netherlands by the autumn.

**Thailand:** The Siam TV consortium is to open the first u.h.f. terrestrial TV service in the country in mid 1997. Coverage is planned to reach 97 per cent of the population by 1999, with a network of 36 transmitters and four studios.

**Ireland:** Plans to privatise RTE-2 have been dropped following the collapse of the TV3 network. RTE's transmission side may be privatised however, with the new concern also being responsible for commercial radio transmissions. A single overall broadcasting authority for both RTE and the commercial networks is envisaged. An inde-



How times change! Left: The Du Mont WABD, New York City, channel A5 test card as it appeared in 1945. Centre: Damascus, Syria ch. E3 received in the Netherlands by Ryn Muntjewerff in 1995. Right: Another photo from Ryn, this time an Iranian announcer received in ch. E2.

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pendent news/current affairs service franchise may be offered, with access to the RTE-2 network. The cost of the broadcast receiving licence is likely to be linked to the going rate of inflation – the last increase was in 1986! These proposals are contained in a Green Paper on the future of Irish broadcasting.

**Romania:** There are now 82 local TV stations in operation throughout the country.

**Russia:** A new commercial station, Kosmos 10, is in operation in Moscow on ch. R51. Transmissions times are 1900-2300 (local time). At present the transmitter power gives a coverage of 25km radius: a power increase is hoped for in 1997.

**Finland:** A local TV service, Skycom One, is in operation at Tampere on ch. E6.

### Planning Permission

After mention in this column of Ian Waller's difficulty in gaining permission for a 3.65m diameter dish I received a letter from Councillor Laurie Vaisey, who is chairman of the Lincoln City Council Planning Committee and is also a reader and a radio/TV enthusiast. He recommends seeking the local council's advice about any proposed aerial system before putting in an application. Laurie points out that planners are human and like to say yes if at all possible. Problems can arise in visually/historically sensitive areas, but again it's worth seeking advice.

According to Laurie, cases sent to appeal are usually won by the authority rather than the applicant! As a planning committee the members meet, discuss, negotiate, have site visits and try very hard to be fair. With a little patience, it's surprising what can be achieved.

I'm grateful to Laurie for his comments and hope that readers involved in anything of this sort will heed his advice.

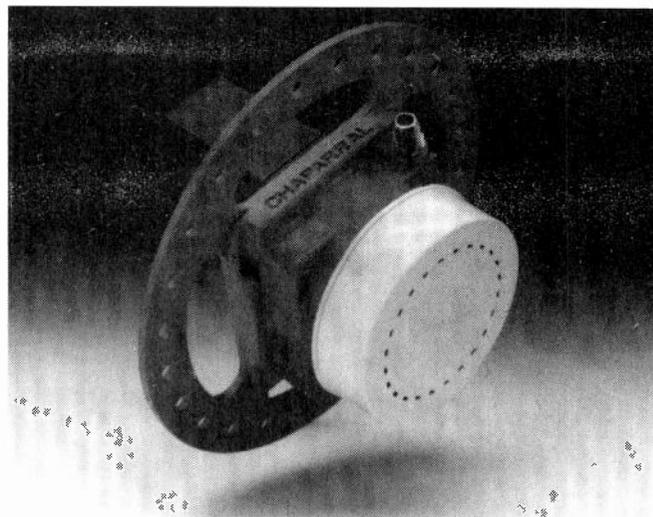
### Chaparral's C band Micropak

Chaparral has introduced a new head end for C band (3.6-4.2GHz) satellite reception. In this band reception generally requires a large dish, often in excess of 6ft (1.8m) diameter: in many regions that rely on the 4GHz band for their TV it's common for monsters upwards of 9ft to be used. A large dish is necessary because the downlink signal levels tend to be much lower in the C than the Ku band, also because for a given dish size the C band gain is lower than the Ku band gain, and to provide adequate directivity, i.e. rejection of signals from adjacent satellites.

It has been traditional to use a feedhorn with a scalar ring assembly at the focal point of the dish, with a servomotor driven vertical/horizontal polariser and an LNB bolted on. The signal pickup probe consists of a quarter-wave stub within the feedhorn. The whole assembly is relatively large and heavy and introduces a degree of signal shadowing at the centre of the dish, reducing the level of signal pickup.

Chaparral's Micropak head end differs in using a rotatable dipole within a much reduced feed 'tube'. The incoming signal is inductively coupled to the LNB, thus avoiding a soldered connection and providing easy dipole rotation for polarisation adjustment. The directly driven, by a small servo motor, dipole gives improved cross-polarisation rejection (the quoted figure is 40dB minimum). An extremely small LNB is directly integrated with the feed package, which has an improved noise temperature characteristic compared to a standard LNB bolted to a feedhorn.

The combination of small size and light weight with improved electronic characteristics enables a smaller dish to be used to obtain the same overall performance, though



**The Chaparral Micropak head unit for C band use, with weather cover fitted.**

the small dish will have a wider beamwidth than a larger one. Typical specification is 65dB gain at a 25°K noise temperature, the coverage being 3.7-4.2GHz with an i.f. output at 950-1,450MHz. The Micropak is designed for use in areas, such as the Americas and SE Asia, where the signal polarisation is linear. An Intelsat version for circular polarisation is not at present available.

Tests have shown that the unit will work well with dishes that have an f/d ratio between 0.28-0.45, which is a wide spread. The unit is completely weatherproof, with a clip on-cover. It's an impressive unit. We'd be interested to hear from anyone who has experience of its use.

### **An Interesting Band III Array**

An Italian aerial manufacturer, Fracarro Radioindustrie SPA, Cassaro, Italy has introduced a Band III array that features a folded director chain ahead of a traditional dipole and folded reflector. It's available in both narrow and wide-band (174-230MHz) versions. Single-channel versions have gains of up to 8dBd and 11dBd respectively for four- and six-element types. With wideband versions the gains are 6.5/7.5dBd.

### **Satellite News**

The Japanese Jsat satellite, due for launch late this summer, will eventually offer fifty digital TV channels provided by NHK and ten other commercial and public TV broadcasters. Two million subscribers are expected by the year 2000.

Bandula Gunasekera (Sri Lanka) reports that APNA-TV is now being transmitted full time (except for 1800-2000) by the Ekran satellite at 99°E, the frequency being 754MHz. Gorizont 21 (103°E) and Gorizont 4 (130°E) carry APNA in Band C.

The Swedish Space Corporation plans to launch another Sirius satellite, at 5°E. This would provide another 'hot spot' in the Scandinavian sky, along with Tele X and Sirius 1. A spot beam covering Scandinavia would offer up to 32 analogue Ku band channels. There would also be pan-European beams.

EBN via the Eutelsat Hot Bird (13°E) now has teletext which should soon run to 800 pages of business news.

Robert Cooper has sent us a copy of *SatFACTS Monthly*, which reports on satellite TV in the Pacific Ocean region. It contains news and articles on installations, dealers and personalities. The subscription is \$40 US or \$40 NZ in the Australasian region, from PO Box 330, Mangonui, Far North, New Zealand. Telephone 64-9-406-0651 or fax 64-9-406-1083.

### **Obituary**

Will Bate of Bridgnorth, Shropshire died on April 23rd, aged 91. He corresponded with me for over twenty years and had been very active in the electronics field, working for Decca in the pre-Tatung days. His daughter Olga Greaves has written that Will died peacefully, in hospital. She also wrote that while clearing up his effects and the technojumble gathered over many years she thought "how quickly a person's existence is wiped away, as transient as a TV picture". Physically, perhaps, but the spirit and warmth of his former being remain. Rest in peace, Will.



# **Test Case 393**

A previous test case showed that Service Manager's diagnostic and servicing skills are not sufficient to cope with some of the things that come into the workshop. So he drafted in our good, freelance friend Roger to help out during the week when two of the regular bench men were away on holiday. He was certainly intent on getting his money's worth out of Roger, who was run off his feet between the audio, video, TV and field service departments. One of his field calls gave Roger particular grief.

The patient was a huge 28in. Panasonic TX28A1, fitted with the Alpha 2W chassis, the complaint being that it didn't "hold teletext steady". And that's exactly what Roger found. The ordinary off-air pictures were correctly locked, but when teletext was called up the display was unlocked, rolling sideways in lines – the sort of thing that would have led you to readjust the line hold control had the problem been with the picture rather than text images. But you don't get a separate teletext line hold pot, so Roger had a tap and bash

around the PCB that contains the text decoder. This had no effect, neither did application of heat and freezer to the text chips and the two associated crystals. Our puzzled locum wanted to avoid having to transport the monster if possible, so he promised to return next day, better equipped for the task of diagnosis...

The rest of the day went a little better, and when it was over Roger had a quick read-up on the operation of this type of two-chip (plus memory) type of text decoder: it uses the Philips SAA5231 and SAA5243 i.c.s, and is found in many manufacturers' sets. The upshot was that he returned to the job next day armed with the service manual, a 6MHz crystal, an SAA5231 chip and a reasonable understanding of the operation of the phase-locked loop circuit used to synchronise the dot clock that controls the display. He settled himself behind the set and started to work.

The symptom suggested that the 6MHz clock was not locked to the incoming TV sync. This may have been because the crystal frequency was way off, or because there was something wrong with the sync or PLL circuits. Roger's little oscilloscope showed him that a good composite video input, with clean sync pulses, was entering the SAA5231 chip at pin 27. His test gear complement didn't

run to a frequency counter to check the 6MHz oscillator, so he twiddled the trimmer C3528, without much effect, then replaced the crystal itself (X3504). As is often the case, this sensible and logical course of action had no effect on the fault: the text display continued to fall sideways and break into lines.

So it had to be the processor chip. Its supply voltage was o.k., its input signal was o.k., and its 6MHz crystal was o.k. Brandishing his soldering iron, tethered to earth by his antistatic wrist strap and secure in his knowledge that he had a sure-fire cure, Roger removed IC3501 and fitted the replacement, fresh from its antistatic bag. He carefully put the old one back in the same bag – which was as well, because there was nothing wrong with it! That became plain when our bemused man once again saw an unlocked display appear on the big screen. He arranged to call with Colin Doc to collect the set that afternoon for workshop repair and went wearily on his way.

It was a couple of days later that Roger got the opportunity to sort out the problem on the service department bench. The cause wasn't far away from the field of his previous operations. What had he overlooked while working on the set in the customer's house? For the solution, turn to page 807.

# Letters

## HI-FI COMPATIBILITY & MACROVISION PROTECTION

The points raised by Michael Maurice in his letter in the July issue are of considerable interest and appear to be little understood. They refer to the hi-fi compatibility problem with prerecorded tapes and colour problems with Macrovision (TM) protected tapes. It's time to get a few things sorted out. I'll start with Macrovision.

In the record mode modern VCRs use gated a.g.c. instead of the original type of a.g.c. that's based on the average level of the video signal being recorded. A gated a.g.c. system examines the signal when it is at a fixed level, in practice the black level during the field blanking period. In this way the a.g.c. circuit is able to check the signal level, and set the record amplifier gain, independently of the varying video content of the signal. So signal sampling for a.g.c. purposes is carried out during the field blanking period.

Macrovision doesn't prevent copying. What it does is to make a mess of the copies by upsetting the a.g.c. action. This is achieved by inserting varying level pulses in the field blanking period at the times when the signal is sampled. The a.g.c. circuit thus sees a varying Macrovision signal instead of a fixed signal level, and as a result the a.g.c. action varies with the Macrovision signal. The sampling is carried out ten times during the field blanking period: six Macrovision pulses are inserted during each of these ten sampling times.

The Macrovision system doesn't interfere with any other VCR function. It has, however, been known to interfere with the colour bursts during the field blanking period. This can cause colour problems at the top of the TV screen, in the same way that any video playback used to produce disturbances at the top, except that only the colour is affected.

If too many colour bursts are lost during the field blanking period, the colour up-converter's VCO can start to drift off frequency. When the burst is next detected it takes a finite time for the VCO to lock up. Hence the loss of colour at the top of the screen. The VCR, the TV set or both can cause the problem.

In the latest JVC ASC news my friend Gary lists some modifications to shorten the colour up-converter VCO time-constant in JVC VCRs so that the colour lock up is quicker. This improves the results with tapes that have Macrovision. But this is not always the case – some TV sets may require the same sort of modification. You'll find a series RC network in the VCO's control voltage filter: to reduce the time-constant and improve the lock-up time, as a general guide increase the value of the resistor by a factor of three.

Now to hi-fi recordings. It's a fact that there is very poor hi-fi track compatibility with the prerecorded hi-fi tapes on sale. I've on a number of occasions received from a manufacturer's customer a bunch of tapes, a VCR and the complaint "these ten tapes will not play back in hi-fi although the other twenty will". So I check the compatibility, tweek the machine and return it with a note listing those prerecorded tapes that are too far out of specification. Naturally I get a telephone call a week later complaining that since the VCR has been to me a large percentage of the other twenty tapes now have hi-fi problems. Tough, the VCR is to specification.

It seems certain that the copying houses do not maintain the compatibility specification of their VCRs for hi-fi tapes sufficiently closely. Why is hi-fi so critical that a tape will play via one machine and not another?

In his letter last month Ian Potts blamed excessive signal level. As the signal is recorded in f.m. form, overloading cannot be the cause of the problem. The audio level depends on frequency deviation, and is insensitive to signal amplitude provided this is sufficient. Excessive recorded signal amplitude is taken care of by the limiters that precede demodulation.

There are only three possibilities here: high recording level at the copying house causing excessive deviation; too high an f.m. carrier record drive signal, which gives rise to patterning and cross-talk with the luminance carrier; and poor track compatibility.

The hi-fi tracks are recorded prior to the f.m. video signal, which erases the hi-fi signal by about 12dB as it's laid down on the tape. Excessive recorded f.m. video will reduce the recorded hi-fi signal even more. This is something the copying houses should check.

Ian Potts' problem is tape track incompatibility, not audio record level overloading. This is clear from his need to use the tracking control. Reducing the audio carrier level is irrelevant, provided it remains above the threshold. The demodulated audio level depends on the f.m. carrier deviation, not the playback signal amplitude.

Incidentally no VHS recorder uses dynamic tracking: this is a 2000 system feature.

With prerecorded material it's more important to use a hi-fi test tape to set up the compatibility, monitoring the hi-fi playback f.m. rather than the video f.m. carrier. Why? If, because of a tracking error, the video playback signal is of low amplitude the result will be a grainy picture. The hi-fi audio on the other hand will mute completely should the carrier dip below the set threshold level at any point along the playback track. With some makes of VCR the muting level has a degree of tolerance: flutter may be apparent, otherwise the machine will switch to linear sound.

*Steve Beeching, T. Eng.,  
Newark, Notts.*

With reference to Michael Maurice's letter (July), I've also experienced curious burbling noises with some hi-fi tapes. I had put it down to some sort of noise reduction or compression system used in the original transfer. The problem never occurs with my own recordings. My children have a large number of Disney tapes. Some of these show the effect and, by experimentation, I've discovered that the ones which give the trouble cannot be copied. Their *Bambi* tape is particularly bad. My Beatles *Help* tape has music tracks that were remastered in stereo: once again strange burbling noises can be heard.

The audio output from my stereo VCR is connected to the hi-fi system. This makes the problem even more apparent. It would be interesting to hear from readers who have Dolby Surround systems, since I feel that these would be affected even more.

I echo Michael's words and would be interested in hearing from the tape duplicating and mastering companies. After all, prerecorded tapes can be expensive. The whole point of the VHS hi-fi system is to obtain the very best audio quality possible. I frequently use my VCR for audio only recordings, and the results are outstanding. Why should I have to tolerate inferior results with so-called professional recordings?

I appreciate that companies have to guard against copying, which costs them millions in lost revenue. Perhaps however they should consider modifying their systems to overcome these problems.

Come on, let's hear from you!  
*Richard Newman,  
Croydon, Surrey.*

## FREE ESTIMATES ETC

If K. Docwra (Letters, July) can give free estimates with no call-out fee one can only assume that he has free petrol, tax, insurance, telephone etc. This sort of thing has been a menace in our trade for years.

Members of the general public are experts at playing one off against another when it comes to providing services. Mr Docwra seems to be the perfect example of the well meaning engineer who is an enthusiastic amateur when it comes to business matters. All he is doing is to make our trade look like a bunch of semi-skilled operators rather than professionals.

The days of an engineer with an open-neck shirt, jeans and a screwdriver in his back pocket should have long since departed. This is a high-tech, high-stress business, and only those with a completely professional approach will survive.

After thirty years in the servicing industry I find that the customers of the Nineties expect a professional to service their equipment. They will pay accordingly, just as they pay for any other service today. The 'no call-out charge, free estimate brigade' are, thank goodness, a minority. Otherwise none of us would earn a living.

When customers who demand no call-out charge etc. contact me I suggest they phone their nearest charitable association. Someone should persuade Mr Dowcra to return to this planet and reality.

Rodney Drysdale, Audio/Vision Services,  
Dundonald, N. Ireland.

## START-UP SUPPLIES

I enjoyed Andy Denham's article on switch-mode power supplies (July) but believe that Kevin must surely have spotted the mistake at one point in WS's account of circuit operation. Here's my guess at the missing dialogue, which follows from the sentence ending "... circuit now provides its own power for IC1" (top of page 657).

At this point Kevin interrupted: "There's something I'm not quite happy about here. Isn't it true that for D1 (Fig. 7) to switch off, its cathode would have to be at a more positive voltage than its anode? This means that IC1's l.t. supply voltage would have to be greater than the h.t. voltage across C1."

