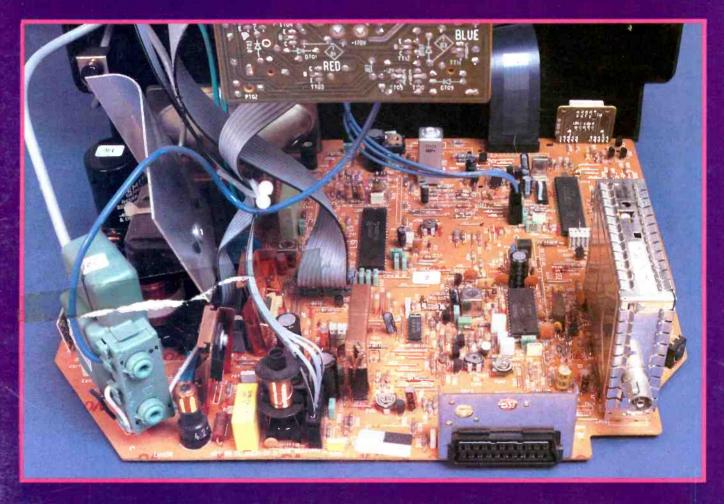
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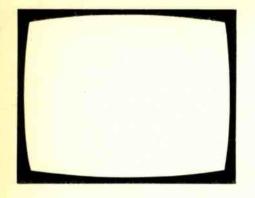
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February 1990

Vol. 40, No. 4 Issue 472

On sale January 17th

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QUERIES

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2SA-640 600 2SA-673 20 2SA-684 600 2SA-699 1000 2SA-708 3000 2SA-715 800 2SA-725 800 2SA-726 250 2SA-725 300 2SA-723 300	2SC-460 10p 2SC-461 30p 2SC-495 60p 2SC-515A 100p 2SC-535 50p 2SC-536 20p 2SC-563 120p 2SC-644 28p 2SC-647 300p 2SC-681 340p	2SC-1946 1500p 2SC-1947 450p 2SC-1957 70p 2SC-1959 20p 2SC-1969 160p 2SC-1970 200p 2SC-1971 400p 2SC-1973 600p 2SC-1973 150p 2SC-1973 130p	2SC-2853 70p 2SC-2876 120p 2SC-2877 120p 2SC-2878 40p 2SC-2899 120p 2SC-2911 120p 2SC-2912 120p 2SC-2912 610p 2SC-2922 610p	2SD-560 184 2SD-571 2SD-575 530 2SD-600 2SD-601 44 2SD-602 2SD-612 100 2SD-612 70 2SD-636 30 2SD-637 44	Op 2SD-1391 Op 2SD-1392 Op 2SD-1395 Op 2SD-1396 Op 2SD-1397 Op 2SD-1399 Op 2SD-1399 Op 2SD-1400 Op 2SD-1402 Op 2SD-1402	450p 150p 150p 240p 250p 210p 300p 280p 280p 120p	VIDEO LAMPS UNIVERSAL VIDEO LAMPS 12V.60 mA (300mm WIRES) RED OR BLUE VIDEO LAMP FOR PANASON	IC	30p 60p	VC 486, VC 3300, VC 8381, VC 9100, VC 9300, VC 9500, VC 9700, VC 582, VC 583, VC 651, VC 681, VC	£18.75
2SA-747A 600) 2SA-798 55j 2SA-748 90; 2SA-769 130j 2SA-770 200;	2SC-711 40p	2SC-1984 150p 2SC-1985 120p 2SC-1986 160p 2SC-2001 60p 2SC-2002 40p	2SC-2929 280p 2SC-2944 620p 2SC-2979 320p 2SC-2988 280p 2SC-2995 60p	2SD-638 64 2SD-639 64 2SD-640 356 2SD-642 56 2SD-655 64	Op 2SD-1409 2SD-1415 Op 2SD-1425	180p 190p 190p 430p 350p	CASSETTE DC MOT	ORS		SONY DSR-35R (FOR C20, 30, 40 SLF1, 3	SLF1UR
2SA-771 130 2SA-781 150 2SA-798 55 2SA-814 170	2SC-733 25p 2SC-761 150p 2SC-762 150p 2SC-783 105p	2SC-2003 25p 2SC-2004 60p 2SC-2021 40p 2SC-2022 200p	2SC-3012 300p 2SC-3019 320p 2SC-3025 500p 2SC-3026 550p	2SD-661 66 2SD-666 70 2SD-667 70 2SD-668 120	Op 2SD-1427 Op 2SD-1428 Op 2SD-1429 Op 2SD-1430	380p 450p 410p 280p	6V 9V 12V CW 12V CCW		240p 240p 240p 240p	SLF1E) DSR-43R (FOR SLC7 RANGE SL 5000,	£19.00 £14.95
2SA-844 30j 2SA-872 40j 2SA-872A 50j 2SA-886 90j 2SA-899 60j	2SC-790 80p 2SC-792 380p 2SC-828 25p 2SC-829 20p 2SC-839 25p	2SC-2023 180p 2SC-2026 60p 2SC-2027 450p 2SC-2028 76p 2SC-2029 120p	2SC-3039 140p 2SC-3040 260p 2SC-3042 300p 2SC-3060 900p 2SC-3057 150p	2SD-669 44 2SD-673 356 2SD-676 256 2SD-716 111 2SD-717 186	Op 2SD-1432 Op 2SD-1433 Sp 2SD-1438	400p 600p 750p 140p 320p	13.2V CW 13.2V CCW		290p 290p	TOSHIBA	
25A-899 650 25A-999 70 25A-919 70 25A-919 70 25A-919 20 25A-919 20 25A-933 40 25A-933 40 25A-933 40 25A-933 40 25A-935 40 25A-952 50 25A-952 70 25A-953 70 25A-956 70 25A-966 70 25A-966 70 25A-966 70 25A-967 70 25A-967 70	2SC-867A 150p 2SC-930 20p 2SC-941 25p 2SC-943 160p 2SC-944 140p 2SC-950 40p 2SC-982 60p 2SC-983 120p	2SC-2029 120p 2SC-2055 120p 2SC-2056 480p 2SC-2056 40p 2SC-2060 60p 2SC-2060 80p 2SC-2071 140p 2SC-2071 70p 2SC-2071 80p 2SC-2071 80p 2SC-2071 950p 2SC-2071 950p 2SC-2071 550p 2SC-2071 550p 2SC-2071 550p 2SC-2071 550p 2SC-2071 550p 2SC-2071 60p 2SC-2071 60p	2SC 3867 150p 2SC 3868 60p 12SC 3868 60p 12SC 3877 12SC 3881 12SC 3881 180p 2SC 385 385 2SC 38	2SD-717 18 10 2SD-722 24 2SD-724 40 2SD-724 12 2SD-734 12 2SD-743 13 2SD-756 10 2SD-756 14 2SD-762 14 2SD-763 14 2SD-763 14 2SD-763 14 2SD-763 16 2SD-773 40 2SD-773	\$250-1441 \$250-1448 \$250-1450 \$250-1450 \$250-1450 \$250-1450 \$250-1457 \$250-1457 \$250-1457 \$250-1457 \$250-1468 \$250-1468 \$250-1468 \$250-1468 \$250-1468 \$250-1468 \$250-1569 \$250-1569 \$250-1569 \$250-1569 \$250-1591 \$250-1591 \$250-1591 \$250-1591 \$250-1591 \$250-1591 \$250-1591 \$250-1591 \$250-1591 \$250-1591 \$250-1591 \$250-1591 \$250-1591 \$250-1591 \$250-1591 \$250-1591 \$250-1591 \$250-1591 \$250-1591	320p 440p 60p 260p 170p 320p 220p 120p 450p 450p 450p 450p 450p 450p 450p 45	* * * * * * * * * * * * * * * * * * *		* * * 90p 150p 230p 280p * * 450p 200p 150p	GRANDATA LT FOR ADDRESS & PH PLEASE SEE THE REVERSE SIDE OF	ONE : F

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VCR	FERGUSON	VIDEO MOTORS	4000B SERIES	74 SERIES	74HC251 25p 74LS114 28p	8255 200p 75188 55p
PINCHROLLERS		AMSTRAD	CMOS IC's 4000 13p	7400 20 p 7401 16 p	74HC253 36p 74LS122 36p 74HC257 40p 74LS123 35p	8256 1200p 75189 55p 8257 220p 75195 185p
AKAI	3292, 3V00, 3V01 150p 3V16, 3V22,	VCR-7000 REEL MOTOR 1700p	4001 13p 4002 13p	7402 18p	74HC258 50p 74LS124 85p 74HC259 52p 74LS125 30p	8259 280 p 75451 40 p
VS9300, VS9500, VS9700,	3V23 65p 3V29/30 120p	FERGUSON & JVC	4006 34p 4007 13p	7404 35p 7405 10p	74HC273 42 p 74LS126 30 p 74HC279 35 p 74LS132 30 p	8271 3400 p 75454 65 p 8272 1200 p 75492 55 p
VS9800 280p VS1, VS2, VS3, VS4, VS5, VS6,	3V31/32 85 p 3V35/36 80 p	CAPSTAN MOTOR 2100p	4008 38p	7406 36p	74HC280 61p 74LS133 30p 74HC283 61p 74LS136 30p 74HC298 50p 74LS138 28p	8279 270 p 8T26 95 p 8282 300 p 8T28 110 p
VS9, VS10 360p	3V38-39 80p	PU-45979 CAPSTAN MOTOR 1950p	4009 20p 4010 21p	7408 25 p	74HC299 105p 74LS139 28p 74HC394 38p 74LS139 65p	8283 400p 8284 440p
AMSTRAD	3V42/43 65p 3V44/45 65p	PU-55371V DRUM MOTOR 1950p	4011 13 p 4012 13 p	7409 20p 7413 30p	74HC356 48p 74LS147 90p 74HC365 34p 74LS148 75p	8287 360 p OPTO 8288 650 p OPTO
VCR4500, VCR4600, VCR4600 Mk2, VCR4700 280p	3V45/54 65p 3V55 65p	PU-46414 REEL MOTOR	4013 19p 4014 32p	7414 45p 7416 40p	74HC366 36p 74LS151 27p 74HC367 36p 74LS153 31p	8748 1100p 8755 1400p
VCR5200 360p VCR7000 360p		PU-51381V 2650 p	4016 18p 4017 29p	7417 32p 7420 22p 7421 25p	74HC368 36 p 74LS154 78 p 74HC373 48 p 74LS155 36 p 74HC374 48 p 74LS156 36 p	AY3-1015 290 p SP0256AL2 500 p 4N25 50 p
FERGUSON	FISHER	REEL MOTOR 1350p	4018 30 p 4019 28 p	7425 15 p 7430 25 p	74HC375 52 p 74LS157 22 p 74HC377 52 p 74LS158 27 p	Z80ACPU 150p 4N26 50p
3V00, 3V16, 3V22, 3V23 280p	VDC 7000	MYN-135V5L FOR NV333, NV366	4020 33p 4021 36p	7437 28p 7438 32p	74HC386 20p 74LS160 38p 74HC390 50p 74LS161 38p	Z80ADMA 500p 4N28 50p
3V29-30, 3V31-32 280 p 3V35-36, 3V38-39, 3V42-43,	VBS-7000 245 p VBS-9000 120 p	SANYO	4022 36p 4023 13p	7442 38p 7447 60p	74HC393 47p 74LS162 38p 74HC423 65p 74LS163 36p 74HC533 65p 74LS164 36p	Z80AP10 220 p 4N29 50 p Z80BP10 340 p 4N30 90 p
3V44-45, 3V48, 280p 3V53, 3V54-55, 3V56-57, 3V58-59,		REEL MOTOR 700p	4024 25p	7450 22p 7451 10p	74HC533 61p 74LS165 50p 74HC540 70p 74LS166 55p	ZBOAGTC 200 p 4N31 90 p ZBOBCTC 320 p 4N32 100 p
3V64-65, FV10-11, FV12-14	HITACHI	4-529V-10800	4025 13p 4026 60p	7454 25p 7470 30p	74HC541 70p 74LS168 60p 74HC563 60p 74LS169 55p	Z80AS10 460p 4N33 100p Z80AS10-1 580p 4N36 58p
HITACHI	17.4.17.00	SHARP REEL MOTOR 1500p	4027 18p 4028 29p	7473 25p 7474 35p	74HC564 60p 74LS170 68p 74HC573 68p 74LS174 30p 74HC574 65p 74LS175 32p	Z808P10-2 580p 4N37 58p Z80ADART 500p 4N38 58p
VT11, VT33 280p VT61-62, VT63-64, VT65,	VT-11, VT-33 100p VT-5000 120p	RMTOV 1008 GEZZ	4029 34p 4030 17p	7475 25 p 7481 90 p	74HC583 90p 74LS190 47p 74HC595 85p 74LS191 43p	74S289 180p 74S387 200p
VT86-88, 280p VT110-122, VT120-128, VT130-135,	VT-5500 130p VT-8000 60p	SONY	4031 90p 4032 52p	7482 60p 7485 28p	74HC597 80p 74LS192 41p 74HC620 110p 74LS193 41p	75107 85p LED DISPLAYS
VT138-150, VT168,-220	VT-8500 60p VT-9300 50p	CAPSTAN MOTOR 700p A-6751131A FOR SLC6	4033 60 p 4034 76 p	7486 28 p 7489 75 p	74HC623 110p 74LS194 41p 74HC640 90p 74LS195 44p	75113 100p 75122 110p
VT5000, VT8000, VT9300, VT9500 280p	VT-9500 50p VT-9700 60p	CAPSTAN MOTOR 2500p BHF 1100D FOR SLC7	4035 42p 4036 180p	7490 35p 7492 45p	74HC643 90p 74LS196 45p 74HC646 120p 74LS197 42p 74HC648 120p 74LS221 45p	75150 95p MAN.72 115p
	-	VIDEO LAMPS	4037 75 p 4038 46 p 4039 180 p	7493 35 p 7495 48 p	74HC651 100p 74LS240 45p 74HC652 100p 74LS241 42p	75154 100p MAN.74 115p 75162 700p MAN.4640 180p
HR3300, HR3330, HR3360, HR3660, HR4100, HR7700 280p	JVC	VIDEO LAMPS UNIVERSAL 30p 12V60mA (300mm WIRES)	4040 30p 4041 36p	7497 80 p 74107 30 p	74HC670 75p 74LS242 43p 74HC688 80p 74LS243 50p	75182 95 p MAN.8910 230 p 75183 95 p OL.747 160 p
HR7200, HR7330, HR7660,		PANASONIC VIDEO LAMPS 60p	4041 36p 4042 30p 4043 36p	74111 52p 74116 85p	74HC690 110p 74LS244 40p 74HC691 110p 74LS245 40p 74HC4002 25p 74LS247 40p	
HR7610, HR7650, HR7655 280 p HRD110, HRD111, HRD120,	HR-3300, HR-3330, 150p HR-3360, HR-3660,	IDLERS & PULLEYS	4044 36 p 4045 72 p	74119 85p 74122 40p 74123 20p	74HC4015 85 p 74LS248 40 p 74HC4016 75 p 74LS249 70 p	
HRD121, HRD140, HRD150 280p HRD160, HRD225, HRD455,	HR-4100 180p HR-7200 70p	REPLACEMENTS	4046 42p 4047 45p	74125 40p 74126 45p	74HC4017 48p 74LS251 24p 74HC4020 50p 74LS253 36p	SOLDERING IRON
HRD565, HRD725	HR-7600 80p HR-7610 95p	HITACHI FF REW IDLER	4048 27p 4049 18p	74126 45p 74132 42p 74141 55p	74HC4022 40p 74LS256 52p 74HC4024 34p 74LS257 32p	ANTEX XS25W 240V Soldering Iron
MITSUBISHI HS200, HS300, HS301, HS302,	HR-7650 75 p HR-7655 90 p	6886971 190p PLAY IDLER	4050 20p 4051 38p	74145 70p 74153 45p	74HC4028 40p 74LS258 35p 74HC4040 34p 74LS259 50p 74HC4049 38p 74LS260 30p	240Vac 540p Spare Element for XS25W 240V 260p
HS303, HS304, HS310, 280p	HR-7700 77 p	V-6861482 320p	4052 35p 4053 35p	74155 45p 74157 45p	74HC4050 38p 74LS266 22p 74HC4051 85p 74LS273 44p	ANTEX C15W 240V Soldering Iron
HS320, HS700 NATIONAL	HRD-110, HRD-111, 100p HRD-120, HRD-225	JAC	4054 53p 4055 52p	74160 50p 74164 50p	74HC4052 86p 74LS279 33p 74HC4053 85p 74LS280 88p	Spare Element for C15W 240V 260p
NV100, NV180, NV300, NV333,	HRD-250, HRD-455, 100p HRD-565, HRD-566, HRD-725,	IDLER ASSEMBLY PU-47752 450p	4056 52p 4060 40p	74167 35p 74173 50p	74HC4059 85p 74LS283 51p 74HC4060 33p 74LS290 26p 74HC4066 33p 74LS293 26p	
NV340, NV366, NV600, 280 p NV777, NV788	HRD-755	TAKE UP IDLER PU-51402A 145p	4063 52p 4066 20p	74174 60p 74175 65p	74HC4072 31p 74LS365 26p 74HC4075 26p 74LS366 31p	
NV230, NV370, NV430, NV460,	MITSHUBISHI	TAKE CLUTCH PU-55373 225p	4067 120p 4068 13p	74176 45p 74180 50p	74HC4078 32p 74LS367 28p 74HC4094 50p 74LS368 30p	DESOLDERING PUMP