There was a pause while WS sighed and knocked out his pipe. "Ye-es" he replied, "I was trying to simplify things, but you're right of course. Any voltage higher than that produced by D2 will push current through R2 and D1 - or a resistor on

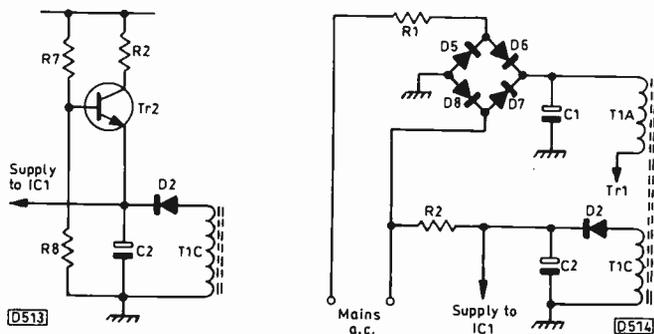


Fig. 1 (left): Use of an emitter-follower to provide a start-up supply.

Fig. 2 (right): The cheap and cheerful approach, obtaining the start-up voltage from the a.c. side of the supply.

its own, like R1 in Fig. 6. What you need to do is to use a circuit like this." He sketched the arrangement shown in Fig. 1.

"Transistor Tr2, which is biased by resistors R7 and R8, replaces D1. When the set is first switched on, Tr2 operates as an emitter-follower, supplying IC1 with a start-up voltage that's set by the values of the bias resistors. R2 still dissipates most of the energy lost during the start-up period. This is kinder to Tr2 - and should Tr2 go short-circuit R2 will prevent the h.t. being applied to IC1 directly, blowing it to bits! When C2 finally gets charged by D2 from the secondary winding on the chopper transformer, the voltage at Tr2's emitter rises 2-3V above that at its base. So Tr2 switches off. The only energy now wasted is that lost by the current flow via R7 and R8. But R7 can have a high value, say 220kΩ, so it will be very little. Just remember that if R7 goes high in value or open-circuit, the set won't start up!"

"You didn't mind me asking?" said Kevin.

"Oh no, I just love having smart lads around to ask awkward questions" WS replied. "Now, back to regulation. . ."

K.C. (Kindly Counsellor!).

Holbury, Hants.

**Editorial comment:** A nice way of doing it (Tr2 etc.)! This is the professional equipment approach. There was actually an error in Fig. 7 in that R2 should have been shown connected to the a.c. side of the supply. In cheap and cheerful consumer electronic equipment the usual approach is simply to leave out D1 and connect R2 to the a.c. side of the bridge rectifier, see Fig. 2. At switch on R2 and C2 act, on the positive-going swings of the mains input, as an integrator. The value of R2 is made sufficiently high to produce a small kick-start supply across C2. On the negative-going swings of the mains input D8 in the bridge rectifier circuit clamps the voltage to chassis.

## BBC UNFAIR

I'm writing to you after seeing a BBC-1 programme broadcast on July 17th. The aim was to catch traders out over repairs. An engineer was called to look at a VCR whose carriage unit had been tampered with. He told the customer that the complete rack assembly would need to be replaced. He mentioned a cost of around £60 and said that the repair would have to be done in the workshop, as it was not recommended to be carried out in the field.

The officer subsequently commented that the machine would have worked perfectly had the carriage been refitted back on its rollers.

Any engineer who has worked on Philips Charley decks will confirm that rack assembly replacement is the standard practice when there are carriage problems. If a tape gets jammed in the unit, many customers will have a go and try to remove it, damaging the cassette housing and forcing the rack unit in the process. Quite apart from that, customers tend to use equipment till it fails. If you refit the carriage and it jams again, they expect another repair free of charge. Replacing the rack kit, along with other components, ensures a long-term cure for any carriage faults with these rather old Philips machines. A trader who does this is simply carrying out a good, reliable repair and also avoiding any bad feeling that would be caused by further trouble with the mechanism.

In many cases you are caught out when an estimate is given and you then find that the video head or a drive component is also faulty.

I feel strongly that the programme was unfair to the engineer and to the genuine traders who appeared in it.

P.C. Martin, D.M.T.V.,

Strood, Kent.

# VCR Clinic

*Reports from Philip Blundell, AMIEEIE, Brian Storm, Michael Dranfield, Eugene Trundle, John Coombes, Mike Leach, John Edwards, Andrew Tebbutt and David Belmont*

## Philips VR422

Plyback produced only a blank screen though the sound came through all right. Checks with the scope showed that the video was being lost in IC7501 (LA7391A). The off-tape f.m. entered at pin 39, came out at pin 3, re-entered at pin 4 but then got lost internally. As voltage checks on the supplies and the record/playback switching didn't come up with anything we fitted a new LA7391A chip. This solved the problem. **P.B.**

## Sharp VCA615

There was an on-screen display problem: all you got was a screen full of zeros. Tests on the OSD generator chip IC5901 showed that pin 7 (CS) didn't go high. The command comes from pin 12 of the RHIX0581 timer chip IC5001. A new RHIX0581 chip restored normal operation. **P.B.**

## Panasonic NVSD25

This machine had no E-E picture. Checks showed that the 12.3V supply was low at about 7V. When the power supply was disconnected from the main board the voltage returned to normal. We eventually found that the UN2211 transistor QR1001, which buffers the power on-off switching, was leaky. A replacement transistor cured the trouble. **B.S.**

## Panasonic NVFS100

There were problems with this S-VHS machine's mechanism, but nothing that you could really put your finger on. The machine would play a tape all right, but when going from play to rewind or fast forward there would sometimes be problems: after briefly spooling backwards and forwards the machine would lapse into standby.

Our first move, more in hope than the expectation that this would work, was to replace the mode switch. We then carried out a full check on the mechanical alignment. All to no avail. The G mechanism in this machine is operated by the capstan motor, through a gear train which is switched in and out by a solenoid. Kick and hold circuits control the solenoid. What was happening was that the kick circuit was operating weakly, sometimes not at all, because C6017 had gone low in value. As a result the pulse to the kick circuit was of low amplitude. **B.S.**

## Panasonic NVHD90

This Nicam machine had no E-E picture. Checks showed that the voltage on the 12.3V line was low at about 5V. As disconnecting the power supply made no difference to the voltage the cause of the fault was clearly in the power supply itself. C1130 (1,000pF) was eventually found to be leaky. **B.S.**

## Panasonic NVJ42

This is one of those Panasonic models that can increase its wind/rewind speed as it spools through the tape, slowing down before the transparent leader that activates the end stop is reached. This machine did not slow down when it

rewound a tape, though it did when it wound one. Thus a tape that was being rewound had to stop very suddenly: sometimes this would tear the leader off the tape. . .

The systems and servo microcontroller chip has to monitor the two reel sensors to determine the type of tape and thus calculate when it should speed up and when it should slow down. If the tape is not recognised, usually because it has a non-standard length and/or hub size, or cannot be spooled evenly, it will not be wound or rewound at top speed. Now back to the fault. The amplitude of the output from the take-up reel sensor was lower than that from the supply reel sensor: perhaps more importantly, there was also a glitch at the bottom of the waveform. A replacement take-up reel sensor, part no. 0N2170, cured the unfortunate tendency to separate leaders from tapes. **B.S.**

## Logik VR955/Samsung VI710

The cause of loss of the test signal and the supply to the r.f. modulator was traced to L105, a 33 $\mu$ H choke on the bottom PCB. A replacement from a scrap machine put matters right. **M.Dr.**

## Ferguson FV31

If the mains input fuse is blackened but the chopper transistor is o.k., replace the mains rectifier's 150 $\mu$ F, 385V reservoir capacitor. It tends to flash over when the mains voltage is applied. A cold test will suggest that it is o.k. **M.Dr.**

## Sharp VCT72H etc

Don't immediately replace the reel idler/clutch assembly if the take-up torque is poor and the tape spills out. The cause of the trouble is more likely to be the take-up reel's soft brake. It becomes contaminated, and as a result introduces more friction than the idler can cope with. The part number in the exploded view in the service manual is 112. This applies to all machines that use the same deck, but quote the part number shown in the relevant manual as different part numbers are used. **M.Dr.**

## Sony SLV415

The drum servo was unstable. It hunted, especially when the machine was cold. When I applied a puff of freezer to the AN3814K drum motor drive chip the drum virtually stopped – it was left just twitching backwards and forwards, even with no tape inserted in the machine. A replacement drive chip, part no. 8-759-420-83, cured the problem. **M.Dr.**

## Philips DMP2 Deck

If the complaint is about intermittent timer recordings and failure to play back a fully rewound tape, fit a Philips brake modification kit. It's part no. 4822-466-40181, contains six different parts and costs about £4. During the tape threading process the take-up spool can rotate

slightly, activating the end sensor with the result that the machine shuts down. **M.Dr.**

### Salora SV6500/Sanyo VHR1100

The customer had previously taken this machine to a local cowboy who said that the capstan motor needed replacement and that this would cost over £100. On inspection we noticed that several chips had been changed. The capstan speed was certainly varying, but careful scope checks around the servo chip IC4002 showed that the tracking control was open-circuit. The NCS part no. for this 100kΩ slider potentiometer is 6130010278. If you don't have an account with NCS, Willow Vale can obtain it for you – quote the same part no. **M.Dr.**

### Sanyo VHR4350

The fault we had with this machine is more common with Hitachi than Sanyo VCRs! After running for one-two hours the sound would be affected by a lot of wow: soon after that the capstan would start to stop at intervals of a few seconds. Under the fault condition we found that the drive chip, which is mounted on the capstan motor, was too hot to touch. The entire motor assembly had to be replaced. **E.T.**

### Sanyo VHR150

This was a simple enough fault, but the cure was very expensive. The machine would sometimes mangle tapes when in the reverse search (review) mode. When we finally got to see what happened, we found that the tape was piling up on the right-hand side of the drum. The cause was excessive friction on the lower drum periphery. We had to replace the lower drum assembly. **E.T.**

### Sony SLV353

If you get tape creasing with one of these machines the first item to check is the pinch roller. Replace it if worn. The other thing to check if necessary is that arm assembly RVS is well lubricated, clean and moving freely so that the tape is removed from the cassette smoothly. **J.C.**

### Sony SLV373

Intermittent drum motor rotation can also show up as picture hunting in a recording. Although the drum motor would appear to be faulty the usual cause of the trouble is one or more of four capacitors, CO13,4,5 (all 0.1μF) and/or CO19 (0.15μF). It's best to replace all four capacitors. **J.C.**

### Hitachi VT150

This machine wouldn't play tapes. On inspection we found that there was no drum or capstan rotation. We also found that the SP/LP tape speed switch didn't operate. The cause was soon tracked down to failure of the STK5476 power regulator IC851 to provide a 5V output. A new chip restored normal operation. **J.C.**

### Hitachi VT63

This machine wouldn't accept a cassette. The tape-in indicator was permanently lit and the carriage loading motor was trying to eject the carriage from the machine! This was all because the carriage-mounted tape end sensors were slightly leaky. The leak couldn't be measured with a

multimeter, but the scope component tester displayed the tell-tale waveform. This is a very useful device! **J.E.**

### Panasonic NV730

The job card read "tape chewing when tape ejected". It failed to mention that no tape transport modes worked, except tape lace/unlace when play was selected. We found that all three legs of the reel motor driver transistor Q1504 were badly dry-jointed. Cleaning and resoldering them provided a complete cure. **J.E.**

### Samsung SI7230

When play was selected the drum rotated and the tape laced up. It then unlaced and the machine shut down. There was no rewind and no fast forward operation. The basic cause of all this was no capstan movement. R244 (3.3Ω) in the 15V feed to the BA6209 capstan drive chip was open-circuit. A replacement immediately burnt up because the chip itself was faulty. A new chip and feed resistor restored normal operation. **J.E.**

### Ferguson 3V29/JVC HR7200

There were no deck functions. A routine check on the tape-end sensor bulb, by depressing the tape-in switch, confirmed that there was no illumination. After fitting a new bulb there was still no light! That'll teach me to be so optimistic. With the tape-in switch depressed the voltage across the lamp was found to be only 1.4V instead of 12V. The supply comes via the collector of the 2SB643 transistor Q1, a pnp device which is on the little PCB that holds the two-pin lamp socket. 12V was present at the emitter of this transistor, but its collector was open-circuit. A new transistor restored the glow and the deck functions then worked normally. **J.E.**

### Samsung VI710

This machine was completely dead, with no displays. A replacement STK5333 power supply regulator chip restored normal operation. **J.E.**

### Akai FS200

The job card said "won't accept a tape, but works all right if a tape is placed in position". The tape loading tray (cassette load block as Akai calls it) was in its correct position but loose, as if it wasn't connected to anything. The customer was quite right: if a tape was placed on the tray and simply pushed down gently into position the machine would work perfectly.

The tray is raised and lowered by a half-moon shaped gear called the eject gear (part no. MZ-387335J). This is driven by a metal-toothed shaft, which is aptly called the eject slider. The gear had severely worn and chipped teeth, while the moulded grip that attaches it to the machine's frame was broken. So there was little or no contact between it and the slider.

After fitting a new gear and reassembling the tray holder and tray it was time for a test run. Fortunately I was able to unplug the machine before the tray had lowered fully, because the reason for the damage was now obvious. There's a spring-loaded piece of plastic, called a torsion arm damper (part no. ML-391745J2), to the left of the carriage. The spring is held in place by a small moulded pip which had broken off. So the spring was left protruding into the tray's path. As the tray was lowered it would jam against the spring, but the tray drive would try to keep it moving.

The weakest point will give, in this case the gear/lever parts.

A new torsion arm and spring finally restored normal operation. Incidentally while I was waiting for these items I found that the machine worked perfectly during numerous test runs. So I'm not sure of their purpose. No doubt someone will write in to enlighten us. **J.E.**

### **Samsung VI375**

This machine was completely dead with a tape loaded in the mechanism. A check in the power supply showed that the 2.7Ω surge limiter resistor R901 was open-circuit. The usual cause of this is failure of the STR11006 power regulator chip. When this chip and the 2.7Ω resistor had been replaced the power supply squeaked loudly. Cold checks revealed that the 22V zener diode ZD101 was short-circuit. A replacement immediately failed.

When we removed the power supply from the rest of the machine and lifted ZD101 from the board we found that the 16V supply had risen to 29V. There was obviously another fault. The culprit turned out to be the 100μF, 25V, 110° electrolytic capacitor C110, which was leaky. If you have difficulty locating it, you'll find that it has a small rubber cap glued to the top. When this item had been replaced the 16V line returned to its normal voltage. After replacing the zener diode and refitting the power supply the machine worked perfectly. **M.L.**

### **Mitsubishi HSM55**

Since there was no 5V supply to the microcontroller chip nothing worked. The STBY 5V supply is obtained from the power supply sub-board which in turn requires a 30V input. This was missing. It's derived from Q901, which had 30V at its collector with plug PZ disconnected. So the 30V supply was being dragged down somewhere else in the machine.

The 30V line also supplies the front panel, via plug PZ, for tuning etc. Checks here showed that the uPC574J-KL regulator IC8A2 was short-circuit. When this item was replaced the supply lines all came up and the machine worked normally. **M.L.**

### **Philips VR2574**

The symptoms suggested that the heads were dirty. But cleaning them made no difference. When the tape path was examined I saw that the entry guide didn't move home fully into the V block. While looking for the reason for this I suddenly realised that the deck bears more than a passing resemblance to that used in the JVC HRD540. In this deck the pin that holds the guide arm in place has a tendency to come adrift. The same thing had happened with this Philips machine. Fortunately the deck is much easier to remove. You don't have to take out the cassette housing, as you do with the JVC deck, to gain access to various fixing screws. **A.T.**

### **Samsung SI1260/Sticky Labels**

The playback picture produced by this VCR had a slight tracking error at the top, as if the back tension needed adjustment. When the top cover was removed and the tape path was examined we found that a sticky label, of the type used to index cassettes, was stuck to the entry guide. Removing it restored normal playback.