NV730, NV810, NV830, 280p NV850, NV870, NV890, NV2000,	MITOHODIOIII	IDLER ARM PU-55373-3-8 285 p	4069 13p 4070 13p 4071 13a	74182 45p 74192 40p	74HC4316 100p 74LS373 45p 74HC4351 110p 74LS374 45p 74HC4352 160p 74LS375 46p	SOLDERING IRON
NV2010, NV3000, NV7000, NV7200, NV7800, NV8600,	HS-200 200p	FAST FORWARD IDLER PU-45896C 210p	4072 13p 4073 13p	74196 40p 74197 45p	74HC4510 120p 74LS390 42p 74HC4511 70p 74LS393 37p	ANTEX XS25W 240V Soldering Iron
NV8610, NV8620, NVG14 NVG7, NVG10, NVG12,		NATIONAL	4075 13p 4076 42p	74393 70p	74HC4514 120p 74LS399 68p 74HC4515 120p 74LS629 95p	240Vac 540p Spare Element for XS25W 240V 260p
NVG18 360 p	NATIONAL	IDLER 200p	4077 13p 4078 13p	HIGH SPEED CMOS	74HC4516 125p 74LS641 88p 74HC4518 55p 74LS642 105p 74HC4520 80p 74LS644 105p	ANTEX C15W 240V Soldering iron 240Vcm 540p
NVG21, NVG25, NVH65 360p PHILIPS	NV-300 160p	SANYO	4081 13p 4082 13p	74HC00 14p 74HC02 14p	74HC4538 75p 74LS645 105p 74HC4543 76p 74LS670 62p	Spare Element for C15W 240V 260p
VR6460 280p	NV-333 135p NV-777 100p	REEL PULLEY 143-0-662T-01201 520p	4085 36 p 4086 30 p	74HC03 14p 74HC04 15p	74HC7266 75p 74LS674 310p 74HC22106 580p 74LS687 250p 74HC40104 190p	
SANYO	NV-2000 150p NV-3000 160p	SHARP	4089 75 p 4093 18 p	74HC08 18p 74HC10 20p	74HC40105 250p COMPUTER	
VHR1100, VHR1300, VHR1500, VHR2300 360 p	NV-7000 95p	IDLER NIDL0005 GEEZ 195p	4094 44p 4095 58p	74HC11 14p 74HC14 26p	74LS SERIES 2114 200p LOW POWER 2532 330p SCHOTTKY 2716 200p	DESOLDERING PUMP
VTC5000, VTC5150, VTC5500, VTC9300, VTCM10, VTCM20 280p	NV-7200 90p NV-8600 160p	IDLER NIDL0006 GEEZ 195p	4098 50p 4099 42p 4501 27p	74HC20 19p 74HC21 20p 74HC27 20p	T.T.L. 2732 280p 74LS00 12p 2732A 300p	Desolder Pump 290p
SHARP		SONY	4502 36p 4503 30p	74HC30 20p 74HC32 20p	74LS01 12p 2764 240p 74LS02 12p 27C64 560p	Spare Nozzle 60p
VC381, VC386, VC2300, VC3300,	PHILIPS	REW. PULLEY	4504 55p 4505 180p	74HC42 30p 74HC51 20p	74LS03	
VC7300, VC7700, VC8300 360p VC9100, VC9300, VC9500, VC9700	VR-6460 170p	A-6706-348-B 400p REW. PULLEY	4506 58p 4507 30p	74HC73 24p 74HC74 24p	74LS05 12p 41256-12 450p 74LS08 12p 256DRAM 450p 74LS09 14p 4116 75p	
VC387, VC481, VC482, VC483, VC486, VC496, VC581 360p		A-6706-391-A/B 300 p	4508 67 p 4510 32 p	74HC75 28p 74HC76 28p	74LS10 12p 4164 150p 74LS11 12p 6116 180p	SOLDER MOP 65p
VC582, VC583, VC585 VC651, VC681, VC685, VC750,	SANYO	SERVICE AIDS	4511 30p 4512 38p	74HC77 35p 74HC85 33p	74LS12 12p 6264 400p 74LS13 20p 6502 300p 74LS14 24p 6502A 400p	
VC780, VC781, VC785,		SERVISOL PRODUCTS	4513 80 p 4514 65 p	74HC86 29p 74HC93 50p	74LS15 14p 65C02 930p 74LS20 14p 6503 570p	
VC793, VCT72	VTC-5000 75p VTC-5300 100p	V. HEAD CLEANER 100p SWITCH CLEANER 115p	4515 65 p 4516 36 p	74HC107 28p 74HC109 28p	74LS21 14p 6520 170p 74LS22 14p 6522 330p	SOLDER
SONY	VTC-5500 95p VTC-9300 220p	SILICONE GREASE 135p FREEZE IT 125p	4517 100p 4518 36p 4519 28p	74HC112 28p 74HC113 28p 74HC123 35p	74LS24 35p 6530 1050p 74LS26 14p 6532 480p 74LS27 14p 6545 880p	18 SWG 500g 500p
SLC5, SLC6, SLC7 360p SLC9, SLC20, SLC24, SLC30,	-	FOAM CLEANER 120p	4519 28 p 4520 36 p 4521 86 p	74HC123 35 p 74HC125 32 p 74HC126 33 p	74LS28 14p 6551 530p 74LS30 14p 6800 210p	20 SWG 500g 650p
SLC33, SLC44, SLHF100 360p SLF1, SLF11, SLF25, SLF30,	SHARP	AEROKLEANE 100p	4522 43p 4526 38p	74HC131 36p 74HC132 33p	74LS32 15p 6802 220p 74LS33 15p 6803 800p	
SLF60, SLF100	VC-381/383/386 125 p	AERO DUSTER 125p PLASTIC SEAL 115p	4527 41p 4528 38p	74HC133 33p 74HC137 52p	74LS31 15p 6808 500p 74LS38 15p 6809 600p 74LS40 15p 6810 150p	
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AKAI	SONY	* UNIVERSAL *	4585 40p 40100 120p	74HC158 34p 74HC160 44p	74LS78 24p 8155 360p 74LS83 37p 8156 360p	
VP-7100 160p	SL-C5, SL-C6 140p	* TRIPLERS * * 450p *	40101 78 p 40102 150 p	74HC161 44p 74HC162 44p	74LS85 37p 81LS95 120p 74LS86 25p 81LS96 130p	FLOPPY DISCS
VS-1 150p VS-2EG 100p	SC-C7 140p SC-C9 165p	* 430p * *	40103 120 p 40104 80 p	74HC163 44p 74HC164 44p	74LS90 26p 81LS97 130p 74LS91 55p 81LS98 130p 74LS92 32p 8224 240p	51/4 inch DSDD (10 in box) Branded
VS-4 120p VS-5EG 100p	SL-8000-8080 200 p		40105 140 p 40106 35 p	74HC165 56p 74HC166 60p	74LS93 26p 8226 240p 74LS95 41p 8228 270p	Name £7.50 51/4 Inch DSDD (bulk pack) 25 £10.00
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TVR-1-2-3 210p	V-5250/5280 230p V-5480 210p	*****	40147 240p 40160 55p 40161 55p	74HC191 55p 74HC192 53p 74HC193 41p	5000 ITEMS AND QUOTATIONS A Please send 70p P&P and VAT at 15	RE GIVEN FOR LARGE QUANTITIES. % Govt, Colleges, etc. Orders accepted.
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CRANDA	TA BARGAINS	★K30, K35, K40, KT3, KT4★ ★ ★ ★ ★ ★ ★ ★ ★	40194 58p 40208 240p	74HC243 60p 74HC244 44p	Fax: 01-	Telex No: 932 885 (Sunmit) 903 6126
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## CONTROLLED NO. 1 1 1 1 1 1 1 1 1 1	BELT KITS		no of belts	NAT. PA	AN. VHS BULB (ALSO SP AL PURPOSE VHS RILLE	IARP)		1.30 IEV		AMSTRAD	
## COLORS AND COLORS A	/K1 AKAI VS9300/9500/9000			3V23 W	TH PLUG			1.59		C.T.V. 1409 - MD1409221	
## CONTRIBUTION 1 1 1 1 1 1 1 1 1	TCE 8903/3V00/3V16/3V22		7 2.40	3V29 W	TTH PLUG			1.59 VIA	1000/4200	V.C.R. 7000 - MD150583	
## CONTRIBUTION 1	K2 NAT.PAN. NV70008/72008		5 . 1.45	AMSTR	AD 4500/4600/5200/90	00		1.80 50	000/5500	V.C.H. 9000 - MD150878	
March Marc	K4 SONY SUBDON/8500/8600		6 3 60	HITAU	19300/9500			0.65 VIDI	EO HEADS	00/100 NON-TXT US8511	1
MATERIAL PROPERTY 1	S SONY SL3000UB		7 2.10	WE WE	LCOME ORDERS FRO	M SCHOOLS, COL	LLEGES AND	TAKE UP ID	LERS	101 SERIES NON-TXT US8513	2
MATERIAL PROPERTY 1	6 NAT. PAN. NV3000B		6 . 1.99	GUVEN	MMENT MOTITUITONS	ON OFFICIAL REC	ZUISTTUM.	ASSY		IR9057 TATUNG RC31	
Topic Topi	(8 NAT. PAN. NV2000B		6 . 1.73					AKAI MI32773	5.63	RDELITY	
15	9 NAT, PAN, NV8600B/8610/V011		7 . 1.50	VHS DF	UM MOTOR		25.50	AKAI 8V327815	4.87	4 BUTTON IR8876	