I seem to recall having a similar fault with a

Ferguson 3V55 some years ago. On that occasion however the label was stuck to the underside of the take-up spool. As a result the machine shut down, because there were no reel pulses. In addition the label was not as obvious and not as easy to remove – the bottom of the machine and the reel sensor assembly had to be withdrawn in order to gain access to it. **A.T.**

### **Sanyo VHR190**

After being recorded for about twenty minutes the f.m. signal would disappear. The bad news is that fault finding in this area is almost impossible, as you can't lift the board out of its can and operate the machine. The good news is that Sanyo can supply a replacement PCB at a reasonable cost. The part no. is 613 123 6110. Fitting a replacement cured the fault. **D.B.**

### **JVC HRD910**

There was intermittent loss of colour in the LP mode. SP was o.k. Our prime suspect was the main video processor chip on the video subpanel, but a replacement made no difference. By coincidence I found that moving the head amplifier brought the colour back. All that was required was to tighten the screws which secure the head amplifier's can to the deck chassis. **D.B.**

### **Hitachi VT65**

This machine would very intermittently fail to record video information. After soak testing it for a week we found that the amplitude of the record f.m. signal input to the head switching chip was occasionally low. Our problems were made much worse by the fact that even the slightest movement would restore the amplitude of the f.m. signal. The cause of the trouble was eventually traced down to IC202, which is a hybrid thick-film chip. **D.B.**

### **Amstrad UF40**

The spring associated with the cassette flap opener had come out of the carriage and landed in the power supply section of the PCB, where it had done major damage that included blowing the optocoupler in half! All the semiconductor devices on the primary side of the power supply were short-circuit, with the fusible resistors open-circuit. When these items had been replaced the power supply worked but we found that the main microcontrolled chip IC6001 had also failed. Replacing this got the machine going again. **D.B.**

### **Sony SLVE80**

The playback picture produced by this six-month old machine was very poor. The cause was a worn upper drum. I don't know how it came to wear so quickly, but it did. A new one cured the fault. **D.B.**

### **Panasonic G Deck**

If the carriage has jammed but when you remove it you find that the rest of the mechanism is correctly aligned the cause of the problem is a worn right-side plate and its corresponding connection gear. Inspection will show that the gear teeth are severely worn. Both items must be replaced or the machine will bounce. This has become such a common problem that I now replace these items automatically. **D.B.**

# *Servicing Notes on Pioneer CD Multiplayers*

*John Coombes*

A common problem with these players is failure to play a disc, which usually means that it will not have read the table of contents. The most likely cause of the trouble is a faulty spindle motor. This can be quickly checked by removing the leads and measuring the motor's d.c. resistance. If the reading is less than  $15\Omega$ , replace the motor. Another check, to prove the point, is to connect the motor to a 6V battery. Remember that in the test mode the micro-controller chip does not read the table of contents: this fact can also be used to establish that all functions are o.k. except that a faulty spindle motor is preventing the machine from playing a disc.

When you replace the spindle motor be sure to use the spacer jig to set the correct spindle table height.

We have found that a lot of skipping can still occur after adjusting a player. The cause of this is vibration because of a faulty spindle motor bearing.

After replacing the spindle motor, check the focus offset, the laser power, the tracking balance and the r.f. level.

If the player fails to work after fitting a new spindle motor, check that the lens is clean. It can be cleaned with isopropyl alcohol. Other possibilities are a power supply fault or a system control problem.

## **The Test Mode**

The test mode is entered by pressing the test mode switch then turning the power on. In this mode the function controls all have different purposes. Operation of the track forward control will move the objective lens up and down. Press play and the spindle motor should rotate at the correct speed. Press pause to close the tracking servo: release pause to open the servo. Manual search forward operates the carriage motor, moving the optical assembly to the outer area. Manual search reverse has the opposite effect, moving the optical assembly to the inner area.

The track reverse key turns the laser on. This is useful for checking the laser's operation and power. The stop key stops all servo operations: the player is then in standby but still in the test mode. To exit from the test mode, turn the power off then on again.

If the track forward key is pressed and disc one remains in place, the laser and focus are both all right. If this action leads to disc one being rejected, the mechanism moving on, suspect a focus or laser problem.

If this first test proves that there is no problem, operate the tracking forward key, wait a few seconds then press play. The disc should rotate normally. We can therefore monitor the r.f. waveform. Ensure that the eye pattern isn't blurred. The laser's output should be 1.5V peak-to-peak. If the speed is excessive when play is pressed, it may be necessary to check the r.f. signal path back to the decoder and the operation of the crystal in the decoder.

## **Maladjustments**

If the tracking balance is incorrectly adjusted the result may be jumping or skipping. The search time is much longer when this preset is misadjusted. The same symptoms occur when the tracking offset control is out of adjustment.

If there's a lot skipping or track jumping, check that the tangential skew is set correctly. If this adjustment is badly out the disc may not play at all. Also check the grating adjustment with these problems. These adjustments should both be carried out when the optical unit is replaced.

## **Skipping/Jumping**

This is a common complaint. There are many possible causes, including the spindle motor and, as mentioned above, misadjustment of various controls. Check that the tracking and focus offset are correct, that the VCO is correctly set up and that the disc turntable height is correct. Make sure that the drive screw from the carriage motor runs freely. Check that the belt isn't stretched or slipping.

If these things are all o.k., bear in mind that the disc may be faulty. The disc can be scratched or pitted, preventing laser reflection. A warped disc will also result in skipping and jumping.

## **Other Problems**

We've had users who have not read the instructions and who have put a disc in the cartridge upside down. If the disc isn't clean there will be no reflection.

In most cases intermittent operation is caused by a faulty spindle motor. The other main possibility for this is intermittent laser operation because the ribbon between the main PCB and the optical unit is faulty. If there's no focusing the disc will not rotate.

If the spindle motor doesn't lock in correctly, the crystal VCO may be out of adjustment (VR604). Use a frequency counter to set it up – the usual frequency is 4.57MHz. Distorted sound or no sound at all can be the result when the frequency is badly out. The frequency can vary with different models: check the service manual for the correct frequency and tolerance.

The player sometimes produces a semicircular scratch on the disc. This is caused by worn cushion pads (part no. PED1001). There are three of them. Replacement will prevent this scratching.

Make sure that you use a good disc when adjusting the laser power. If a poor disc is used the reflection will be poor and the laser power setting will be incorrect. If the output is higher than 1.5V peak-to-peak, the tracking/focus servo setting may be incorrect. Remember that overrunning the laser may shorten its life.

In general, if all the adjustments are carried out correctly but the eye pattern is still not good the laser unit is suspect. Mechanical wear can also cause poor laser output.

15.80H	3.83	2SC2073	0.77	2SD639	0.60	BC252B	0.07	BF470	0.33	BY399	0.11	HA13119	2.05	MJE18004	1.80	STK7358	5.81	TDAL1519A	2.74	TDAR178FS	3.81
1N4001	0.04	2SC2078	0.86	2SD667	0.38	BC258	0.09	BF493	0.36	BYD14J	0.26	HA13403	3.59	MJE2955	0.68	STR40090	5.81	TDAL1520B	2.48	TDAR180	4.87
1N4002	0.07	2SC2120	0.23	2SD669A	0.64	BC300	0.48	BF494	0.12	BYD330	0.43	HA1377	2.62	MJE2955T	0.68	STR4211	12.63	TDAL1521	3.36	TDAR190	2.91
1N4003	0.05	2SC2166	1.29	2SD716	1.46	BC301	0.28	BF757	0.43	BYD33J	0.27	HA1338SP3	7.69	MJE3055	0.52	STR441	28.40	TDAL1524A	1.88	TDAR8305	7.21
1N4004	0.07	2SC2229	0.28	2SD718	1.21	BC303	0.24	BF758	0.32	BYD33M	0.21	HM6232	10.46	MJE3055T	0.74	STR451	23.50	TDAL15530	4.79	TDAR8380	2.53
1N4005	0.00	2SC2230	1.66	2SD734	0.26	BC307	0.06	BF759	0.38	BYD330	0.25	HM6251	9.57	MJE340	0.50	STR50020	9.02	TDAL15540	8.12	TDAR9503	2.13
1N4006	0.06	2SC2235	0.36	2SD762	1.80	BC307B	0.14	BF760	0.26	BYD330	0.19	JDB	0.00	MM650	5.98	STR50103	4.10	TDAL1670A	2.98	TDAL1014	1.87
1N4007	0.06	2SC2236	0.36	2SD820	5.06	BC307C	0.15	BF762	0.30	BYD330	0.21	K42206	1.32	MPSA60	0.35	STR54041	4.36	TDAL1675A	3.85	TEA1039	2.14
1N4148	0.06	2SC2240	0.16	2SD837B	1.12	BC308	0.06	BF788	0.52	BYD330	0.27	K42223	0.60	MPSA42	0.23	STR5412	3.68	TDAL1701	2.65	TEA2018A	1.70
1N5061	0.00	2SC2271	0.67	2SD855	1.03	BC308A	0.09	BF869	0.25	BYW56	0.31	K42263	0.55	MPSA43	0.15	STR58041	6.41	TDAL1770A	30.29	TEA2029C	5.69
1N5062	0.51	2SC2274	0.35	2SD863	0.35	BC308C	0.06	BF870	0.29	BYW95C	0.65	K48301	1.42	MPSA55	0.26	STR59041	6.67	TDAL1872A	4.83	TEA2031A	3.40
1N5400	0.07	2SC2314	0.38	2SD869	1.18	BC309	0.04	BF871	0.41	BYW96E	0.94	KBL08	1.42	MPSA56	0.12	STR6020	5.38	TDAL1905	2.12	TEA2164	2.96
1N5401	0.14	2SC2335	1.12	2SD870	3.81	BC309C	0.14	BF959	0.18	BYX55600	0.23	KIAG210AH	6.15	MPSA92	0.18	STR6020KIT	15.05	TDAL1908A	2.12	TEA2165	4.27
1N5402	0.12	2SC2458	0.14	2SD871	5.08	BC327	0.10	BF960	0.30	BYX71600	1.45	KSR1001	0.14	MR854	0.65	STRD4420	11.16	TDAL1950	1.86	TEA2165A	9.58
1N5404	0.13	2SC2482	0.35	2SD880	0.36	BC327B	0.17	BF966	0.26	BZV10	1.34	KSR2001	0.14	NE545B	3.20	T6064V	2.63	TDAL2002	1.12	TEA5101A	3.95
1N5406	0.12	2SC2570A	0.30	2SD882	0.43	BC328	0.07	BF970	0.30	BZV6110	1.34	KSR2004	0.14	NE555N	0.40	T6067V	5.04	TDAL2003	0.90	TEA5115	2.91
1N5408	0.09	2SC2581	3.08	2SD898B	6.41	BC337	0.14	BF970	0.30	BZV6110	0.78	L200CV	2.19	NE556	0.43	T9053V	0.93	TDAL2004	2.57	TC106D	0.82
1N914	0.04	2SC2603	0.25	2SD965	0.67	BC337L	0.22	BFR34A	0.78	BZV6110	0.19	LA1230	2.95	NE592N	1.91	T9064V	1.51	TDAL2005	1.63	TC106M	0.75
2N2222	0.22	2SC2625	2.94	2SD973	0.38	BC338	0.06	BFR90	0.59	BZV6112	0.12	LA1230	2.95	NE592N	1.91	T9064V	1.51	TDAL2006	1.06	TC106M	0.75
2N2222A	0.23	2SC2655	0.31	2SJ115	7.69	BC368	0.11	BFR91A	0.68	BZV61120	0.09	LA1261	1.29	NE640N	4.45	TA7109AP	3.63	TDAL2006	1.06	TC106M	0.75
2N2369A	0.18	2SC2705	0.22	2SK1117	3.06	BC369	0.17	BF991	0.60	BZV6113	0.11	LA2503	2.29	DA200	0.22	TA7205AP	1.28	TDAL2030H	0.74	TC1225M	1.02
2N2907	0.20	2SC2724	0.19	2SK192A	0.36	BC372	0.43	BFR91A	0.92	BZV6120	0.19	LA4270	2.73	QA90	5.23	TA7217AP	1.46	TDAL2030V	0.74	TC1225M	1.02
2N3053	0.38	2SC2979	2.74	2SK794	6.41	BC461	0.31	BC461	0.55	BZV6127	0.19	LA4282	8.89	CQ71	1.03	TA7222P	1.28	TDAL2040H	0.11	TL111	1.94
2N3055	0.50	2SC3117	0.60	3SK88	2.57	BC517	0.14	BFY51	0.39	BZV6133	0.19	LA4422	1.36	P600A	0.33	TA7227P	2.29	TDAL2170	7.08	1P110	0.36
2N3440	0.35	2SC3153	2.40	74LS247	0.62	BC546A	0.07	BR100	0.21	BZV6156V	0.11	LA4440	1.80	PC814	1.29	TA7233P	1.97	TDAL2270	2.45	1P12H	0.95
2N3442	1.00	2SC3156	6.61	7805	0.78	BC546B	0.12	BR103	0.53	BZV6162V	0.07	LA4445	2.99	PC16C5/YXT50	1.81	TA7240P	2.74	TDAL2540	1.12	1P121	0.42
2N3707	0.12	2SC3179	0.82	7806	0.60	BC547	0.11	BR303	1.22	BZV6175V	0.09	LA4460	1.31	R2M	0.67	TA7250	4.07	TDAL2541	0.72	1P127	0.47
2N3773	1.34	2SC3182	2.49	7808	0.72	BC547A	0.04	BR444	1.02	BZV6182V	0.19	LA4461	2.71	R4050	3.04	TA7250BP	3.74	TDAL2542	5.95	1P132	0.65
2N3819	0.55	2SC3199	0.43	7809	0.69	BC547B	0.11	BRX49	0.43	BZV6191V	0.09	LA4475	2.99	R4051	4.80	TA7270P	1.59	TDAL2574A	2.99	1P137	0.48
2N3904	0.32	2SC3225	0.60	7812	0.52	BC548A	0.11	BRX49	1.20	BZV6191V	0.30	LA4476	2.99	RBI56	2.40	TA7271P	11.33	TDAL2578A	2.91	1P295	0.94
2N3906	0.30	2SC3241	1.19	7815	0.82	BC548B	0.06	BRX56	0.43	BZV6191V	0.10	LA4508	2.77	RC4558	0.48	TA7273P	4.14	TDAL2579A	4.91	1P29C	0.41
2N4123	0.00	2SC3302	2.12	7810S	0.06	BC548C	0.06	BR550	0.75	BZV6191V	0.09	LA4508	2.77	REGBAY10	17.56	TA7274P	2.74	TDAL2581	4.27	1P29E	0.37
2N5296	0.69	2SC3311	0.29	78M05	0.35	BC549B	0.11	BSS38	1.77	BZV61930	0.10	LA6538	0.60	RGPI0G	0.26	TA7280P	2.94	TDAL2581Q	2.99	1P305	0.94
2SA1013	0.35	2SC3330	0.26	7905	0.35	BC550	0.15	BT139600	1.29	BZV7936	0.11	LA6510	2.94	RGPI5G	0.33	TA7281P	2.78	TDAL2582	2.05	1P30C	0.17
2SA1015	0.11	2SC3355	0.96	7915	0.82	BC550C	0.09	BT151500R	1.44	BZV7947V	0.07	LA7520	4.80	RGPI5J	0.24	TA7288P	2.04	TDAL2593	0.76	1P31A	0.33
2SA1015GR	0.11	2SC3358	0.69	AA119	0.36	BC556A	0.06	BT151800	1.15	BZV7956V	0.05	LA7800	2.41	RGPI5M	0.44	TA7299P	2.65	TDAL2594	2.21	1P31C	0.77
2SA1016	0.26	2SC3420	0.55	AA143	0.13	BC557	0.15	BUI104	1.43	BZV7962V	0.08	LA7801	2.41	RGPI30M	0.30	TA7317P	3.44	TDAL2595	3.19	1P32A	0.41
2SA1020	0.10	2SC3420	0.55	AA143	0.13	BC557A	0.15	BUI205	1.07	BZV7962V	0.08	LA7820	2.71	RM11C	1.71	TA7609P	2.19	TDAL2600	4.86	1P32C	0.40
2SA1029	0.19	2SC3502	0.45	AC151	0.52	BC557B	0.06	BZU208A	1.44	BZV7965V2	0.13	LA7835	1.88	S2000A3	1.54	TA7680AP	4.59	TDAL2611A	0.64	1P35C	1.39
2SA1048	0.26	2SC3656	0.18	AC159K	0.40	BC558B	0.08	BZU208A	1.25	BZV79810	0.11	LA7837	1.63	S2000AF	1.68	TA7698AP	3.60	TDAL2611AQ	1.32	1P36C	1.37
2SA1286	0.60	2SC3679	4.45	AC187K	0.53	BC560C	0.06	BZU208B	1.61	BZV79810	0.07	LE33G	4.70	S2055AF	2.02	TA7769P	4.01	TDAL2653A	2.99	1P41C	0.43
2SA1370	0.43	2SC3788	0.77	AC188	0.40	BC635	0.19	BZU208B	1.61	BZV79811	0.11	LC7132	4.10	SA129302	8.20	TA7784P	2.25	TDAL2655B	19.93	1P42A	0.35
2SA1489	2.40	2SC3795	1.97	AC188K	0.82	BC636	0.14	BZU208B	1.61	BZV79812	0.07	LE33G	4.70	SA129302	8.20	TA7784P	2.25	TDAL2655B	19.93	1P42A	0.35
2SA1706	0.52	2SC3795B	2.63	AD149	0.52	BC637	0.11	BZU208B	1.61	BZV79812	0.07	LE33G	4.70	SA129302	8.20	TA7784P	2.25	TDAL2655B	19.93	1P42A	0.35
2SA562	0.17	2SC3807	0.84	AF124	1.75	BC639	0.09	BZU208B	1.61	BZV79824	0.11	LM1203	10.47	SA5012	3.34	TA8205	3.93	TDAL3190	1.27	1P42C	0.35
2SA564	0.33	2SC3883	5.92	AF125	0.82	BC640	0.06	BZU208B	1.61	BZV79827	0.11	LM1303N	10.87	SA5243PE	10.87	TA8205AH	4.50	TDAL3330	12.29	1P491A	1.20
2SA608	0.24	2SC3892A	4.79	AF126	2.23	BC679	0.40	BZU208B	1.61	BZV79827	0.11	LM3171	1.29	SAB3035	1.71	TA8207	2.74	TDAL3505	2.40	TL062	0.60
2SA673	0.12	2SC3953	0.72	AF127	0.77	BC717	0.27	BZU208B	1.61	BZV79833	0.11	LM324N	1.48	SG264A	11.57	TA8210H	5.28	TDAL3541	0.98	TL071	0.69
2SA684	0.43	2SC4106	2.05	AF139	0.29	BD1031	0.26	BUS050F	1.35	BZV79836V	0.11	LM3329	0.50	SGSIF344	7.28	TA8215H	5.73	TDAL3560	2.96	TL071CP	0.60
2SA733	1.18	2SC4242	2.31	AN5265	1.76	BD1032	0.26	BUS050F	1.35	BZV79836V	0.11	LM3329	0.50	SGSIF344	7.28	TA8215H	5.73	TDAL3560	2.96	TL071CP	0.60
2SA769	1.29	2SC4517	4.70	AN5435	1.46	BD1035	0.33	BUS050F	1.35	BZV79847V	0.06	LM3407S	0.41	SL1430	1.92	TA8216H	8.01	TDAL3561A	3.30	TL072	1.03
2SA844	0.26	2SC4517A	2.52	AN5512	1.01	BD1036	0.20	BUS050A	0.95	BZV79851V	0.13	LM358N	0.60	SL1431	2.40	TA8220H	7.69	TDAL3562A	5.90	TL072CP	1.03
2SA872	0.35	2SC4558	0.12	AN5515	1.29	BD1037	0.46	BUS050AF	1.08	BZV79852V	0.11	LM3800	1.02	SL1432	6.19	TA8221H	6.16	TDAL3562ATF	3.34	TL074	1.15
2SA872A	0.35	2SC4742	4.70	AN5521	1.66	BD1039	0.18	BUS050APH	1.99	BZV79852V	0.11	LM3800	1.02	SL1432	6.19	TA8221H	6.16	TDAL3562ATF	3.34	TL074	1.15
2SA916	0.57	2SC536	0.30	AN661D	0.94	BD1040	0.24	BUS050B	1.32	BZV79859V1	0.11	LM3914M	0.57	SN76705AN	1.70	TA8410K	4.27	TDAL3566	6.41	TMP47C432P818	15.19
2SA933	1.00	2SC639	0.56																		

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# What a Life!