Toping T	10 TOSHIBA V8600		2 150	SANYO	500 REEL MOTOR		12.95	VHS gen THORN/JV	C4.95	I.S. 500 12 BUTTON FD09820	
15	14 SANYO VTC5300		5 . 1.85	SHARP	REEL MOTOR		19.50	FISHER 490400900	3.95	A.V.S. 14 BUTTON FD09111	
15	15 JVC HR7650/3V31		3 . 2.00	FFD	CHECON WIDEO	CDADEC		FERG 3292 F/F	1.45	1A1 32 BUTTUN IR8963	
1.70	17 SHARP 8300		6 1.76			STANES		FERG 3V00 F/F	1.46	ADDA AUT ADDO	1
1.70	18 SHARP 9300		5 . 1.47			0110-010-088	30.00	FERG 3V00 TAKEUP	4.95	GC56520831/C1404H-C1658H-/R83 GCA 512220/C1653	14 3
SEMANGOR WOTH-SQUEEN OR ROULES OR ROULES FINAL DOOR 1.75 FINA	19 HITACHI VT8000/8300/8500		3 . 1.05	CAPSTA	AN BELT	01X0-033-018	1.75	FERG 3V16 TAKEUP	4.95	GCA 512230/C2086H-C2087H	23
## PRIAMOR WORLD 1.20 VORANT 1.20 VORA	21 HITACHI 9500		3 . 1.12	CAPSTA	N MOTOR			FERG 3V16 TAKEUP	late 5.85		
## PRANCED WORD 1-120 OSSETT LAMP OT 10-14-142 1-20 OSSETT LAMP OT 10-14-142 1-21 MAT PAN LYNCHOLD 1-22 OSSETT LAMP OT 10-14-142 1-21 MAT PAN LYNCHOLD 1-22 OSSETT LAMP OT 10-14-142 1-21 MAT PAN LYNCHOLD 1-22 OSSETT LAMP OT 10-14-142 1-21 MAT PAN LYNCHOLD 1-22 OSSETT LAMP OT 10-14-142 1-21 MAT PAN LYNCHOLD 1-22 OSSETT LAMP OT 10-14-142 1-21 MAT PAN LYNCHOLD 1-22 OSSETT LAMP OT 10-14-142 1-22 MAT PAN LYNCHOLD 1-22 OSSETT LAMP OT 10-14-142 1-23 MAT PAN LYNCHOLD 1-23 OSSETT LAMP OT 10-14-142 1-24 MAT PAN LYNCHOLD 1-25 OSSETT LAMP OT 10-14-142 1-24 MAT PAN LYNCHOLD 1-25 OSSETT LAMP OT 10-14-142 INT 10-	22 SONY SLC6		6 . 1.90	CASSE	TE LAMP	01X0-040-008	1.59			GCA 510/10/C206/H-IR8456 GCA 510870/C2069-C2269H-IR8877	2
## PRIAMOR WORLD 1.20 VORANT 1.20 VORA	24 NAT. PAN. NV300/NV333		6 . 1.55	CASSE	TE LAMP HOLOER	01X0-033-417		FERG 3V29 TAKEUP	CL 2.08		
## PRIAMOR WORLD 1.20 VORANT 1.20 VORA	25 TOSHIBA V7540		5 . 1.90					FERG 3V29 TAKEUP	SPL 2.13	RTP05/VRC IR138 - TP8-120-120E	
## PRANCED WORD 1-120 OSSETT LAMP OT 10-14-142 1-20 OSSETT LAMP OT 10-14-142 1-21 MAT PAN LYNCHOLD 1-22 OSSETT LAMP OT 10-14-142 1-21 MAT PAN LYNCHOLD 1-22 OSSETT LAMP OT 10-14-142 1-21 MAT PAN LYNCHOLD 1-22 OSSETT LAMP OT 10-14-142 1-21 MAT PAN LYNCHOLD 1-22 OSSETT LAMP OT 10-14-142 1-21 MAT PAN LYNCHOLD 1-22 OSSETT LAMP OT 10-14-142 1-21 MAT PAN LYNCHOLD 1-22 OSSETT LAMP OT 10-14-142 1-22 MAT PAN LYNCHOLD 1-22 OSSETT LAMP OT 10-14-142 1-23 MAT PAN LYNCHOLD 1-23 OSSETT LAMP OT 10-14-142 1-24 MAT PAN LYNCHOLD 1-25 OSSETT LAMP OT 10-14-142 1-24 MAT PAN LYNCHOLD 1-25 OSSETT LAMP OT 10-14-142 INT 10-	25 JVC/HR //00/3V23		2 . 0.96 4 1 75	LOADIN	G MOTOR	01X0-034-059	12.02	HITACHI F/F 688697	1 2.90	RTP07/R388N - TP200-300-390	
## PRINCIPACION NOTIFICATION OF THE PRINCIPACION OF THE PRINCIPACI	28 AMSTRAO 7000		3 . 1.45	PINCH	ROLLER ASSEMBLY			HITACHI 6413663		RTP400/401 IR401 - TP400VT-500V	т
## PRINCIPACION NOTIFICATION OF THE PRINCIPACION OF THE PRINCIPACI	38 AMSTRAO 4500/9000		3.25	RF COM	IVERTER	D1X0-040-003	67.09	HITACHI 6383531		VRC 204 U.S TP12 IR 8613 TXT - TP400TT	T
## PRINCIPACION NOTIFICATION OF THE PRINCIPACION OF THE PRINCIPACI	9 NAT. PAN. NU777		4 1.80	TAKE U	P CLUTCH ASSEMBLY	01X0-042-013 .	2.00	• HITACHI 6861471	2.43	GRANADA UNIVERSAL IRRASO	1
## PANASON WORTH PANASON 1	0 SONY T9		6 2.20	TAKE U	P SPLIDLER ASSY	01x0-040-023 . 01x0-040-007		HITACHI 6861482		LTT	The state of the s
PRINCIPLE WORTH-LOD	1 IUSHIBA 9600		4 . 1.20	UPPER	ORUM ASSEMBLY	01X0-040-002	45.00	HITACHI 6886971	2.90	C V C 32 - RG15-HS8573	
PRINAMENT 1.70	3 FERGUSON 3V35-36		0.85			01X0-040-019	1.44	NAT PAN VXP0463	3.20	R.G. 305 - WITH MUTE IR8649	
PRINCIPLE WORTH-LOD	4 FERGUSON 3V42-3-4-5-8		0.90				1.00	NAT PAN VXP0401	1.08		
TRAIL CHANGES TRAIL TRAIN CONSIDER BOOSTER BO	6 PANASONIC NV370-430		1.20					NAT PAN VXP0344	1.22	J.V.C. TP843/TXT IR170	
READ CAMPAIGN 1.76 CAM	7 HITACHI 9300		0.85	CASSET	TE LAMP	01X0-041-142	1.54			REDIFICION	
TRIAD 4500 4500 500 500 500 500 500 500 500 5				VCR3V	12			NAT PAN VXP0433	5.50	REDIFUSION MK 4 TEXT IR8838	
TRAD 7000	TRAD 4500/4600/5000/9000	3.75	1			01X0-042-089	24.89		PUL5.10	SONY	
WELLAR 1.00	TRAD 7000	3.75		Ata se	75/36/38/30			SHARP 0005	2.20	SLC7 - RMT 200	
CASSETTE MODIFIES 1.5 FOR CASSETTE MODIFIES 1.5 CASSETTE M	GUSON 3V35	3.75	1 - 1			01X0-066-014	1.20	SHARP 006	2.20		
CASSETTE MOTION CASSETTE M	YO VTC9300/VBS7000	3.75	1 1	CAPSTA	IN MOTOR	01X0-065-009	26.44	SUNY SLC5/7/3000	1.27	PHILIPS G11 TXT IR8435/IR170/843	
TAKE UP CLUTTH BELT QIXX 066-013 2.06 BIQ25S 0.58 Wisking part of special part of	Y C//J//SL1/	3.75	1	CASSET	TE HOUSING ASSY					G11 TXT U.S. 31 BUTTON	
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Column	HR2200/3320/3330/3V22	3.75	1 1	LOWER	DOOR SPRING	01X0-065-110 .		TRANSISTO	RS	KT3/K30 NON TXT IR8331	
## CADITY SOOD 3.75 GEC TAKE UP CLUTTH BELT 01X0 060-013 2.06 0131 0.33 0.33 0131 0.33	NVS9700	3.75	1	SPOOL	CARRIER IDLER	01X0-066-089	2.55	BC337	0.18	KT3/K30 TXT IR8420 KT3/K30/K35/K48 TXT/MON TYT	
## T. CEPERAL ## 1.75 HITACH LASO LASO	ACHI VT5000	3.75	1 1	TAKE U	P CLUTCH BELT	01X0-066-013	2.06	B0131	0.33	(REPLACES RC5 SERIES)	
Company Comp	NRP VC6300/6500	3.75	1			01X0-065-014 .		BD235	0.60	IR9072 REP RC5991 TV/VCR DIGITA	
VERSAL OPPYINGRAT 7.50 SURCIAIR VERDAYASD CASSETTE HOUSING ASSY DIXO 083-069 25.25 BUTI AF 2.58 BUTI AF				LOWER	DOOR FLAP	01X0-065-424 .	2.58	BU208D	2.20	IR9062 TV/VCR REP. RC5525.31.36.37, 48.41, 45	
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VIELLITE EQUIPMENT WAR ARK SPECIALISTS IN COMPUTER PASTS AND MEMBER AND SECURITY SECURI	AD CLEANER	0.96	1	VCR3V4	14/5			BUT11	2.58	THE FOLLOWING TV REMOTES ARI	E EXACT REPLACEMENTS F
TELLITE EQUIPMENT We are SPECIALISTS in COMPUTER PARTS AND HAVE 10TS OF DOUGNES THAN 10TS OF THAN 10T	A ECCENTRICITY GAUGE	57.92	1	CASSET	TE HOUSING ASSY					1 10 98/100 PLEASE STATE MODEL	RANGE OF CHASSIS INC. ' NO. OF SET OR ORIGINAL
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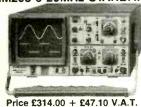
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SPECIFICATION

- SPECIFICATION

 \$ 2 Channels

 \$ Bandwidth: DC-20MHz

 \$ Sens: Ch1, Ch2, 2mV/cm

 * Timpebase; 0.2s-20ns/cm

 * Triggering: DC-40MHz

 * Active TV-Sync-Separator

 * Variable hold-off

 * Trigger LED Indicator

 * Calibrator: 1KHz Square wave

 * Component tester

 * Plus many features

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SPECIFICATION

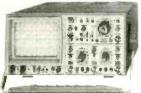
- 2 Channels
 Bandwidth: DC-60MHz
 Sens: Ch1, Ch2, 1mV/cm
 Timebase: 2.5s-5ns/cm
 Triggering: DC-80MHz
 Active TV-Sync-Separator
 After delay trigger
 Sweep delay & Delay line
 Trigger LED indicator
 Calibrator: 1KHz & 1MHz Sq. Wave
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SPECIFICATION

- SPEUIR ATTOM

 3 Channels

 8 Bandwidth: DC-100MHz

 \$ Sens: Ch1., Ch2., Ch3., 1mV/cm

 1 Timebase A: 2.55-5ns/cm

 1 Timebase B: 0.2s-5ns/cm

- * Timebase B: 0.25-bns/cm

 * Triggenng: DC-130MHz

 * After delay trigger * Delay line

 * Triggen LED indicator

 * Overescan LED indicator

 * Active TV-Sync-Separator

 * Calibrator: 1KHz & 1MHz Sq. Wave

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- SPECIFICATION

- SPECIFICATION HMZ1

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 **Bandwdhir DC-20MHz

 **Sens: Ch1., Ch2., 2mV/cm

 **Timebase Analogue: 0.2s-20ns/cm

 **Timebase Digital: 5s-2µs/cm

 **Timebase Digital: 5s

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331 IF at 250\/	R.E.	ANG	305
47UF at 250V	65		318
100UF at 250V	1.25		7145M
47UF at 250V 100UF at 250V (All Single Ended PCB Ty	(pe)		339A
part on ground or the try	por	HAI	366W
DIODES			366WR
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BY133	.20	HA1	392
BY179	65	HA1	397
BY223	1.25	HA1	3001
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5V1, 5V6, 6V2, 6V8, 7V5, 8	JV2,	MZS	93B1
BZK61C (1.3 Watt) 3V3, 4 5V1, 5V6, 6V2, 6V8, 7V5, 8 9V1, 10V, 11V, 12V, 13V, 1 18V, 20V, 24V, 27V, 30V, 3 36V, 47V, 56V, 62V, 7 100V, 110V, 120V, 130V. F	5V,	MU	13002
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100V, 110V, 120V, 130V. F	kts	CAA	A3027
of 5 per value1	1.00	SAA	\5000A
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	-	-STK	21291
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500MA, 630MA, 800MA,		STK	439
500MA, 630MA, 800MA, 1A, 1.25A, 1.6A, 2A, 2.5A, 3.15A, 4A, 5A, 6.3A,8A1	1 20	STK	4332 435 437 439 459 461 461 463 15332
	ZU	STK	461
20mm Q/B: (Pkts of 10)	1Δ	SIK	465
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Mains Trans. (TX90) On/Off Switch (Remote) Push Button TX90 Tuner. FERGUSON VIDEO SPARES 3V00/16/22 Capstan Motor Drum Motor Pinch Roller	14 14 14 24 24 	.95 .95 .95 .95	Pinch Roller Play Idler Video Head V4100/VT11E/VT33E Capstan Motor (VT31 Capstan Motor (VT30 Clutch Assy, FF/Rew Idler (Genuin Pinch Roller Video Head V4005/VT63E
Mains Trans. (TX90) On/Off Switch (Remote) Push Button TX90. Tuner FERGUSON VIDEO SPARES 3V00/16/22 Capstan Motor Drum Motor Pinch Roller Take-Up Clutch (Small) Take-Up Clutch (Large)	14 14 14 24 24 	.95 .95 .95 .95	Pinch Roller Play Idler Video Head V4100/VT11E/VT33E Capstan Motor (VT13 Clutch Assy FF/Rew Idler (Genuin Pinch Roller Video Head V4005/VT63E Capstan Motor
Mains Trans. (TX90) n/Off Switch (Remote) Push Button TX90 Tuner FERGUSON VIDEO SPARES 3V00/16/22 Capstan Motor Drum Motor Pinch Roller Take-Up Clutch ((Large) Video Head 3V29/30		.95 .95 .95 .95 .95	Pinch Roller Play Idler Video Head V4100/VT11E/VT33E Capstan Motor (VT13 Capstan Motor (VT13 Clutch Assy FF/Rew Idler (Genuin Pinch Roller Video Head V4005/VT63E Capstan Motor End Sensors (Pair)
Mains Trans. (TX90) On/Off Swirtch (Remote) Push Button TX90 Tuner. FERGUSON VIDEO SPARES 3000/16/22 Capstan Motor Princh Roller Take-Up Clutch (Small) Take-Up Clutch (Large) Video Head 30729/30 Capstan Motor	14 12 14 14 24 24 3 5 5 5 15	.95 .95 .95 .95 .95	Pinch Roller Play Idler Video Head V4100/VT11E/VT33E Capstan Motor (VT3 Clustch Assy FF/Rew Idler (Genuin Pinch Roller Video Head V4005/VT63E Capstan Motor End Sensors (Pair) Pinch Roller
Mains Trans. (TX90) On/Off Switch (Remote) Push Button TX90. Tuner FERGUSON VIDEO SPARES 3V00/16/22 Capstan Motor Drum Motor Pinch Roller Take-Up Clutch (Small) Take-Up Clutch (Large)	14 12 14 14 14 15 15 15 15 15 15 15 15 15 15 15 15 15	.95 .95 .95 .95 .95	Pinch Roller Play Idler Video Head V4100/VT11E/VT33E Capstan Motor (VT13 Capstan Motor (VT13 Clutch Assy FF/Rew Idler (Genuin Pinch Roller Video Head V4005/VT63E Capstan Motor End Sensors (Pair)

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Reel Idler (Genuine) ... Reel Motor (Genuine)...

Gear Idler Assembly. Pinch Roller

Video Head

Reel Idler...

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Tuner		Pinch Rolle
Tuner	14.33	Play Idler
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Video Head		Kit (Genuin
video nead	13.33	Cassette Li
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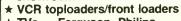
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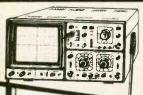
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All packs are £1 each. Note the figure on the extreme left is the pack ref number and the next figure is the quantity of items in the pack, finally a short description.

- 13A spurs provide a fused outlet to a ring main where devices such as a clock must not be switched off.

 6V 1A mains transformers upright mounting with BD2
- BD9 BD11
- BD13
- Triang clamps that soft mere supright mountaing with fixing clamps, abinet ideal for extensions, takes our speaker. Ref BD137.

 30 watt reed switches, it's surprising what you can make with these burglar alarms, secret switches, relay, etc., etc.

 25watt loudspeaker two unit crossovers.
- BD22 BD30 Nicad constant current chargers adapt to charge
- BD32
- BD42
- Nicad constant current chargers adapt to charge almost any nicad battery.

 Humidity switches, as the air becomes damper the membrane stretches and operates a microswitch. 13A rocker switch three tags so on/off, or change over with centre off. 24hr time switch, ex-Electricity Board, automatically adjust for lengthening and shortening day, original cost £40 each. BD45
- with series resistor, these make **BD49** Neon valves
- Neon valves, with series resistor, these make good night lights.

 Mini selector, one use is for an electric jigsaw puzzle, we give circuit diagram for this. One pulse into motor, moves switch through one pole. Suck or blow operated pressure switch, or it can **RD56**
- BD67 be operated by any low pressure variation such as water level in water tanks
- RD103A
- Valet level in what laths.

 50 7 50mA power supply, nicely cased with mains input and 6V output leads.

 Stripper boards, each contains a 400V 2A bridge rectifier and 14 other diodes and rectifiers as well BD120 as dozens of condensers, etc. Very fine drills for pcb boards etc. Normal cost
- BD128 10 about 80n each
- about 80p each. Plastic boxes approx 3in cube with square hole through top so ideal for interrupted beam switch. Motors for model aeroplanes, spin to start so needs no switch. Microphones inserts magnetic 400 ohm also act BD132 2 BD134 10
- BD139
- Reed relay kits, you get 16 reed switches and 4 coil sets with notes on making c/o relays and other BD148
- safety cover for 13A sockets prevent those inquisitive little fingers getting nasty shocks. Neon indicators in panel mounting holders with RD149
- BD180 RD193 6 5 amp 3 pin flush mounting sockets make a low
- RD199
- RD201
- BD211
- 5 amp 3 pin flush mounting sockets make a low cost disco panel.

 Mains solenoid, very powerful, has 1in pull or could push if modified.

 Keyboard swirtches made for computers but have many other applications.

 Electric clock, mains operated, put this in a box and you need never be late.

 12V alarms, make a noise about as loud as a car how Slightly coiled but OK. BD221
- hom. Slightly soiled but OK. 6in × 4in speakers, 4 ohm made from Radiomo-BD242
- bile so very good quality.

 Panostat, controls output of boiling ring from simmer up boil.

 Leads with push-on 1/4in tags a must for hook-BD252 BD259
 - 50 ups – mains connections etc.

 Oblong push switches for bell or chimes, these can mains up to 5 amps so could be foot switch if
- fitted into pattress RD268
- fitted into pattress.

 Mini 1 watt amp for record player. Will also change speed of record player motor.

 Mild steel boxes approx 3in × 3in × 1in deep standard electrical.

 Tubular dynamic mic with optional table rest. Books, useful for beginners, describes amplifiers equipment and kit sets.

 Miniature driver transformers. Ref. LT44. 20k to BD283

BD263

- BD305 BD400
- BD653 1k centre tapped BD548 relays each with 2 pairs changeover
- contacts 4.7 µf non-polarised block capacitors, pcb mounting. BD667

There are over 1,000 items in our Bakers Dozen List. If you want a complete copy please request this when ordering.

TOASTERS, 2 slice toasters - may need slight attention. Only £3.00 each

PERSONAL STEREOS. Again customer returns but complete and with stereo headphones a bargain at only £3.00 each. Our ref. 3P83.