**Donald Bullock**

I just can't handle the video rental business Steven has built up, nor the customers it attracts. So when Steven decided to take a few days off last week he arranged for young Doreen Dense to look after that side of things.

## **A Pile of TVs**

Come Monday morning I decided to attack the nasty jobs that always seem to edge towards my end of the bench. The first was a 5in. JVC colour set, Model CX60ME, whose operation was intermittent. I'm not always able to open little TV sets. The last time I tried, every screw I undid made something drop off inside the cabinet until I had a sealed box full of bits. I hoped for better luck this time.

I needn't have worried. It opened easily. I noticed a small panel that stood up on one side of the main panel. Wagging it produced and cleared the fault. The joints were dry, and resoldering them cured the trouble. That hadn't been too tricky. I looked towards the next job.

It was a tired-looking Bush 2020T colour set. "Goes envious" said the card, in Steven's writing. He's getting to be quite a wag. The picture and sound seemed normal to me when I connected the set to the mains supply, so I left it running. I was just about to pick up a further job when this French fellow breezed in with a Blaupunkt FM100-21AX colour portable.

"Wonder if you can get it going?" he said. "It packed up some time back and another dealer said it was unrepairable."

When I plugged it in and switched on there was a blank screen, apart from a third of the picture at the top. I didn't have the circuit diagram but spotted the field output chip and noticed a nearby 1,000µF, 25V electrolytic. Thinking of all the Bush field scans I'd restored by replacing capacitors like this one, I took it out and checked it on the bridge. One microfarad. Not enough! A replacement brought back an excellent picture.

Meanwhile the picture on the soaking Bush set had become green at the extreme left-hand side. I blew hot air through the back: as the chassis warmed,

the green area spread slowly across to the right until it covered the whole screen. When I removed the back I subjected the TDA3562A colour decoder chip to the heat and freeze treatment. This confirmed that it was the cause of the trouble. It's mounted on a small subpanel.

The ticket attached to a Toshiba 150R6B 14in. portable read "cuts out when warm". I plugged it in and gave it the hairdryer treatment. After a few minutes it cut out. When I opened it up I saw that there was a huge crop of dry-joints around the line output transformer. I resoldered them then switched on again, full of confidence. This time matters were worse. The set was dead.

A line output transformer as badly dry-jointed as that one would have been sending nasty, spiky r.f. pulses along the paths connected to it. To the scan coils for a start and, heaven forbid, probably to the signal stages. I checked the line scan coil connections and found awful dry-joints here as well. Resoldering them restored a good picture. I was grateful as I boxed the set up.

But I wilted a bit when I saw that the next set was a Sony KV21XMTU. It was dead. This was not surprising when I examined the chassis and found that a dry-joint on one leg of R614 (220Ω, 10W) in the snubber circuit had cooked the PCB and made it conductive: the 2SD1548 chopper transistor Q602 and the mains fuse had also snuffed it. Tidying up the chassis and replacing these items brought the set back to life.

## **Ribald Reg**

Then Ribald Reg minced in with his hands thrust deeply into the pockets of his old Humphrey Bogart trenchcoat. Reg never had a character of his own. He settled for the Humph one after seeing Casablanca. He looked tense and uncertain.

"This set's giving me plenty of trouble" he lisped into my face. "And I'm sick of the hassle."

"O.k., o.k., just bring it in." Just then Greeneyes came in with my tea.

Humph watched her as she clip-clopped out. "Nice dame" said his teeth, "who's she?"

"Mrs D. Bullock, Humph" I said.

He brought the set along later. It was a 10in. Philips portable, Model 10CX1120/05B. The set worked all right when I plugged it in, but as it warmed up the picture developed a faint blue haze. Then it began to flash blue. I've had this fault before with these sets and went straight to the tube base panel, where there are some sealed presets I've never been able to clean. For some

reason it always seems to be the blue adjustment and background potentiometers that play up in this way. Replacing them with open ones, as I've done on previous occasions, cleared the trouble.

## **Tipsey Ted**

My next caller was Tipsey Ted. He runs a village pub on the main road and treats life as though it's one big joke. Perhaps he's right. I can't afford enough drink to be able to find out though.

"You're lucky today Don. I've got a camcorder and a recorder up the creek, and I'm letting you mend them. Only one thing. You'll have to get them from my wagon. I've got a bad back."

"I spend all my life carrying stuff in and out of this workshop" I said. "I'd develop a bad back if I had the time."

The camcorder and VCR were sitting on top of a load of coloured parasols. "What are these for, Ted?" I asked.

"To put over the tables outside the pub. Brings the motorists in. They pinch a few glasses, but we make up by charging them a bit extra when they order their drinks."

"Er, right" I said. The camcorder was a Chinnon one whose viewfinder had detached itself from the main body because the screws had worked loose. As I've had this before I did it while he waited.

I removed the carriage door, dismantled the casing top and bottom then withdrew the four deck-securing screws. After turning the camera over I removed the two screws that secure the lens assembly. This gave me access to the viewfinder section. I fitted two new screws and painted on a couple of spots of Loctite. "It won't come back with that particular fault" I added after reassembling the unit.

Ted's VCR was a Panasonic NVDH8. When I plugged it in and switched on it clunked and died. I opened it up and replaced the STK5339 regulator chip then, as usual with these machines, I checked the low-value electrolytics in the power supply. Several had gone low in value. After replacing them the recorder worked well enough.

"Pop in for a drink sometime" Ted said as he left.

"Join the mugs under the parasols, eh?" I said.

## **A Delivery**

Our postman came in with a parcel from SEME. Another Philips 10CX1120/05B set had come in a week earlier with the usual faulty tube base panel problem, the picture flashing blue. With this set the panel was beyond

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repair. Both Willow Vale and SEME quoted £48.36 plus VAT for a replacement panel, bringing the total cost of the panel to £56.82. Rather a lot. Our reaction was not to encourage Philips and scrap the set, but the customer wanted the repair done. So we tossed a coin and ordered the spare from SEME. When we fitted it we obtained an excellent picture.

What with this sort of thing and the incomprehensible manuals Philips produces nowadays I don't feel the same endearment to the company that I did at one time. Can anyone remember the excellent grey covered manuals the company produced years ago? (Of course! – editor. But they came from service subsidiary Amalgamated Electric Services Ltd. Who remembers that organisation?) Like its service and prices, they were wonderful. But times change. It's not so bad for the newcomers. They never knew the good times.

### Two More

It was getting on, but I decided to have a go at a couple more sets. The first was a Bush colour receiver fitted with the T24E chassis. Pretty ancient. "No colour" Steven had written. I poked around the line output and colour decoder sections but couldn't see anything obvious. So I got out the scope and colour bar generator. Eventually I found that R229 (3.6kΩ), in the line pulse feed to the colour decoder, had risen in value to 175kΩ. Should have remembered that stock fault. A replacement cured the trouble. Though old, the chassis seemed to be in almost mint condition. And the picture was excellent, as though the tube was new.

The last set was a Ferguson model fitted with the TX10 chassis, the one with the fold-down panel at the rear of the main one. The sound was o.k., but there was no colour and after a while the picture occasionally rolled for fifteen

seconds. At the same time the whole picture changed from very light to very dark. A few minutes later it began to slip sideways as well, first to the left and then to the right. It all then gradually came right again.

I'd never before seen all these symptoms together on one of these sets: unstable sync, no chroma, video trouble. It seemed to me that the place to look for the cause was around the signal/sync take-off stages. Or maybe there was a decoupling or power supply fault.

I was spared further thought by Greeneyes who came in to see where I'd got to.

"There's more to life than gazing into the back of a telly" she said.

"Yes. I'll just put a mention of the fault in my next *Television* column. Who knows, someone might come up with the answer and save me from further frustration. Meanwhile, let's go kill a little time."

# Test Report: The Ozan Teletest Pro Pattern Generator

*Eugene Trundle*

We reviewed the Ozan Teletest, a hand-held pattern generator designed for TV and VCR installation and servicing use, in the November issue last year. The manufacturer has now introduced the Teletest Pro which, while based on the previous design, is aimed at professional and semi-professional users. The main differences with the Pro version are the omission of a u.h.f. output, the provision of a wider range of patterns, the inclusion of sockets for composite and for S video outputs, and a choice of audio test tones which are obtained from two balanced (three-pin XLR plug) outputs. There's a higher price tag for all this.

Switch selectors on the Pro model offer the following eight patterns: 75 per cent (EBU standard) colour bars; a grey-scale step wedge; a 17 x 23 line crosshatch with border castellations; a saturated red raster; a black raster with colour bursts; a multiburst which consists of vertical gratings that correspond with 3.5MHz and 1.75MHz; a 17 x 22 dot pattern with border marks; and a peak white raster. The audio outputs are 1kHz and 10kHz sinewaves at 0dBm, corresponding with the standard line level of 775mV at 600Ω.

The unit consumes about 120mA from an internal battery or a mains unit which is included with the instrument. Other details are given in the accompanying specification table.

## **Construction**

As before I started with a look inside. Construction is very similar to that of the basic model, the main items being a fibreglass PCB, fourteen i.c.s including an EPROM, and a couple of crystals. The total component count is in excess of a hundred. There are three presets, which are accessible without breaking the main seal or removing the case. They provide compensation for ageing and drift in the sync and colour subcarrier generators and the YC processing circuits. I was impressed with the ruggedness and strong construction of the output sockets. They are plainly designed to withstand thousands of connections and disconnections. Taken together, these factors suggest that reliability and longevity are assured.

## **On Test**

When they were checked against a broadcast transmission I found that the sync and subcarrier frequencies were within 2Hz and 10Hz of the specified standards. Likewise the luminance, chrominance and audio levels were within a few per cent of the nominal values when correctly terminated. The sync pulse trains, blanking intervals and colour bursts were checked and found to be to broadcast specification.

An examination of the patterns on a TV screen and on an oscilloscope showed them to be fine, with precise interlacing and timing. The black and white levels on the colour bars and the step wedge corresponded with those of a broadcast test pattern, as did the picture-centring border castellations with the crosshatch pattern.

The black raster with bursts – I found the signal very



**The Ozan Teletest (left) and Teletest Pro (right).**

'clean' – is useful for video-editing users who want to 'black' a tape before insert-editing. The crosshatch and dot patterns are an ideal aid when aligning video-projector images as well as direct-view c.r.t.s. I would have liked a wider range of grating sizes in the multiburst pattern however, so that the luminance frequency response in TV/video equipment being tested could be better evaluated. The gratings provided produce a vertically-split screen, with the finer lines on the right-hand half of the screen.

I was pleased with the purity and shape of the audio sinusoidal waveforms, but would have preferred a 5kHz or 6kHz tone alongside the standard 1kHz rather than the somewhat piercing 10kHz tone, which is beyond the range of longitudinal videotape sound tracks. The balanced XLR audio output ports are fine for the use intended for this instrument, but some semi-pro gear is fitted with phono audio connectors – this is also the case with top-of-the-range domestic video equipment and many monitors. For these it's necessary to make or buy adaptors. L and R phono sockets would have been a welcome addition. The instrument can be switched to audio-only operation when required for audio line identification or sound-channel testing; this saves on battery power.

In general use I found that the Teletest Pro is handy, reliable and convenient. The versatile battery-mains power system is good for both bench and location work. As with the standard Teletest unit, a tough protective case would have been a useful accessory.

## **Conclusion**

For domestic TV and VCR installation, setting up and servicing the cheaper, standard Teletest unit is the best and most versatile tool. For those involved in broadcast, professional and semi-pro work, for facilities houses and video production companies, the Teletest Pro is the more suitable, handy source of test patterns and tones for everything from lining-up equipment on location to checking

video distribution systems and colour monitors. Money is less tight in these fields than in the video/TV repair trade, so the price of £209.95, which includes delivery but not VAT, will be acceptable for most potential users.

### **Availability**

The Teletest Pro is available, with a one-year parts and labour guarantee, from Ozan, 37 Haviland Road, Fern-down Industrial Estate, Wimborne, Dorset BH21 7SA. Phone 01202 877 270 or fax 01202 877 271.

### **Brief Teletest Pro specification**

**Composite/YC video output:** 75 per cent EBU bars at 1V p-p at 75Ω, PAL 4.433MHz, via BNC and S sockets.

**Audio outputs:** 1kHz and 10kHz sinewaves.

**Sync:** 15.625Hz/50Hz, fully interlaced to CCIR specification.

**Size and weight:** 145 x 90 x 45mm, 265g.

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# **TV Technology from Philips**

*Frank Harding*

Philips has always been at the forefront of TV technology. The company's latest sets are amongst the best available and incorporate a number of interesting innovations. Several terms that could cause confusion have been adopted to refer to them. A brief explanation of some of these terms should be helpful for technicians.

### **Crystal Clear**

This refers to a combination of several techniques. First there's SCAVEM, which stands for SCAn VELOCITY Modulation. This improves transitions between black and white areas of the picture by altering the horizontal speed of the electron beam when such a transition occurs. When a rapid transition is detected in the signal, a pulse is generated to produce the SCAVEM effect via an extra coil mounted on the neck of the tube. The result is improved definition between black and white: vertical lines are sharper, as are white characters on a black background.

Another vital element of Crystal Clear is the use of a comb filter to separate the luminance and chrominance components of the video signal. This virtually eliminates cross-colour effects from such things as checked jackets and, if you can ever see one, the high-frequency bars on a transmitted test pattern. Moiré patterning is also reduced. The use of a comb filter, also called a digital filter, enables the full luminance signal bandwidth to be maintained.

Another feature of Crystal Clear is Black Stretch. This is a way of improving the apparent picture contrast by making completely black something that's almost black. The distinction between the black and white sections of the picture is increased. Combine these items with a black-matrix c.r.t. and you have a TV set with one of the best pictures possible.

### **Widescreen Formats**

Philips has been making widescreen sets for some three years now. The industry standard for the widescreen aspect ratio is 16:9. Until recently the sources of widescreen signals have been restricted to prerecorded tapes and laser discs.

### **Movie Expand**

The problem is that most, if not all, so-called widescreen tape

signals have a letterbox format. Thus even with a widescreen set you get a border all round. This also applies with the PAL Plus transmissions from Channel 4 received by non PAL Plus receivers. By using the Movie Expand feature on Philips sets that have it, you can make the letterbox picture fill the screen. There's a loss of vertical resolution however, because the spaces between the active lines carry no information. Thus the line structure can look quite coarse. There is a way round this, as we shall see later.

### **Panorama**

Since most current transmissions are in 4:3 aspect ratio form the owners of widescreen sets are faced with a problem. They can either watch the picture in the 4:3 form, leaving black bands down each side, or they can expand the picture electronically to fill the 16:9 screen.

The trouble is that you cannot fit 4:3 into 16:9 and retain the full picture. With early widescreen sets you could expand the picture at the expense of losing a slice from the top and bottom. Most shots didn't look too bad, but any subtitles were lost. This was overcome by having a remote control field shift facility. It enabled the whole picture to be moved up so that the subtitles could be read. But there was more picture loss at the top.

The Panorama mode in current sets provides a better solution. It alters the 4:3 picture electronically to fit the 16:9 screen. While the centre of the picture is left virtually unchanged, the sides are stretched to fill the screen. As the picture height remains the same there is no loss of subtitles. The effect is far more pleasing to the eye. It can give greater realism to sports programmes with noticeably less picture distortion.

### **Zoom**

Various picture ratios have been used over the years. As a result you may not get a full-screen display with a widescreen set. Some ratios give borders at the sides or top. The zoom feature in some Philips sets enables the viewer to adjust the picture size in steps to obtain the 'best fit'.

### **Widescreen Plus**

In mentioning the Movie Expand feature earlier we pointed out that when a letterbox picture is expanded to fill the screen there's a loss of vertical resolution. There has been talk recently of Widescreen Plus offering a possible solution. The gaps between the lines can be filled by using interpolation techniques to create extra lines. This is done by storing the picture in a memory and using a chip to decide what information should be added via the extra lines. It's in some ways a little like a video version of the error-correction system used in a CD player. You thus get an expanded picture with full definition.

It should be pointed out however that this system has not yet been adopted. It may remain on the drawing board.

# Satellite Workshop

Jack Armstrong

I have to be out and about as well as attending to repairs in the workshop. So the other day I was at the top of a ladder, adjusting the alignment of an 80cm dish, when I noticed two men performing a similar feat at the other end of the two gardens. But whereas I was working on a south-facing wall, they had fixed their dish to a north-facing one!

"Can we borrow your meter mate?" shouted the smaller of the two. He was steadying the ladder for the burly bloke at the top.

"Not much point really" I replied, and carried on tightening my bolts.

"Why's that then?" enquired the larger man. "We've been at this for two hours, but I can't get a picture. I measured the LNB with my multimeter and it's got two volts, so it must be all right. Just let me borrow your meter a minute to finish off."

I was not inclined to enter into a hollering match, so I descended the ladder and walked towards the fence. The smaller guy let go of the ladder and ran towards me. This was a mistake, because his chubby chum had both hands on the dish at the time. The ladder tilted sideways, and its occupant was left hanging from the wall bracket!

I decided to make my exit, and headed for the house to finish tuning the receiver. There are times when it's prudent to follow a course of non-involvement. This was one of them.

## Tuning In

Once inside the house I showed the owner how to tune in the new Astra 1D channels. He had just moved here, and had brought his Pace PRD900 with him. Fortunately it had a 2GHz bandwidth tuner and was able to handle the input from an enhanced LNB. The problem was to make him understand that the channel frequencies displayed on the screen would all be 250MHz higher than those listed.

To further complicate matters I'd used his old standard LNB to receive the Eutelsat transmissions from 13°E via the same dish. I had to select the second input for these channels, and the frequencies were correct.

He really didn't understand, and wanted me to tune in every single channel for him, including around thirty radio transmissions. I was impressed about this – not many people know that BBC Radio 1 to 5 are available via Astra, let alone the BBC World Service.

"It's going to cost you another thirty five quid if I have to squat here for the next hour to tune in all the channels" I pointed out. "It would be simpler if you'd let me take the receiver back to the workshop to upgrade the software."

## Interference

At this point he became distracted. He was staring at the blank screen, which said 'Radio'.

"What's that?" he asked.

"It's a blank screen that says 'Radio'" I replied, helpfully.

"Yes, but there's a line moving across it!"

I stared at the screen and, sure enough, a vertical band periodically swept from right to left. My customer grabbed the remote control unit and began to flick through the channels, staring intently at the screen.

"There it is again!" he shouted, pausing at the Bravo test picture.

I had to admit that he was right but tried to reassure him, saying that it was very slight interference that wouldn't show up when he was watching a film.

"But it's not right" he said, "and it didn't do this at the old house. It must be the new dish."

I was convinced that it was a receiver fault, and suggested that I should take it back to the workshop where I could fix the fault and fit the latest microcontroller chip which would be compatible with his enhanced LNB. He finally agreed. At this point his wife strolled in and asked, innocently, "Have you asked the technician about that picture interference?"

## On the Bench

When I returned to the workshop I took the cover off his receiver and saw that it had suffered from overheating at some stage during its life. The interference line was being caused by C96 (1µF), which was leaky. According to a Pace bulletin to hand it should be replaced with a multilayer ceramic type. This is not the sort of thing one has laying about, so I fitted a non-polarised electrolytic as a temporary cure and made a note to order the correct part from Davenham Satellites.

There was also a faint but audible whine on every channel. This was because C278 (2,200µF) had dried up. It's mounted close to a 12V regulator with heatsink, and simmers gently. For good measure I replaced C5, C7 and C8 in the power supply, since Pace recommend upgrading them to devices rated at 105°C.

I finally fitted the latest microcontroller kit from Davenham Satellites (1 Firths Fields, Davenham, Northwich, Cheshire CW9 8JB – 01606 49 085). The pin-out differs slightly from the earlier version, so I had to follow the instructions that come with it, cutting a track and adding a wire link. You may also have to change a tiny surface-mounted resistor: fortunately the later value was fitted, so I didn't have to hunt for my tweezers and magnifying glass.

The serial number label said that the receiver was a 2GHz version. This was confirmed by the part code stamped on top of the tuner – it included the 'G77'. I did a quick check to make sure that everything worked, and that the menu now included the 9-75GHz LNB option, then screwed it all back together. The plastic rivets were rock solid, a sure sign that the receiver had become too hot. I would have to make sure that the customer didn't put it back inside his so-called hi-fi cabinet.

## A Ferguson SRV1

The customer's helpful report on a Ferguson SRV1 (Pace SS9000) satellite receiver that was awaiting atten-

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tion said "goes off sometimes and resets all channels". It had by now been sitting on the bench warming up for two hours, and had not yet "gone off". As I moved it to one side however the picture flickered and the receiver appeared to tune through several channels before coming to rest on an Astra 1D test card! Now the SS9000 cannot normally tune this low, so it was obvious that the tuning voltage had dropped to zero. When I tapped the receiver it zipped back to Sky News.

I removed the board from the chassis and inspected the tracks for signs of a crack or a dry-joint. Sure enough the transformer's soldered joints looked very grey, and closer inspection revealed a fine circular crack in two joints. Resoldering them cured the problem, as I proved by gently tapping the unit with a ball-point pen.

Clearly one of the transformer windings concerned supplied the tuning voltage, while the other one supplied 5V to the microcontroller chip. Fluctuations in this latter supply were causing a 'brown out' condition, and whenever this occurred the microcontroller chip performed a factory reset.

While about it I replaced C9 and C11 in the power supply, since they can lead to failure if they've been subjected to heat for a few years. Faint, white dashes on the decoded channels indicated that C29 was also in need of replacement. There were no other lines on the picture, but I decided to replace the capacitor inside the tuner as well. When I put it all back together I wished I hadn't, as there was now no LNB voltage. It took another five minutes for me to find that I'd not resoldered the end pin on the tuner!

## TELETEST COMPETITION

A competition/draw featured in our May issue, run in conjunction with Ozan, had as its prize a Teletest pattern generator. The response from readers was remarkable, with hundreds of entries from all over the world. The answers to questions posed are:

- (1) How many test patterns does the Teletest generate? Four - colour bars, grey scale, crosshatch and red purity.
- (2) What is the frequency of the Teletest's audio tone? 1kHz, in the form of a 1V peak-to-peak pure sinewave.
- (3) What type of battery does the Teletest use? A 9V PP3.

The answers could be found by checking with Ozan's advertisement in the same issue.

The first correct entry drawn from our postbag came from Mr Lilwag of London, who has been sent his Teletest. Congratulations!

Ozan has recently introduced the Teletest Pro, which is designed to cater for the needs of the broadcast and semi-professional TV engineer. A review appears elsewhere in this issue.

# Inside the Panasonic Alpha 4 Chassis

Part 4

Ray Meadows

In this concluding instalment we'll take a look at the video and audio signal processing arrangements used in the chassis.

## Video Processing

The video processing circuitry is similar, though somewhat simplified, to that used in the Alpha 3 chassis. We described the Alpha 3 arrangements in the May 1994 issue. The picture signal improver (PSI) circuit is no longer used, and the black-level expander is not incorporated in UK models. While Alpha 3 sets all use the Philips TDA4650/V3 multistandard colour decoder chip, UK Alpha 4 models are fitted with the PAL-only TDA4510 chip (the TDA4650 is retained in Continental models). Similarly while the Alpha 3 chassis uses the TDA3505 video control chip, UK Alpha 4 models have the TDA3504 which has a slightly reduced specification. Thus Secam and NTSC reception is no longer possible, though modified NTSC signals that have a 4.43MHz colour subcarrier frequency can be displayed.

The video signal from the AV switching chip IC3002 on panel H is fed via connectors E11 and E35 on panel E to the video processing panel C, where it's buffered by emitter-follower Q602. Fig. 1 shows in block-diagram/skeleton circuit form the subsequent signal paths. Filter LC301 separates the luminance and chrominance components of the signal: it incorporates a low-pass filter for luminance and a bandpass filter for chrominance signal selection. Secam-equipped sets have an additional path for the Secam chroma signal.

## Luminance Signal Processing

The low-pass filtered luminance signal is fed via buffer transistors Q303 and Q318 to the peaking circuit. Filter

X661 between these buffers removes any residual chroma information. The peaking circuit, based on transistors Q681 and Q682, provides selective boosting or attenuation of the luminance signal in the 1.5-3.5MHz range, adjustment being implemented by Q302 which receives its base input from the main microcontroller chip. The peaked luminance signal is then fed via buffer transistor Q693 to the luminance delay line DL300, whose output goes to the TDA3504 video control chip IC303 where it's matrixed with the colour-difference signals to produce RGB outputs.

Non-UK models, which have black-level expansion (BLE), incorporate buffer transistor Q301 and a Sony CX20125 BLE chip, IC301. This 'stretches' the luminance information in dark areas of the picture to enhance its visibility. To do this, the 'average' luminance signal black level is compared with a black-level sample taken during the blanking interval: the result is used to adjust the luminance gain nonlinearly.

## Chrominance Signal Processing

The bandpass-filtered chroma output from LC301 is buffered by Q605 then fed via diode D600 to the colour decoder chip IC601. With an S-video input, external chroma from IC3001 (see Fig. 3, July) is fed in via D601. In the S-video mode, a bias voltage from the main microcontroller chip via R667 turns on D601. IC601's chroma input is at pin 9 (pin 15 in Continental models). The PAL only decoder chip uses a single 8.86MHz crystal and a dozen of so other components. Its colour-difference (B - Y and R - Y) outputs are fed to the TDA4660 digital delay line chip IC602.

Continental models fitted with a multistandard colour decoder chip can process PAL and modified NTSC signals as standard, and Secam signals in conjunction with an addi-

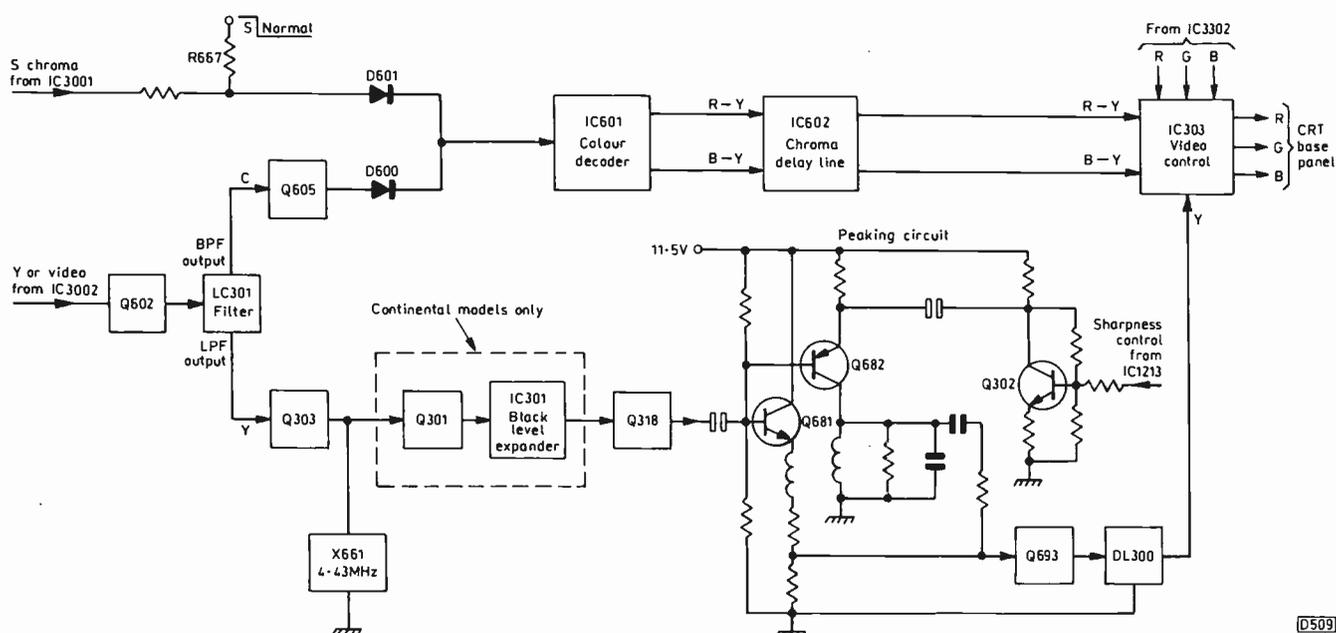


Fig. 1: The video signal processing arrangements, shown in block diagram form.

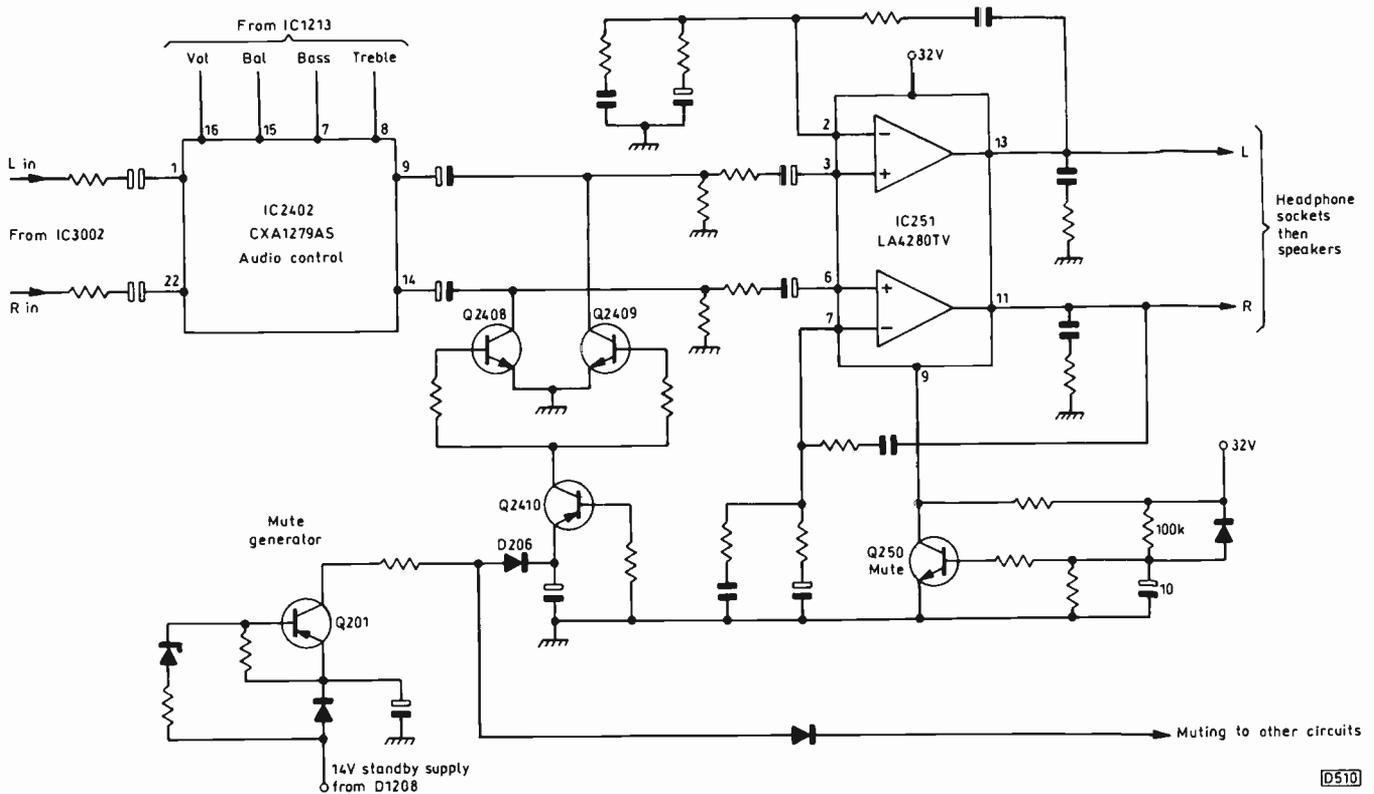


Fig. 2: The basic stereo audio amplifier system.

tional bell filter and an extra chroma bandpass filter in parallel with the main filter. System selection is automatic: the decoder chip checks all new transmissions for 80msec in each mode. When it has found the correct mode, system signals appear at pins 25, 26, 27 and 28 for modified NTSC, NTSC, Secam and PAL respectively. These are used to control the bandpass filter(s) and delay line. There are very few peripheral components around the multistandard decoder – most pins are used for external capacitors that set the options, or for clamping. Pin 21 is connected to an 8.86MHz crystal, to obtain the PAL reference signal. As a 7.16MHz crystal is not fitted, even Continental 'multistandard' models cannot decode 3.58MHz NTSC signals.

The TDA4660 digital delay line chip IC602 uses internal digital switched capacitors to adjust the relative delay between the B – Y and R – Y signals. This enables colour phase errors to be cancelled. A 3MHz clock, which is synchronised by the line-frequency component of the sandcastle pulses, controls the movement of the signals through the chip. Following the delay section of the chip, the colour-difference signals pass through 1MHz bandpass filters then out to the TDA3504 or TDA3505 video control chip IC303.