MAINS OPERATED MICROWAVE CONTROL PANEL with touch witches. This unit has a 4 digit display with a built in clock & 2 relay outputs – one for power & 1 for pulsed power level. Could be used for all sorts of timer control applications. Only £6.00. Our ref. 6P18.

EQUIPMENT WALL MOUNT. It is a multi-adjustable metal bracket that could be used for mounting flood light, loud speaker, TV camera, even a fan and on almost any sort of wall or ceiling even between wall and ceiling. The main fixing brackets rotate such that an inward or an outward corner can be accommodated. Front panel also titts upwards or downwards to a reasonable angle and can be easily removed separately for wiring. A very useful bracket. Regular price would be around £6 each. Our price only £3. Our ref 3P72. Or 2 for £5. Our ref 5P152.

COPPER CLAD PANEL for making PCB. Size approx 12in long \times 8½in wide. Double-sided on fibreglass middle which is quite thick (about 1/16in) so this would support quite heavy components and could even form a chassis to hold a mains transformer, etc. Price £1 each. Our ref BD683.

POWERFUL IONISER

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

REAL POWER AMPLIFIER for your car, it has 150 watts output Frequency response 20hz to 20khz and signal to noise ratio, better than 60 db. Has built in short circuit protection and adjustable input level to suit your existing car stereo, so needs no pre-amp. Works into speakers, Bell 30P7 described below. A real bargain at only £57.50. Order ref. 57P1.

REAL POWER CAR SPEAKERS. Stereo pair output 100w each.
4-Ohm impedence and consisting of 61/2* woofer, 2* mid range and 1* tweeter. Each set in a compact purpose built shelf mounting unit. Ideal to work with the amplifier described above. Pric eper pair £29.96. Order ref: 30P7.

STEREO CAR SPEAKERS. Not quite so power –70w per channel. 3" woofer, 2" mid range and 1" diameter. Again, in a super purpose built shelf mounting unit. Price per pair: £27.95. Order ref: 28P1.

VIDEO TAPES. These are three hour tapes of superior quality under licent from the famous JVC Company. Offered at only £3 each. Our ref: 3P63. Or 5 for £11. Our ref: 11P3. Or for the really big user 10 for £20. Our ref: 20P20.



ELECTRONIC SPACESHIP. Sound and impact controlled, responds to claps and shouts and reverses when

to claps and shouts and reverses when it hits anything. Kit with really detailed instructions, ideal present for budding young electrician. A youngster should be able to assemble but you may have to help with the soldering of the components on the pcb. Complete kit £10. Our ref 10P81.

12" HIGH RESOLUTION MONITOR. Black and white screen, beautifully cased for free standing, needs only a 12v 1.5 amp supply. Technical data is on its way but we understand these are Tinput. Brand new in maker's cartons. Price: \$22.00 Free Delivery. Order ref: 25P10

14" COLOUR MONITOR made by the American Display Tek company. Uses high resolution tube made by the famous Japanese Toshiba company. Beautifully made unit intended for console mounting, but top and sides adequately covered by plated metal panels. Full technical spec. on its way to us. We have a limited number of these. All brand new still in maker's cartons. Price: £89 each plus £6 insured carriage. Order ref: 89P/1.

COMPOSITE VIDEO KITS. These convert composite vid separate H. sync, V. sync and video. Price £8.00. Our ref: 8P39

separate m. sync, v. sync and video, Price £8.00. Our ref: 879.9.

BUSH RADIO MIDI SPEAKERS. Stereo pair. BASS reflex system, using a full range 4in driver of 4ohms Impedance. Mounted in very nicely made black fronted walnut finish cabinets. Cabinet size approx 81/2in wide. 14in high and 31/2in deep. Fitted with a good length of speaker flex and terminating with a normal audio plug. Price £5 the pair plus £1 post. Our ref £914.1.

31/2in FLOPPY DRIVES. We still have two models in stock. Single sided, 80 track, by Chinon. This is nithe manufacturers metal case with leads and ICD connectors. Price \$40, reference 40P1. Also a double sided, 80 track, by NEC. This is uncased. Price \$5.50, reference 60P2. Both are brand new. Insured delivery £3 on each or both.



ATARI 65XE COMPUTER

At 64K this is most powerful and suitable for home and business. Brand new, complete with PSU, TV lead, owner's manual and six games. Can be ers manual and six games. Can be yours for only £45 plus £3 insured delivery.

REMOTE CONTROL FOR YOUR 65XE COMPUTER, With this outfit you can be as much as 20 leef away as you will have a pystick that can transmit and a receiver to plug into and operate your computer and TV. This is also just nght you want to uself with a big screen TV. The joystick has two fire buttons and is of a really superior quality, with four suction cups for additional control and one handed play. Price £15 for the radio controlled pair. Our ref 15P27.

ASTEC PSU. Mains operated switch mode, so very compact. Outputs: +12 v . 25 A, +5 v 6A, $\pm 2 v$, 5A, $\pm 12 v$, 5A Size: $7^{14} \ln \log x$ $4^{3} \sin wide \times 2^{34} \ln high$. Cased ready for use. Brand new. Normal price £30+, our price only £12.95. Our rel 13P2.

VERY POWERFUL 12 VOLT MOTOR. Vard Horsepower. Made to ne Sinclair C5 electric car but adaptable to power a go-kart, a , a rail car, model railway, etc. Brand new. Price £20 plus £2

PHILIPS LASER
This is helium-neon and has a power rating of 2mW.
Completely safe so long as you do not look directly into the
beam when eye damage could result. Brand new, full spec,
\$30 plus \$3 insured delivery. Mains operated power supply
for this tube gives 8kv striking and 1.25kv at 5mA running.
Complete kit with case £15, ditto for 12v battery. Also £15. Our ref 15p22.

ORGAN MASTER. Is a three octave musical keyboard, it is beautifully made, has full size (piano size) keys, has gold plated contacts and is complete with ribbon cable and edge connector. Can be used with many computers, request information sheet. Brand new, only £15 plus £3 postage. Our ref 15P15.

TULL RANGE OF COMPONENTS at very keen prices are available from our associate company SCS COMPONENTS. You may already have their catalogue, if not request one and we will send it FOC with your goods.

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

12 VOLT BRUSHLESS FAN. Japanese made. The popular square shape (4½in × 4½in × 134in). The electronically run fans not only consume very little current but also they do not cause interference as the brush type motors do. Ideal for cooling computers, etc., or for a caravan. 28 each. Our ref 8P26.

MINI MONO AMP. on p.c.b. size 4" × 2" (app.) Fitted volume control and ahole for a tone control should you require it. The amplifier has three transistors and we estimle the output to be 3W rms.

lore technical data will be included with the amp. Brand ne perfect condition, offered at the very low price of £1.15 each of 13 for £12.00

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JOYSTICKS for BBC, Atari, Dragon, Commodore, etc. All £5 each, State which

TELEPHONE TYPE KEY PAD. Reaily first class rear mounting unit. White lettering on black buttons. Has conductive rubbers contacts with soft click operation. Circuit arranged in telephone type array. Requires 70mm by 55mm cut out and is connected by 10-pin IDC socket. Price: £2.00 each. Order ref. 2P25.1

SUB-MIN PUSH SWITCHES. Not much bigger than a plastic transistor but double pole. PCB mounting. Three for $\mathfrak{L}1$. Our ref BD688.

AA CELLS. Probably the most popular of the rechargeable NICAD types. 4 for \$4 00. Dur ref. 4P44

20WATT 400HM SPEAKER. With built-in tweeter. Really well made until which has the power and the quality for hi-fi reproduction. 6^1 /2in diameter. Price \mathfrak{LS} . Our ref $\mathfrak{SP}15\mathfrak{LS}$. It is heavy so please add \mathfrak{LS} to cover postage if not collecting.

THINI RACIO MOCULE. Only about 2in square with ferrite aerial and solid, dia tuner with its own knob. It is a superhet and it operates from PP3 battery and would drive a crystal headphone direct but be better with our mini mono amp. Pace £1. Our ret-B0715.

Bull Gin MAINS PLUG AND SOCKET. The old faithful 3 pin with screw terminals. The socket mounts through a 1½ in hole and the mains is brought in by the insulated plug. Used to be quite expensive but you can have 2 pairs for £1 or 4 of either plug or socket for £1. You could make yourself a neat and compact bench panel with these. Our ref BD715, BD715S or BD715P.

MICROPHONE. If you want a low cost microphone then just arrived we have a very small hand-held dynamic mic with on/off swiftch in the handle, its lead terminates with one 3.5 plug and the other a 2.5 plug for remote control. Price only £1. Our ref BD711.

MOSFETS FOR POWER AMPLIFIERS AND HIGH CURRENT DEVICES. 140v 100w pair made by the famous Hitachi Company, Reference 25K413 and its compliment 25J118. Only £4 the pair. Our ref 4P42.

Also available in H pack. Ref: 2SJ99 and 2SK343 £4.00 a pair. Ref. 4P51.

TIME AND TEMPERATURE LCD MODULE. A 12 hour clock a Ceisius and Fahrenheit thermometer a top hot alarm and a top cold alarm. Approx 50×20mm with 12.7mm digits. Requires 1AA battery and a few switches. Comes with full data and diagram. Price \$6.00. Our ref: 6P12.