### Video Control

IC303 is where the colour-difference and the luminance signals meet. Matrixing produces RGB outputs: the chip also incorporates switching so that RGB inputs from the on-screen display generator, the teletext decoder and the AV1 connector can be added. The chip carries out analogue brightness, contrast and colour adjustment, using signals provided by the main microcontroller chip IC1213. There are presets for factory contrast and brightness adjustment. The service manual provides alignment details for these presets should readjustment be required.

The RGB outputs from IC303 appear at pins 1, 3 and 5 respectively and are passed to the output stages on panel Y.

Continental models fitted with the TDA3505 chip have a c.r.t. leakage current feedback input. This enables the chip to carry out automatic grey-scale tracking adjustment to compensate for changes in the tube's characteristics as it ages.

IC303's RGB output pins are protected from c.r.t. flashover damage by zener diodes. These are normally connected to chassis via the service switch. When this switch is opened, the RGB outputs rise and the field feedback path to the timebase generator chip is shorted out, thus stopping the field scanning (see Fig. 2 last month). This produces on the screen a horizontal white line that can be used to adjust the low-light white balance.

### The Audio Amplifier

All models provide stereo sound. The output stages are incorporated in a Sanyo LA4280TV chip (IC251) which is mounted on panel E. Prior to this the audio signals pass through a Sony CXA1279AS audio control chip, IC2402. Fig. 2 shows the arrangement.

Audio from the TV/AV switching chip IC3002 on panel H passes to panel E, entering IC2402 which carries out volume, balance, bass and treble adjustment under the control of signals from the main microcontroller chip IC1213. Signal muting is incorporated between IC2402 and IC251, the circuit consisting of transistors Q2408 and Q2409 which are driven by Q2410. This receives an input from the main mute generator (Q201 and its associated components), which is a type of reset circuit connected to the standby supply. At power on Q201 generates a mute pulse. This switches Q2408/9 on via Q2410, shorting IC251's audio inputs to chassis for the duration of the mute pulse. A second, simple mute circuit is provided by Q250 and its associated components.

As with the Alpha 3 chassis, the component values in the amplifier feedback circuits differ depending on the type of

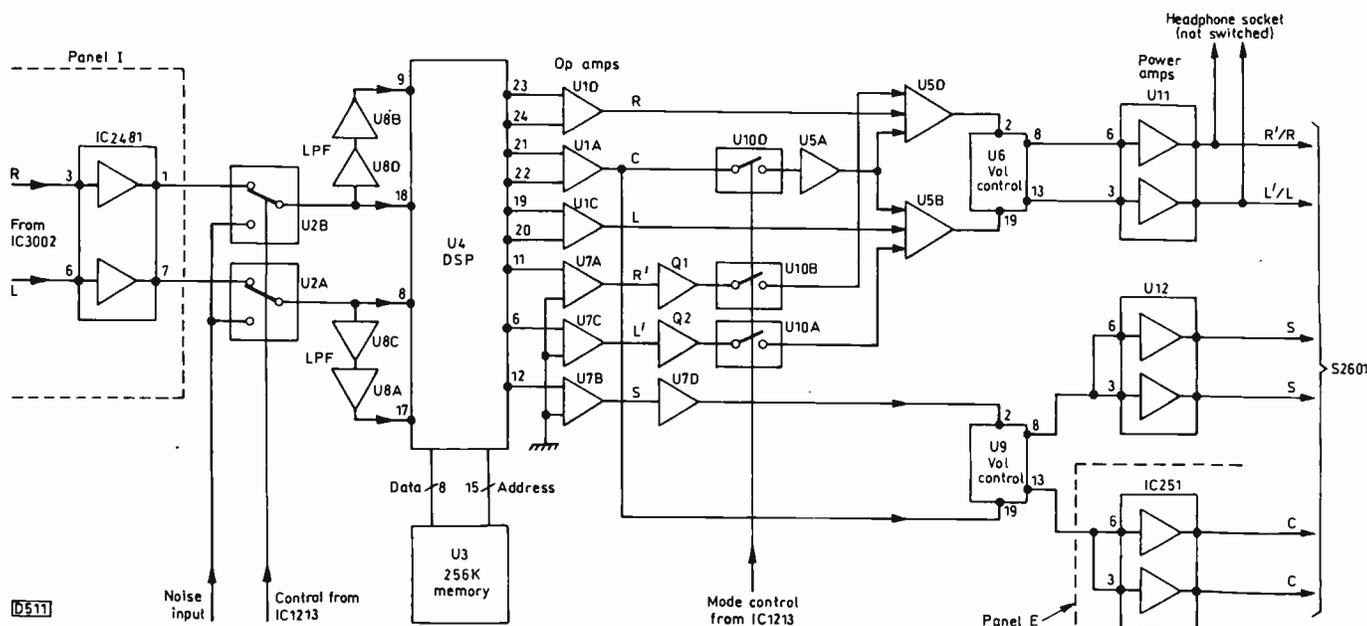


Fig. 3: Block diagram of the Dolby Pro Logic processing system.

loudspeakers used in the set. Dome speakers for example require a non-linear amplifier response to match their own non-linear frequency response.

### Dolby Pro Logic

Two Alpha 4 models, the TX25X1DP and TX28X1DP, feature Dolby Pro Logic sound. The same basic stereo amplifier is used for the sets' internal speakers, but in the 'normal' Pro Logic mode it's fed with the centre channel audio: four extension speakers that are supplied with the set provide the left, right and surround sound outputs.

Extra switching and decoding is required to implement the various audio modes, see Fig. 3. There are three additional panels, I for the audio switching, K for the Pro Logic decoding and X which contains a switch-mode power supply. The audio controller chip IC2402 (panel E) and the ambience chip IC2451 (panel H) are no longer required.

The normal left and right stereo signals from the TV/AV switching chip IC3002 on panel H travel via panel E to IC2481 on panel I. This dual op-amp chip provides gain before passing the left- and right-audio signals to panel K. The first chip here is a CMOS 4053 analogue switch, U2, whose purpose is to allow pink noise to be applied to the digital signal processor (DSP) chip U4 for channel balance adjustment. This switch is ganged with U10 at the output side of U4. The left- and right-audio signals from U2 are then split, two feeds going directly to U4 while two other ones pass to U4 via the low-pass filter chip U8.

The DSP chip, a Yamaha YSS215, is controlled by an external 11.2896MHz crystal. It provides analogue-to-digital conversion, processing for Dolby Pro Logic (and other) signals, then digital-to-analogue conversion. Digital memory chip U3 provides 256K of storage, in a 32K by 8-bit format, to provide audio delays for some of the 'atmospheric' modes. The signals pass to and from U3 via an 8-bit data bus.

U4 provides six audio outputs, as follows: normal (unmodified) left and right (L and R); modified left and right (L' and R'); centre and rear surround (C and S).

Note that the L' and R' signals are the L and R signals with the surround information removed. The normal stereo mode uses the L and R signals while the Dolby Pro Logic mode uses the L', R', C and S signals.

The quad op-amp chips U1 and U7 convert the differential outputs from U4 to single-ended form, after which analogue switch U10, quad op-amp U5 and transistors Q1 and Q2 matrix the audio channels in accordance with the

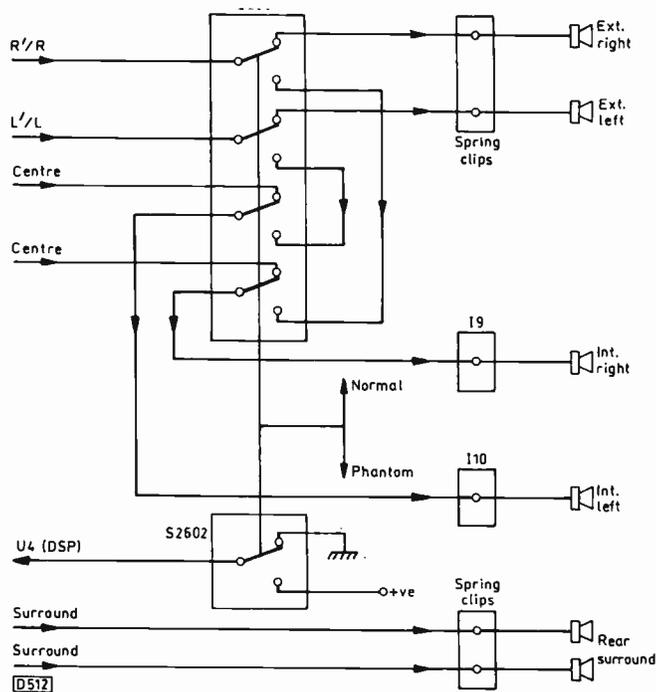


Fig. 4: The centre mode switching arrangement.

selected audio mode. Dolby Pro Logic uses the maximum capabilities of the system, with four discrete audio channels. Thus two stereo volume control chips are required. U6 handles the L' and R' (or L and R where appropriate) signals while U9 handles the C and S signals. The L' and R' signals from U6 are fed to the stereo audio amplifier

U11; the S signal goes to both amplifiers in U12; the C signal goes to the normal stereo sound output chip IC251 on panel E to drive the set's internal speakers.

Before the amplified audio goes to the speakers it takes a trip to the headphone socket (L' and R' channels only) and then the centre channel mode switch S2601 on panel I, see Fig. 4. When this switch is in the normal Dolby Pro Logic position the audio signals are all connected to the appropriate speakers. With the switch in the 'phantom' position the centre channel is disconnected and the L' and R' signals are routed to the internal speakers. A second switch, S2602, is ganged to S2601: it tells the DSP (U4) about the 'phantom' centre speaker connection. U4 then closing U10D so that the centre channel information is evenly mixed with the L' and R' signals. A virtual or phantom centre speaker condition is thus created. This is useful, because it means that no audio information is lost should the viewer decide to leave the external left and right speakers disconnected.

The links to the four external speakers are via spring terminal clips at the rear of the set. The internal channels are connected directly to the dome speakers.

Power for the additional Dolby Pro Logic decoder and amplifiers is provided by panel X. This contains a switch-mode power supply that uses a UC3482 control chip and a f.e.t. chopper transistor. The secondary side of chopper transformer T1 provides 35V for the amplifiers and 5V, 8V and -8V supplies for the DSP chip and the op-amps. This power supply, and indeed the whole Dolby Pro Logic system, is very similar to that used in Pace satellite receivers such as the MSS1000.

### **In Conclusion**

This concludes our investigation of the technology used in the Panasonic Alpha 4 chassis. Future articles will take a look at the new Z5 and the Euro 2 digital chassis.

## **ANSWER TO TEST CASE 393**

**- see page 789 -**

If the dot clock in a teletext decoder ceases to be locked to the video signal the result is loss of text display synchronisation: so long as the data clock remains locked to the data rate, the rest of the decoder works correctly. In this case there was little doubt that the 6MHz dot clock was running at the wrong frequency, but the two major components concerned with timing and synchronising it - the crystal and the i.c. that contains the PLL - had both been checked by substitution during Roger's first attempt to repair the set.

Further study of the circuit diagram in the workshop suggested several other possibilities: the second (CCT) chip, whose internal timing chain forms part of the phase-locked loop, and the external components associated with the horizontal phase detector inside the SAA5231 (VIP) chip. Starting with the latter, filter capacitor C3513 was replaced on the grounds that an electrolytic is more prone to failure than the other components. The text display still broke up.

Another TV receiver that uses the same chip set was by chance in the workshop. By comparing the operating conditions in the two sets, Roger at length discovered that C3511, the 220pF timing capacitor in the VIP chip's pulse generator circuit, was the culprit. When tested it was found to have internal leakage. A replacement produced a locked, steady text image.

# Next Month in TELEVISION

## **INSIDE THE FERGUSON TX90E CHASSIS**

This interesting TV chassis is of Thomson manufacture and is based on both the IKC2 and the TX80. Don't confuse it with the original, Ferguson-designed TX90 which - to make life simple - is something quite different! The TX90E uses an interesting SGS-Thomson i.c. line-up. Mark Paul will be examining this and the various features of the chassis in a new series starting next month.

## **SATELLITE TV**

There's lots to report on and write about on the satellite TV front. Articles/features to appear next month will include:

Δ Production modifications to the Grundig GRD150/250 series to improve the sound quality.

Δ Jack Armstrong on LNB developments, and of course his workshop notes.

Δ Roger Bunney reviews the Echosphere RR50 Mk 2 satellite receiver, which is ideal for the sat-zapper enthusiast.

Δ More satellite notes from Hugh Cocks.

## **MULTI-CHANNEL TV DISTRIBUTION**

Domestic TV distribution systems are becoming ever more elaborate and trial-and-error installation methods are not appropriate. Bill Wright considers the basic principles of system design and the use of channel-pass filters and other components.

## **NOTES ON THE HITACHI CPT2196/2198**

Some fault notes on these popular sets from John Coombes.

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# The Cambridge iTV Trial

Peter Brough

Just over a year ago Cambridge-based Acorn Computers, which is best known for its educational computers, set up a company called Online Media to develop interactive TV (iTV) systems. Online is playing a major role in one of the world's most advanced iTV trials, which is being run by British Telecom in Cambridge.

Present TV services are one-way: viewers simply decide which programme to watch. A VCR enables viewers to watch what they want when they want, and offers features such as pause, rewind and fast forward. Interactive TV takes this a stage farther: the viewer can select programmes and services by sending data back to the service provider. The best-known example is video on demand (VOD), which enables the viewer to use a remote control handset to select a film from an on-screen menu. The film is then transmitted to the viewer's home. The viewer can control it as if the source is a VCR, going into pause for example should the phone ring or rewinding it to a favourite scene. VOD is just one of many iTV services: others include home shopping, home banking, computer games, interactive educational programmes and information sources.

## The Equipment

A typical iTV system uses a set-top box for a variety of purposes, such as signal processing, digital signal decomposition, network linking and interfacing with audio/video equipment and sources. The iTV link can be via cable/telephone connection or satellite or terrestrial transmission. The Cambridge trial is using telephone cable connections.

A number of other companies are involved in the Cambridge trial. Service providers include NatWest Bank, Anglia Multimedia (which is providing educational programmes and software), NOP, ITN and Tesco. The programmes and services are stored on giant video servers produced by ICL and DiskBrick.

Cambridge Cable's fibre-optic TV system, which is available to 67,000 homes, is being used for the trial. The data transmission uses a process known as ATM (Asynchronous Transfer Mode). This can transmit data, which is in the form of 48-byte packets that have their own address, at very high speeds (155Mbits/sec). ATM is ideal for carrying a mix of audio, video and text data. The ATM system and switching has been supplied by ATML and SJ Research.

The set-top box developed by Online Media uses a processor produced by another Acorn offshoot, ARM (Advanced Risc Machines). Because the box carries out a lot of the processing required, Online describes it as an 'intelligent' one. Some interactive services use 'dumb' set-top boxes, with centralised signal processing. This helps to reduce the cost of the boxes, since they incorporate less electronics. But Online maintains that a distributed form of processing, with smart boxes, is much more flexible.

The Online boxes use an ARM 610 RISC (Reduced Instruction Set Computer) chip set. In addition there are 2Mbytes of RAM, 2Mbytes of ROM and an MPEG-1 decoder. The box has a variety of audio, video, I/O ports

and network interfaces: scart, phono, S video, RGB and u.h.f. connectors are provided, and there are serial and parallel ports.

The present system runs at 2Mbits/sec. Later versions could run at between 8-25Mbits/sec. Eight is ideal for MPEG-2 video. High-cost applications such as teleworking could use the higher data rates. The Online system is symmetrical, i.e. the data rates to the home and back to the service provider are the same. This enables advanced features to be incorporated. You could for example have a home security camera linked to the set-top box to transmit pictures to a terminal in your office.

This autumn will see the arrival of a second-generation box which uses a new chip set called ARM7500. This incorporates far more functions into a single processor chip, reducing the box's cost, size and power consumption. Existing boxes cost around £400: Online is confident that this can be reduced to less than £300.

## The Trial

The first phase of the trial, to check out the technology, started in September 1994. Set-top boxes were installed in ten employees' homes. The second phase, with about a hundred homes connected to the service, began last March. The number is expected to grow to 250 by the end of the year.

Each viewer has his own PIN code, which is used when logging on to the service. This enables the set-top box to 'learn' the types of programme preferred. ITN is developing an index news service that will put news items into categories such as sport or politics. Games can be downloaded to the set-top box and played on the user's TV set. It's also possible to play interactive games with other users on the network.

The interface is interesting, consisting of a series of static pictures which are numbered. Films might be picture three for example, banking picture seven. By pressing these numbers on the remote control handset the appropriate service is called up. Online says research carried out shows that viewers dislike a 'busy' animated screen when making a selection. A series of tests that will put the system through its paces is about to be carried out, with thousands of random selections taking place simultaneously.

The Cambridge trial seems to be proving that iTV technology works. There are still many other issues to be resolved however. One of these is standardisation. Unless standards are established, the set-top boxes will not be able to operate with various service providers and other networks. Online and DEC are working on this issue.

It's still early days for iTV. No one knows yet exactly what services viewers will want and, more importantly, be prepared to pay for. But the signs are that many of us will be using iTV within the next decade.

## Acknowledgement

My thanks to Malcolm Bird, chief executive of Online Media, for help in the preparation of this article.

# JVC Camcorder Power Supplies

*Keith T. Keeton*

The following fault notes relate to various adaptor/charger units produced by JVC for use with the company's camcorders. These switch-mode power supplies are reliable and don't give much trouble. Later ones rarely develop a fault. When these units fail however more than one component can be defective. This can cause problems unless every component is checked. It is also not easy to establish whether the cause of the fault is in the primary or secondary side of the circuit, as there is feedback from the secondary side for regulation purposes. Repairs can therefore be costly, especially if a faulty component is overlooked when some replacements have been made - you can watch your money go up in smoke.

## Model AAV2

**Power light not on, no d.c. output:** TF3 on the main board open-circuit. Replace TF3, IC1, Q1, R10 and D1. There's also a modification: replace D15 with a 15V zener diode.

**Power light on, charging voltage low:** Q7 and TF4 on the main board faulty. We have also had the board broken at the output.

**Power light on but no d.c. output:** Check for a crack in the main board, at the output. If the crack is not too bad it can be repaired. Otherwise, replace.

## Model AAV5

**Power light not on, no d.c. output:** Various causes have been experienced, as follows:

(1) A blow up around Q2/3 (primary side of the circuit) on the main board, with obvious damage. Replace IC1 (THE049), Q2 (2SD571), Q3 (2SC1573B), Q4 (2SC2785FF) and R3 (part no. QRD121J394).

(2) TF2 (YU40306) on the main board high resistance.

(3) TF1 high resistance and Q2 short-circuit. Replace Q2 (2SD571), IC1 (THE049), D3 and TF1.

(4) D23 (20V zener diode) on the sub-board short-circuit. There was 11V at C18 with the sub-board disconnected.

**Power light not on, no d.c. output, unit works when taken apart:** Battery terminal (main board) earthing to chassis. Insulate.

**Failure to charge. Power light on but d.c. output low (8V**

**on load):** T4 on the sub-board open-circuit. Repair (part not available). Diagnostic note - 11V on one side of T4 only.

**Not charging batteries. Power light o.k., d.c. output o.k.:** We've had two causes of this one, as follows:

(1) SW1 on the sub-board faulty (power o.k. at one side, no output at the other). Replace - part no. YU40310.

(2) Replace LED D10 (GL9PR24) and zener diode D17 (short-circuit). D17 is part no. RD30EST1B2. Components are on the main and sub-board. Diagnostic note - charge light fades when battery is connected. TF2 may blow.

**Not charging batteries. Power light o.k., d.c. output o.k., unit works when dismantled:** Battery terminal shorting against shielding. Insulate battery terminal (main board).

**Power light on, d.c. output appears to be o.k. but drops on load. We've experienced two causes of this, as follows:**

(1) TF2 (YU40306) on main board high resistance. Diagnostic note - voltage at both sides of TF2 11V with no load, drops at one side when on load.

(2) Optocoupler PH1 (PC115) on main board faulty, not feeding reference voltage back to the primary side of the circuit. Diagnostic note - power light fades on load, output voltage drops to 1V. Can be fatal to the power supply.

## Model AAV6

**Power light not on, no d.c. output:** We've had two causes of this, as follows:

(1) R1 (68k $\Omega$ ) on main board open-circuit so no supply to IC5.

(2) R1 (68k $\Omega$ ) and Q6 (2SK903) on main board faulty. Diagnostic note - no voltage across C21, no voltage at R2, Q1 appears to be short-circuit.

## Model AAV12

**Power light not on, no d.c. output:** We've had two causes of this, as follows:

(1) Q6 (2SC3752ML) on main board short-circuit. Failure of Q6 means that IC1 (UPC1394C) and Q4 (2SC13185R) will also have to be replaced.

(2) No continuity between the base of Q6 and D5/R10 on the main board, because the track at the base of Q6 is broken. The track can be repaired.

## Model BBP1

**Power light not on, no d.c. output:** We've had two causes of this, as follows:

(1) Main fuse blown, Q1 (2SC3260) short-circuit and R3 (0.82 $\Omega$ ) open-circuit. Replace these items, also IC1 (EHMJ11L96). These items are all on the main board.

(2) C9 and R6 on main board faulty. Replace these items, also Q1, IC1, R3, R4, D1, D7 and D8.

# Servicing Matsui/Saisho VCRs

## Part 1

Jack Barclay

This article deals with Matsui and Saisho VCRs that were introduced after 1990. They are fitted with a new mechanism which has one loading motor that drives both the front loading assembly (carriage) and the main mechanism. You can recognise this mechanism by the fact that the loading motor is mounted on top of the mechanism, at the rear right-hand side, and is coupled to the front loading assembly by means of a belt. Models in the range include the following:

**Matsui:** VX1000, VX1100, VX2000, VX2500, VX2700, VX3000, VX6400, VX6600, VP9301, VP9401 and VP9501.

**Saisho:** VR3400, VR6000A, VRS5000A and VXL12A.

### Model Guide

The first machines to be fitted with this mechanism were the Saisho models listed above and the Matsui VX3000, VX6000, VX6400 and VX6600. They have a large 64-pin microcontroller chip for system control and a second 64-pin microcontroller chip for the front panel operation and display. A manual rotary tracking control is provided. Features such as teletext, Nicam sound, linear stereo recording, on-screen displays and audio power amplifiers depend on model specification.

The Matsui VX1000, VX2000 and VX2500 came next. The VX1000 is a basic two-speed, two-head VCR with remote control; the VX2000 is the same with linear stereo sound (not Nicam); while the VX2500 is a four-head version of the VX1000. These models have a single 80-pin flatpack microcontroller chip that drives the display and monitors the operation keys directly, without the need for a second microcontroller chip.

Matsui then got the centre-loading bug. The first machines of this type were the VX2700 and VP9301, the latter being Matsui's first VideoPlus model. The mechanism is mounted centrally: to accommodate this the power supply, which had previously been mounted at the rear of the machine, was moved to the space at the left-hand side of the unit, the main PCB being fitted above the mechanism, at its rear.

Accessibility is good. The various PCBs are linked by large ribbon cables with plenty of slack to enable the unit to be operated in the service position.

The latest models in the range are the VX1000, the VP9401 and more recently the VP9501. In these the main PCB is beneath the mechanism. The power supply plugs into this board directly. An 84-pin flatpack microcontroller chip carries out the syscon, servo and timer functions, a separate display driver chip being fitted on

the front PCB. These machines have different electronics, with little in common with their predecessors. The VP9501 has an auto set-up facility: simply connect the machine to the mains supply, plug in an aerial and the channels will be tuned in automatically with the correct time and date being set – this information is provided by the teletext service. The VP9501 is also a four-head machine, producing perfect still and good trick pictures.

### Mechanism Details

Although the deck layout is conventional, all tape functions are carried out with the tape fully laced up around the drum. There are three motors, as follows: a direct-drive drum motor; a capstan motor which also drives the spools via a belt, clutch and idler; and the loading motor which as mentioned earlier drives the front loading assembly and the deck loading, via three belts.

Mechanism servicing usually calls for removal of the front loading assembly. To do this, remove the belt that connects it to the loading motor pulley, remove two screws at the bottom rear of the assembly, then remove (if fitted) the screw at the top, front right-hand side of the

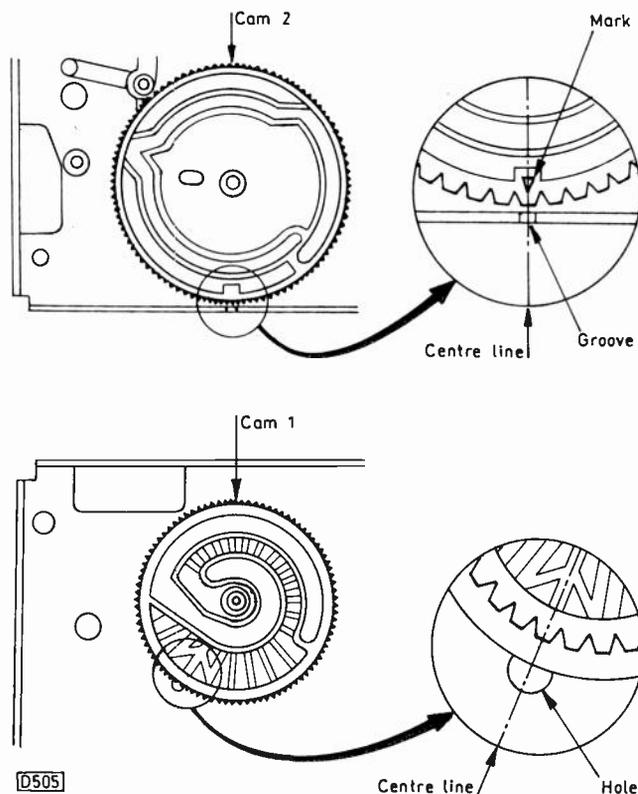


Fig. 1: Correct alignment of Cam 1 and Cam 2.

unit. After removing the cabinet front, the loading unit can be lifted out.

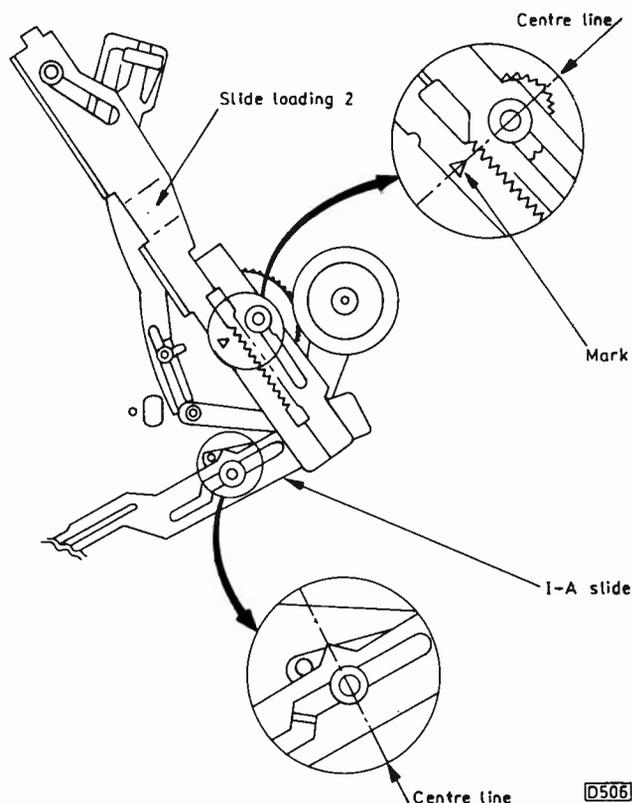
Most of the mechanics are on the underside of the deck. There are two cams. The smaller one (Cam 1) drives a toothed bracket which, in turn, drives the loading arm gears. The larger cam (Cam 2) operates the clutch, brakes, back-tension arm and the rotary mode switch. This cam is partly concealed by the mechanism PCB, which carries the beginning and end of tape sensors, the rotary mode switch, the front load switch, the connections to the electromagnet and the loading motor, the LED tower and the

reel sensor. A ribbon cable connects it to the main PCB – in the VX1100, VP9401 and VP9501 however the mechanism panel plugs into the main PCB directly.

A worm assembly links the two cams. This is in turn driven by the loading motor, via a belt that passes through the mechanism. As there's a timing relationship between these two cams and the front loading unit, the timing should be checked whenever any work has been carried out on the mechanism.

## Servicing

The mechanism PCB has to be removed to gain access to the underside of the mechanism. It's best to slacken the



**Fig. 2: Correct alignment of the supply and take-up loading gears.**

wires to the loading motor then, after removing the three screws, withdraw the capstan motor plug, unsolder the wires to the electromagnet and lift out the board.

It's unusual to find that the timing relationship between the two cams is incorrect. But, see Fig. 1, check that the moulded arrow in Cam 1 is aligned with the hole in the deck and that the arrow in Cam 2 is pointing at the groove cut-out in the deck. If adjustment is required, remove the worm assembly: take out the screw and bracket near the pulley, slip off the belt then lift out the assembly. The worm assembly also has to be removed to get the capstan motor out. With the cams in the position described above the mechanism is in the eject mode.

When you replace the mechanism PCB ensure that the mode switch is located correctly. A small peg in the switch fits into the hole in Cam 2. Also check the supply and take-up loading gears – see Fig. 2.

One fault you can get with these machines is wow and flutter on the sound. It can be caused by excessive back tension. You might find that the back tension is as high as

60-70g. Resetting the back tension to between 25 and 35g will clear the fault and still provide good pictures and sound.

A worn pinch roller is another cause of the fault. It can also be responsible for creasing along the edge of the tape. Replacement is simple enough.

Fortunately these decks don't seem to suffer from clutch wear, which was a problem with their predecessors. I've only ever had to replace one clutch unit.

## Drums

With all except for the most recent models (VX1000, VX1100, VX2500, VX2700 and the VP ones) the upper drum can be separated from the lower drum and replaced. You may occasionally find a faulty lower drum. Removal and replacement is simple. Unplug the drum motor connector on the underside of the deck; above the deck, disconnect the head amplifier plug, remove the 5V regulator transistor, take out three screws and lift the drum unit from the machine. When replacing the drum, note the two grey wires that go to the full erase head. They can get trapped beneath the drum, giving rise to tracking errors.

Later drums have the stator and rotor unit fitted above the heads. As the upper and lower drum sections cannot be separated, the complete unit has to be replaced. There are several different types, which are not interchangeable. It's thus important to quote the correct model number and version when ordering replacements. A fault you can get with these later drums produces a rice pattern effect. This is caused by static build up: drum replacement is the only cure.

## AC Heads

There are two types of audio-control head, stereo and mono. The stereo heads are prone to wear, the usual symptom being poor sound on one or both channels.

The control head section can go open-circuit with later machines, the result being no control pulses. Nine times out of ten it's the control head winding that fails, though the audio section does occasionally fail. I've not had this fault with stereo heads.

## The Mode Switch

We've already mentioned the rotary mode switch, which is mounted on the mechanism PCB. It can cause a number of elusive faults. The most common one is loops of tape being left out of the cassette when this is ejected. Another fault I've had is that the mechanism loads up when a cassette is inserted: it then jams in the fully laced-up position. Check by substitution.

## The Capstan Motor

The direct-drive capstan motor can cause some peculiar faults. Problems I've come across include slow rotation when there is no tape in the machine, wow and flutter, and of course no go. Replacement is simple, but requires removal of the mechanism PCB and the worm shaft to gain access.

## The Front Loading Assembly

Customer misuse has been the cause of most of the faults I've had with the front loading unit. Replacement is

often simpler than repair, but note that there are different types of flap opener – this depends on whether the flap is on the cabinet front or the carriage. You may have to use the original flap opener. The units are available from Mastercare, CPC and other distributors at around £16.

## **Belts**

My recommendation is to replace all four belts when one of these machines comes in for service. Failure to do so can result in bouncers. Slipping belts can cause timing problems. In later models a slightly thicker belt is used to drive the carriage. If the front loading belt slips, the loading tray may not seat correctly. As a result the tape will be looped when the cassette is ejected.

## **Loading, Run and Eject Sequences**

Before we go on to the electronics used in these machines the sequence of events that occurs when a cassette is loaded, run or ejected should be noted.

Insertion of a cassette into the carriage activates the front load switch on the mechanism PCB. The loading motor starts, the cassette is taken in and lowered, the clutch lever on the housing moves to disengage the carriage drive, the drum motor starts then the capstan motor does a shuffle. If all these things operate correctly, the tape is laced around the drum. This is what happens in the stop, fast forward and rewind modes.

In play or fast-forward search the back-tension arm and pinch roller then move to their respective positions. In the rewind search mode the back-tension arm is moved back in.

When eject is selected the tape is unlaced, the capstan motor shuffles, and if all is correct the tape is ejected.

In the standby mode the tape is wound back into the cassette. This will also happen when the machine is left in the stop position for more than a few minutes.

## **System Control and Timer Operation**

As previously mentioned in earlier models there are two 64-pin microcontroller chips, one on the main PCB for syscon operation and one on the front PCB for the timer and function operations.

The front PCB also accommodates the channel data memory chip IC603 and the circuitry that produces the tuning voltage. This has proved to be reliable. For tuning drift suspect either the active filter chip or the 33kΩ resistor that feeds the collector of the voltage-converter transistor. In the manual I'm looking at these items are IC6201, R6201 and Q6201 respectively, but the component reference numbers can vary from model to model. Note that the Matsui VX6600 has no front panel display, information being shown on the TV set's screen.

If you get a dead machine with the power supplies in order, check the orange trimmer TC601.

The main microcontroller chip IC6001 is extremely

reliable. It communicates with the front panel microcontroller chip via four ports, strobe, serial clock, serial data in and serial data out.

The motor loading drive chip IC6003 is type BA6247. It fails quite often for no apparent reason, sometimes leaving a big hole in the front. Its replacement will usually restore normal operation.

## **Servo Control**

IC2001, type OEC9011, carries out servo control. It's not too reliable, a common fault being no capstan or drum operation. When you remove the chip you will probably find it burnt, with a small crack on its underside and the PCB beneath scorched. Replacing it will restore capstan and drum operation.

Failure of this chip can produce the following situation. When a cassette is inserted it will be lowered but the tape will not lace. The machine will then refuse to return the cassette and go to standby.

## **The Power Supply**

These machines all use similar, conventional power supplies, with an STK5342 as the main regulator device. A transistor fitted to the drum block provides the AT6V (All Time 6V) supply. When you remove this transistor from the drum block or refit it, make sure that you don't lose the copper spring. To leave the transistor in with dollops of heatsink compound but no copper spring will not do!