REMOTE TEMPERATURE PROBE FOR ABOVE, £3.00. Our ref: 3P60

A REAL AIR MOVER. Circular axial fan moves 205 cubic foot per min which is about twice as much as our standard 4/2in fans. Low noise mains operated 6/2in da, brand new. Regular price over 530,00.0 up price only £10,00.0 ur ert 10P71 600 WATT AIR OR LIQUID MAINS HEATER. Small coil heater made for heating air or liquids. Will not corrode, lasts for years. Coil size $3in \times 2in$ mounted on a metal plate for easy fixing. 4in dia. Price £3.00. Ref: 3P78 or 4 for £10.00. Our ref 10P76.

EX-EQUIPMENT SWITCHED MODE POWER SUPPLIES. Various makes and specs but generally +-5, +-12v ideal bench supply. Only £8.00. Our ref: 8P36.

ACORN DATA RECORDER. Made for the Electron or BBC computer but suitable for others. Includes mains adaptor, leads and book. £12.00. Ref: 12P15.

PFTE COATED SILVER PLATED CABLE. 19 strands of .2mm copper will carry up to 30A and is usually indestructable. Available in red or black. Regular price is over £120 per red. Our price only £20 00 for 100m red. Ref. 20P21 or 1 of each for £35.00. Ref 35P2. Makes absolutely superb speaker cable!

NEW PIR SENSORS. Infar and movement sensors will switch up to 500w mains, UK made. 12 month manufacturers warranty, 15-20m range with a 0-10min timer, adjustable wall bracket. Only £20 00. Ref. 20P24. MITSUBISHI 3/Y: DISC DRIVES. Brand new drives, ½2 height double sided, double density warranted. Our price £60.00. Ref. 60P5.

10 MEMORY PUSHBUTTON TELEPHONES. These are customer returns and sold as seen. They are complete and may need slight attention. Price £6.00. Ref: 6P16 or 2 for £10,00. Ref: 10P77. BT approved.

NON-MEMORY PUSHBUTTON TELEPHONES. Same condition as above with

DEHUMIDIFIERS. Domestic mains powered dehumidifiers these are customer ce £30.00, Our ref: 30P9. Callers only pi eturns and sold as seen. Price £30.00 vorking dehumidifiers at £99.00 each

SPECTRUM PRINTER INTERFACE. And a sectionics interface to your Spectrum complete with printer cable for only £4 00 Our yet. 4P52.

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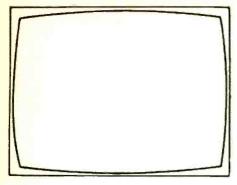


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COVER PHOTO

This month's cover photograph shows the Salora L chassis. See article on page 274. Because of production difficulties during the Christmas/New Year period when this issue was being prepared we have been able to include only a short introductory article on the Salora K and L chassis. The series will continue in future issues.

TELEWISION

The Kingfisher-Dixons Saga

As the UK's largest retailer of consumer electronics goods Dixons must take considerable responsibility for the state of the market in recent years. For many years the company's growth in size and profitability continued without pause. But three years ago, despite a booming demand for consumer electronics goods, Dixons started to falter. Profitability fell from £103m pre-tax in the financial year 1987-8 to £78.4 in 1988-9 and is expected to fall to around £40m in the current year. Turnover has not fallen in proportion however. This suggests that Dixons' main aim has been to retain market

Dixons has traditionally followed a policy of aggressive pricing. This has had an effect on the industry's profitability overall. Other dealers have had to pare their prices, to the undoubted benefit of consumers. But there can come a point where lack of profitability affects the long-term health of both trade and industry. It could well be argued that Dixons' sales practices have not been exactly helpful to UK industry.

In this connection it's interesting, once again, to compare the situation in the UK with that in Japan. Japanese industry has been producing much of the product that Dixons and others have been able to sell at highly competitive prices. Over the last decade Japanese manufacturers have faced stiff competition from other far eastern manufacturers who have benefited from substantially lower costs. Nevertheless the Japanese industry has continued to prosper and, important for long-term survival, has continued to invest massively in research and development, thus keeping ahead in the technological race. The Japanese industry's ability to do this has been helped by the fact that price cutting is not a major feature in Japanese retailing. This is in turn helped by the fact that Japanese customers prefer to buy Japanese products, while access to Japanese markets for manufacturers in other countries has traditionally been extremely difficult. A profitable home market has provided a solid foundation for Japanese industry. Manufacturers in the UK have on the other hand faced the full blast of international competition. The result of course is that there is virtually no indigenous UK consumer electronics industry left. Free traders will argue that this unfortunate result is simply because not all markets are free. The moral would seem to be to ease up on free trading until they are. You do not find Continental manufacturers accepting this situation. It's straight to the European Commission with chapter and verse. Not that this has been all that helpful in practice.

One cannot complain that Dixons has taken any unfair advantages. It has every right to buy where it wants and to sell aggressively. But things haven't turned out all that well for Dixons over the last three years, as the figures quoted earlier show. It will be worrying for investors in Dixons that this fall in profitability has occurred during both booming and declining market conditions. Also that the share price has fallen by two thirds over the last two and a half years, during which the overall market has risen by a

Kingfisher, the Woolworths group that also owns B and Q, Superdrug and Comet, has mounted a strong attack on Dixons, maintaining in particular that its profits in recent years have been aided by property disposals and have relied excessively on income derived from credit and insurance sales. This may be so, though the full facts are not

publicly known. It would, from the consumers' point of view, be ironical if their cheap purchases ended up being expensive when bought on credit. But then that's all part of what has soured the UK's trading situation in recent times.

Dixon's reply to Kingfisher's 120p a share offer is that this is an attempt to grab Dixons on the cheap and that Dixons has evolved a strategy to rebuild profitability, in particular through consentrating on higher margin lines and on the presentes offered by particular through concentrating on higher-margin lines and on the prospects offered by new products. Maybe Kingfisher is taking advantage of a temporary setback at Dixons. But then that's what modern business practice is often all about. Dixons should be the last to complain, having made a £1.8bn bid for Woolworths back in 1986 after swallowing Currys in 1984! Would Kingfisher be able to run Dixons better? One can't say of course. It's relevant that Comet's profitability has also fallen sharply during the

The whole business may be put on ice by being referred to the Monopolies and Mergers Commission. Dixons is understood to have a market share of about twelve per cent at present, with Comet's market share being put at ten per cent, giving a total of 22 per cent. Is this a monopoly situation or not? Here again there are other factors to take into account. The combined group would have a massive share of the out-of-town market, and meanwhile figures from Ferguson show that independent retailers have over

the past year been taking a substantially larger share of the market.

Kingfisher's move is probably opportunist. Geoffry Mulcahy, Kingfisher's chief executive, has described the bid as being a strategic move to give the company market leadership and enable it to restructure a large part of the electrical retailing section with the aim of greater efficiency and profitability. Maybe. For the time being the unedifying attack and counter-attack continue. It certainly seems that Kingfisher will not get Dixons for 120p a share – Dixons' share price has hovered at around 135p since the bid was first announced.

Servicing the Salora K and L Chassis

Part 1

Nick Beer and Ian Bowden

The Salora K and L chassis employ the Ipsalo-3 power supply/line deflection circuit. Its features include the use of a single chopper transistor and yet another hybrid chopper control chip, this time type LF0059. The chassis themselves are very different in physical appearance, though the circuits are similar. The K is an upright, hinge-back type that's akin to the H and J chassis. It's used in sets fitted with 20, 21, 22, 24, 26 and 28in. tubes – from the sizes you'll note that some are "traditional" while others are FS tubes. The L is a horizontal, slide-out chassis which, in addition to the larger screen sizes, is also used in 14 and 15in. models. Both chassis are found under other guises, such as Hitachi, Granada, Finlandia and Luxor. Many of them are thus used as rental sets.

The Ipsalo-3 Circuit

Fig. 1 shows the Ipsalo-3 circuit used in the K chassis. We'll provide a brief run-down on the circuit operation, starting with the action of the start-up circuit.

The mains input is rectified by the bridge rectifier DB701-4 whose reservoir capacitor is CB707. Surge limiting is provided by RB702 and filtering by RB703/ CB708. A d.c. supply of some 300V is thus present across CB708. As with the previous chassis a diac, DTB705 in this circuit, is used to get things going. CB711 charges from the 300V line via RB704, and when the voltage across it reaches approximately 30V the BR100 diac fires. The pulse produced in this way at the base of the BU508 chopper transistor TB701 switches it on. DTB705's conduction rapidly discharges CB711: when the voltage across it drops to about 22V the diac switches off, removing TB701's base drive. At this point the current flowing through the primary winding (pins 1-2) of the Ipsalo transformer MB600 reverses. The voltage developed across the secondary winding 17-18 brings rectifier diode DB603 into conduction, charging CB604. Meanwhile CB711 charges again and the cycle repeats. Thus the voltages across CB604 and CB621/2 gradually build up.

The TDA2579 timebase generator/sync chip ICB500 requires a switch-on supply at pin 16. During normal operation it's powered by a 12V supply at pin 10. As the voltage across CB621/2 builds up, a point is reached at which the voltage at pin 16 of ICB500 is sufficient for the line oscillator to start up. The set will now come into operation. The line-frequency pulses produced at pin 11 of the TDA2579 chip are fed to the line driver transistor TB502 and to pin 13 of the hybrid chopper control chip HB600, which now takes over the provision of drive for the chopper transistor. Once normal operation has been established, DB706 and RB705 ensure that the voltage across CB711 never reaches the level at which DTB705 will fire.