The mains transformer has four secondary windings. After rectification and regulation, 30V, -30V, switched 12V and 5V lines are produced. There are also unregulated 18V and 12V lines, and a 4V a.c. supply for the display filament.

Machines that incorporate audio power amplifiers have a heavier mains transformer: it has an extra winding to supply the amplifiers with an unregulated 16V supply.

As with most power supplies that use this type of regulator chip, the STK5342 i.c. is the usual cause of power supply failure.

## **On-screen Display – Model VX6600**

Model VX6600 is fitted with an on-screen display system, the front panel fluorescent display being omitted. An OEC7007 chip, IC4801, provides the on-screen display. Video goes into the chip, where it's processed to produce the display. If there's no video input, a blue screen will appear. If there's a blank raster, check coils L4801 and L4802. They tend to go open-circuit.

## **Next Month**

In Part 2 next month we'll continue with the electronic circuitry used in these machines. The articles will end with a faults list and some useful parts numbers.

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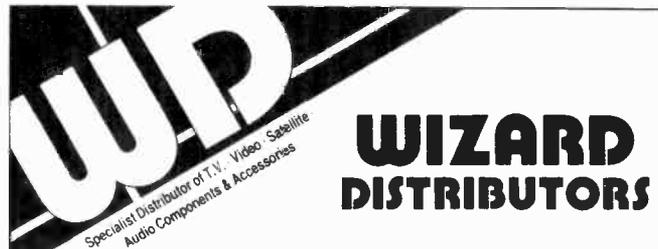
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**MISCELLANEOUS**

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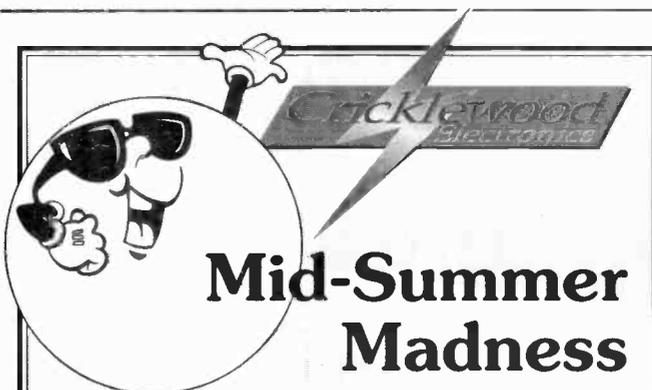
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<b>Panasonic</b>	
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<b>Sharp</b>	
VC9300, 381, 481, 500, 571, 600, 682, 772, VCA100, 105, 106, 202, VCD801, VCM73, T72	£14.50
Not all models are shown for each make. A vast range of other makes & models i.e. Akai, Alba, Aiwa, Fidelity, Fisher, Funai, GEC, Goldstar, Granada, Grundig, Hinari, Orion, Philips, Sanyo, Sentra, Proline, Salora, Sony, Samsung, Toshiba & Mitsubishi are available	
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Idler Assembly FVHP615, 715, 905 etc	£5.00
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<b>Philips</b> - Idler Mod. - VR6462, 6463	£4.50
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Idler Assemb. VB710, 790	£9.75

Not all the models are given under each make. Please ask for models & makes not listed.

**VIDEO MOTORS**

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Capstan Motors - VT11, 14, 17, 38, 39	£30.00
VT33, 34	£32.00
VT62, 63, 64, 640, 65	£22.75
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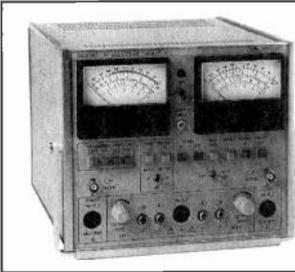


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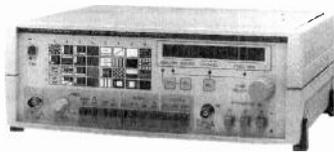


**Audio Analyser**  
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**Television Pattern Generator**

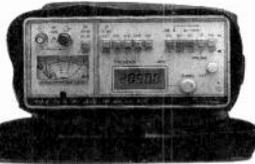
Model GV-298



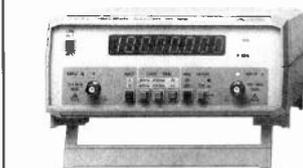
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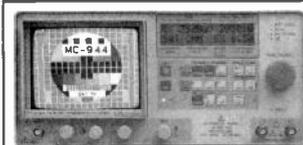


Ideal instrument for the professional installer of FM/TV aerials and satellite TV dishes. Covers 48 to 856 MHz and 950 to 2050 MHz. Lightweight, compact and rechargeable battery operated. £ 654



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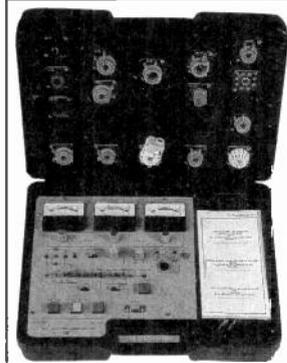
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Model TA-903

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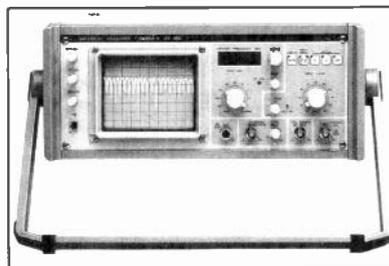
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Model TA-901

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PROMAX

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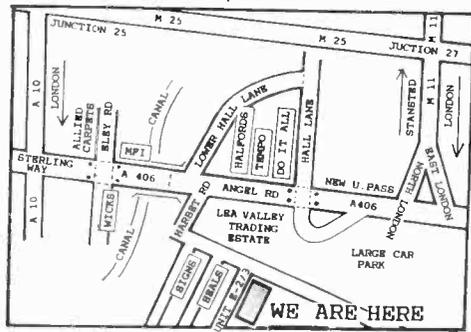
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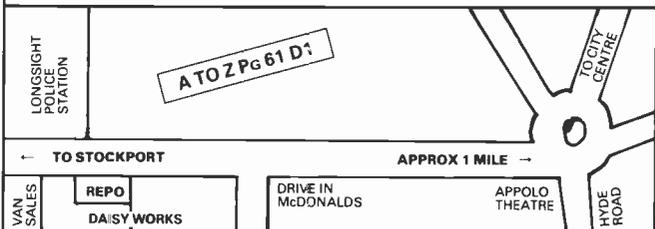
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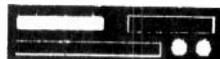


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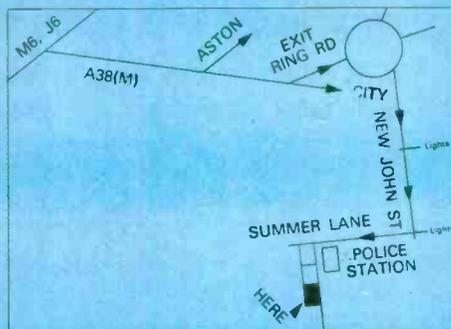
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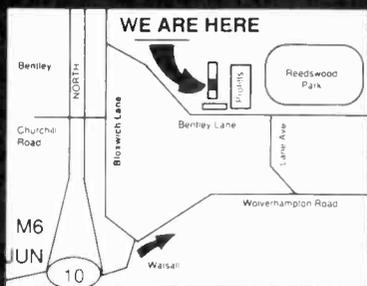
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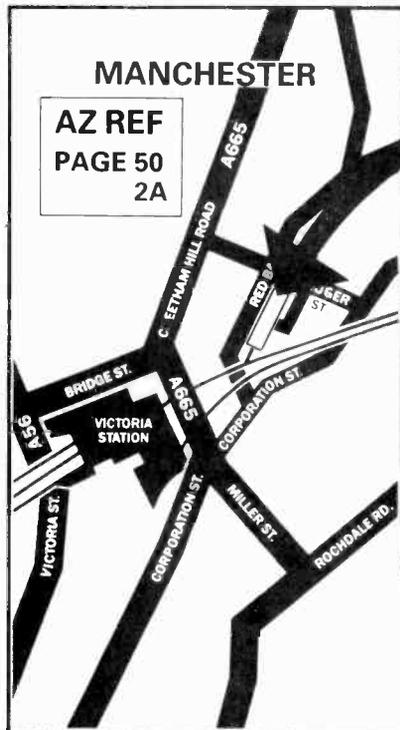
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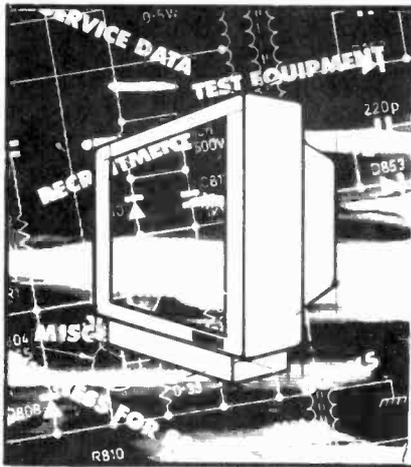
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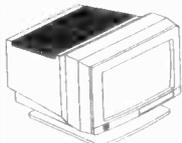
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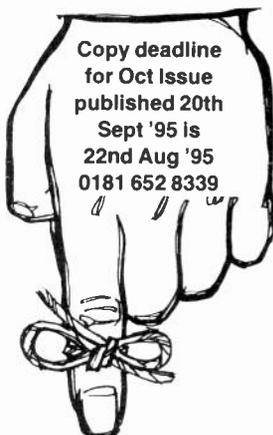
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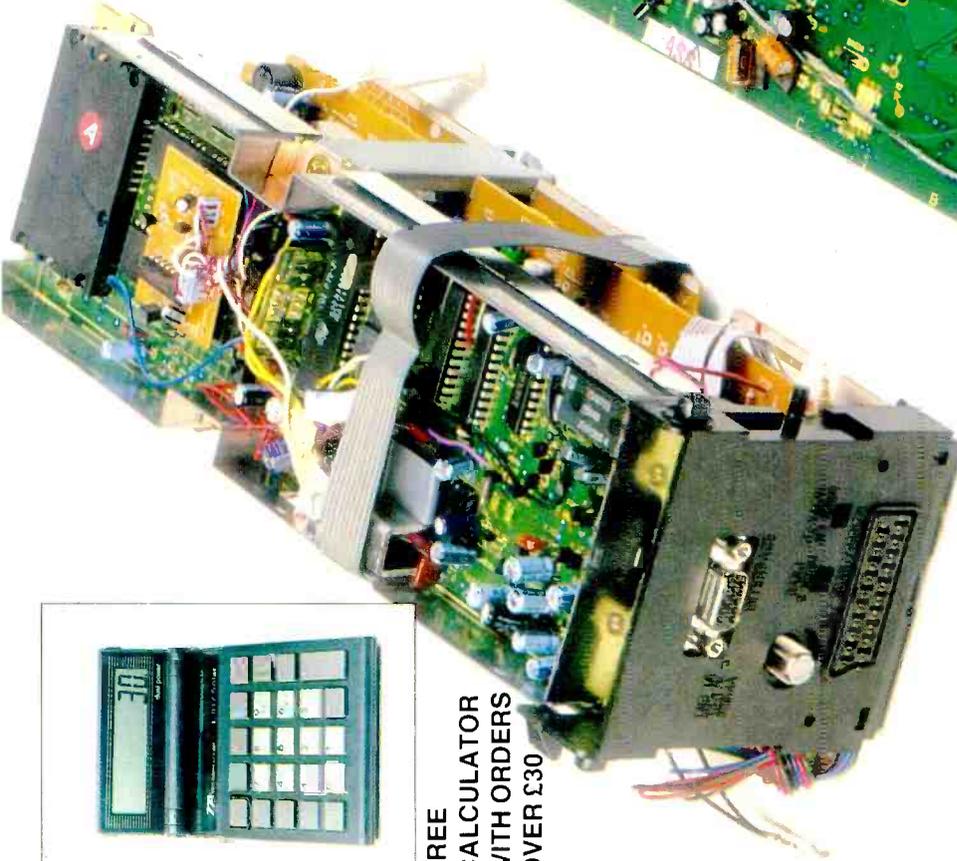
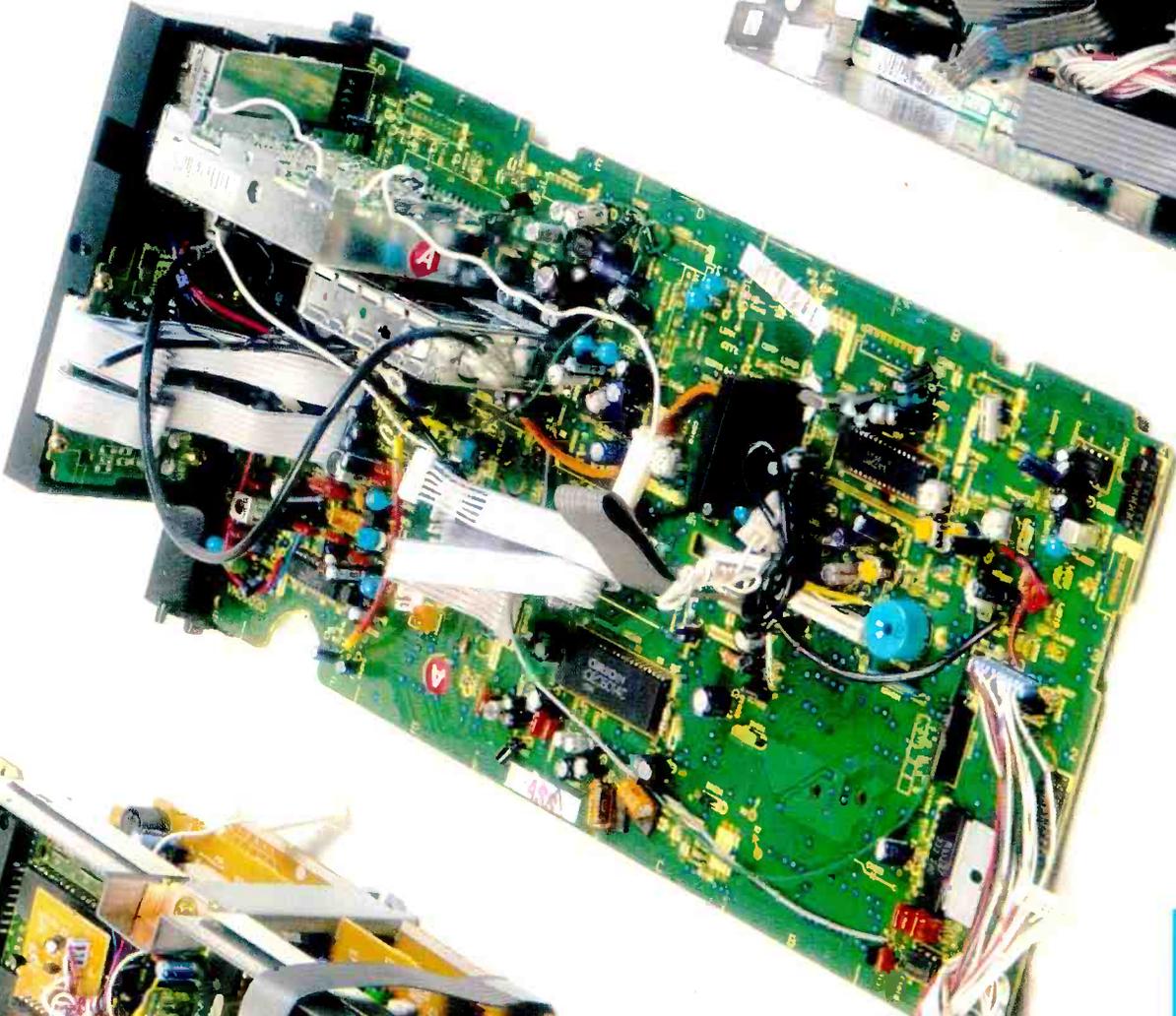
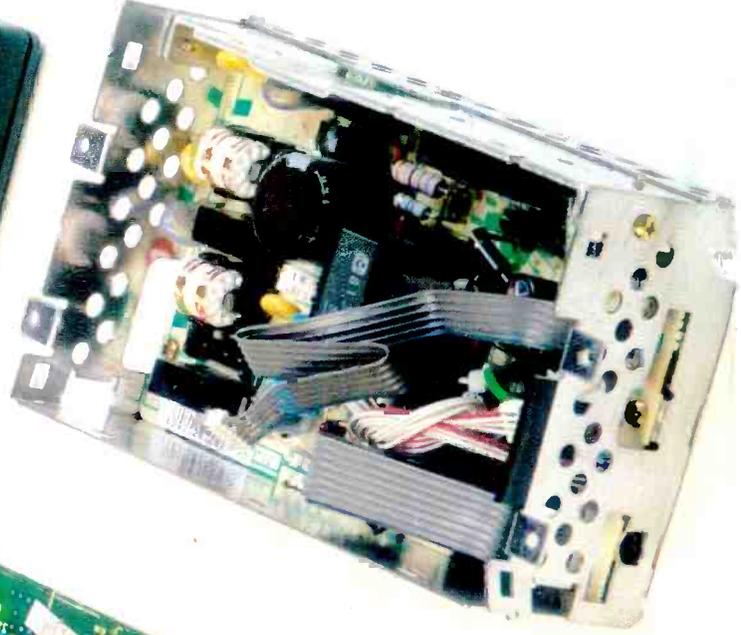
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