During normal operation HB600 provides a pulse-width modulated drive to the chopper transistor to regulate the supplies derived from the Ipsalo transformer. HB600 also incorporates overload protection circuitry. The LF0059 has twenty pins and the usual green and white appearance. It's driven by 2V peak-to-peak line-frequency pulses at pin 13. For regulation, the voltage developed at pin 14 of the Ipsalo transformer by

the action of the line output stage is sensed at either pin 5 (90° tubes) or pin 6 (110° tubes). If an overload results in the voltage at pins 8 and 16 rising to 9.5V the protection circuit in HB600 operates and the set trips.

In the standby mode the control circuitry increases the voltage at pin 7 of HB600 from 0V to 5V. As a result of the action of the internal circuitry the chopper is switched on when the negative-going edge of the line pulse at pin 13 occurs. Thus the chopper and the line output transistors are on at the same time. The latter continues to conduct until energy has been drained from the secondary windings of the Ipsalo transformer. The close-coupled windings 17-18 and 19-20 continue to develop sufficient voltage however to keep the chopper circuit, the line oscillator and the remote control circuitry in operation, so that the set can be brought back from the standby mode.

In the K and large-screen L chassis the e.h.t. is derived from a diode-split winding on the Ipsalo transformer. With small-screen L chassis sets a tripler is used.

K and L Chassis Compared

The Ipsalo-3 circuit is the heart of these sets and is common to the K and L chassis. There are considerable variations in the rest of the circuitry however, and several different control systems are used. We will consider these latter arrangements in a subsequent instalment, when we give details of the enabling procedures, which again vary with the different versions of these chassis.

The timebase and signal circuits used in the K chassis are fairly conventional. There's a definite resemblance to the J chassis in fact. The colour decoder for example is based on the use of a TDA3562A chip (ICB200), and the notes on this device on pages 103-4 of the December issue apply here as well. The line and field timebase generators and sync circuitry are in a TDA2579 chip (ICB500) as previously mentioned. A TDA3654 (ICB501) is used as the field output device.

A parallel system is used for the vision and sound i.f. signals. The i.f. bandpass setting SAWF has two outputs, the sound i.f. going to a TDA2545A chip while the vision i.f. output goes to a TDA2549.

There are several options available as plug-in PCBs with this chassis. Thus there appear to be several unused connectors and you may find yourself going in all directions if you try tracing the print connections. The options include teletext, a stereo sound decoder, a satellite TV decoder, SECAM and NTSC decoders and an f.m. tuner for radio reception.

A pair of TDA2030 chips (ICE1/2) is used in sets with stereo sound facilities, with processing (tone and balance control etc.) carried out within a TDA1524A chip (ICE3). Non-stereo versions have a single TDA2030. The 6MHz f.m. output from the previously mentioned TDA2545A sound i.f. chip is fed to a TBA120T intercarrier sound chip on the audio module.

The arrangements used in the L chassis are somewhat simpler. This is mainly due to the use of a TDA4505 chip that includes the i.f. signal processing and also incorporates the sync circuits and timebase generators. The

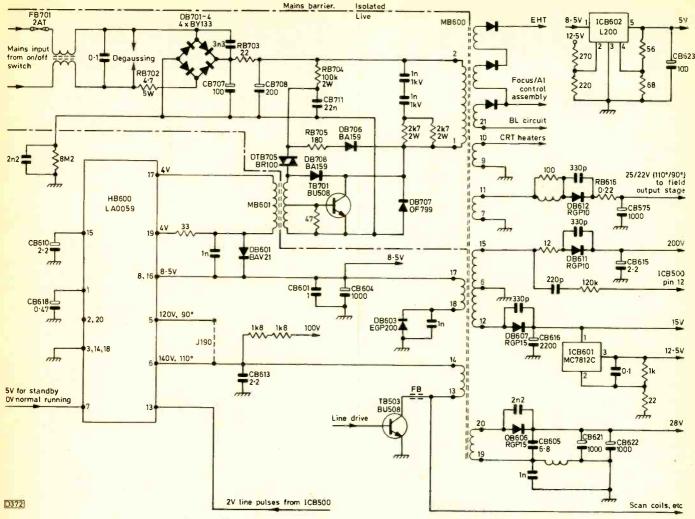


Fig. 1: The Ipsalo-3 circuit as used in the K30 series chassis.

colour decoder is a TDA3301. Once again a TDA3654 is used for field deflection.

Basic K Chassis Faults List

To round off this initial instalment on these chassis, here's a brief faults list covering common problems with the basic K chassis. Faults relevant to the Ipsalo-3 circuit also apply to the L chassis (but note that the circuit reference numbers differ with the small-screen version).

- (1) No go. On several occasions we've found the chopper transistor TB701 to be short-circuit and the filter resistor RB703 open-circuit. DB707, which is in parallel with TB701, is usually also short-circuit.
- (2) Set does not start initially but if left switched on will start after a time ranging from half a minute to several minutes. You will usually find that the $1,000\mu\text{F}$ 8.5V supply reservoir capacitor CB604 is open-circuit or leaky. We try to fit a replacement rated at 25V if the physical size permits in a particular set. CB601 which is in parallel with CB604 can also cause this problem. Several different values have been used in this position. We find that the higher value $1\mu\text{F}$ improves starting and cures any problems here. It's not unusual to have to replace both these capacitors for a no start condition.
- (3) No sound, no picture but two bars present on the display. Monitor pin 11 of the TDA2579 timebase chip

ICB500. You will find that line-frequency pulses begin to appear then, shortly after switch-on, stop. The cause is that the BC557 transistor TB541 in the switch-on line is short-circuit.

- (4) Noise and "splashes" on the picture. Suspect CB101 (22nF) which decouples pin 4 (tuning voltage) of the tuner unit.
- (5) Height and/or width twitch up/down or in/out. First check whether the height control RTB543 and/or the line phase control RTB542 is noisy. Usually however the LF(0)59 chopper control chip HB600 is faulty. You may, if you don't hold this device in stock, be able to monitor its output with a scope: usually however the fault is not regular enough for this.
- (6) No sound or vision. On several occasions the TDA2579 chip ICB500 has been faulty. This chip can also sometimes load down the 12V rail with the result that the set trips.
- (7) Intermittent no picture or sound with the channel display pulsing. This can occur with sets that incorporate teletext. Remove the teletext panel to confirm that the fault has cleared. If so the fault is due to misoperation of the crystal oscillator on this panel. Replace all associated components the crystal, transistor, capacitors, etc. Then recheck. If the fault is still present suspect the DPU2540 chip.

Teletopics

THE BROADCASTING BILL

The government's Broadcasting Bill was published on December 7th. Its main purposes are to alter the method of awarding the ITV franchises and set up a fifth national TV channel covering seventy per cent of the UK, three national commercial radio networks and several hundred local and communal radio stations. It will enable TV broadcasting companies to be taken over, though only with the agreement of the Independent Television Commission, successor to the IBA. David Mellor, Home Office minister responsible for broadcasting, has said that the government does not regard the bill in its present form as final, and expects it to be amended. "It is the best fist the draughtsmen could make of it" he said in introducing the Bill, "we are certainly willing to listen." The aim is to increase competition and widen the choice of channels. Criticism so far relates mainly to the proposed method of awarding the ITV franchises - to the highest bidder after an initial assessement of applicants. Commenting on the Bill, George Russell, chairman of the IBA/ITC, said "I am encouraged that the government has taken account of the constructive comments and suggestions made over the past year since the publication of the White Paper. An initial look at the Bill shows that these have been carefully considered and that a significant number have been incorporated. Further debate and clarification are needed on a number of matters, including the franchise process, ownership and the structure of Channel Four."

SATELLITE TV SLOW DOWN

According to the *Financial Times'* Satellite Monitor, satellite TV installations plummeted in November to only 35,000, after a record 122,000 in October and 72,000 in September. The figures are produced by Continental Research whose chairman John Clements suggested that heavy advertising of Sky Television in September and October might have brought forward installations that would otherwise have been made later in the year while BSB's advertising in November could have resulted in many viewers delaying a decision. Continental concludes that the market has become very volatile.

Publisher Robert Maxwell is negotiating with Alan Bond to purchase his 36 per cent stake in BSB. Some uncertainty has been introduced by the Broadcasting Bill which would limit Robert Maxwell, as a newspaper publisher, to a stake of no more than 20 per cent. BSB has sought from its backers an urgent injection of a further £150m, part of a final funding operation that's eventually expected to raise an additional £700m for the project. Now that the problems with the receiver decoding/unscrambling chips have apparently been overcome, it's hoped that BSB will be able to start broadcasting in early April.

BUSINESS NEWS

Kingfisher, the ex-Woolworths group which owns Comet, has launched a takeover bid worth £568m for the Dixons group. The bid values Dixons' shares at 120p.

Paul Spring Electronics is to become a division of

Ferguson, trading under the name Telefunken. This clears up an anomaly following Ferguson's takeover by Thomson, which owns Telefunken. Granada has sold its brown goods servicing division Serviscope to Computed of Doncaster. Beon Corporation, a Hong Kong based company, has bought Hinari's consumer electronics manufacturing operation: Beon plans to assemble TV sets at the Cumbernauld plant.

According to the latest BREMA figures CTV exports at £194·2m exceeded imports by £41·1m during the first nine months of 1989 while the trade deficit in VCRs was cut by more than half to £31m. The slow-down in consumer spending resulted in CTV deliveries to the trade falling by 27 per cent in the third quarter.

SERVICING SLUMP

Graham Knight, writing in *Electrical and Radio Trading*, mentions a survey of 150 dealers carried out recently by Colour Engineering Services of Davyhulm, Manchester into whether chargeable servicing had increased or decreased in comparison with the previous year. Thirteen per cent reported an increase, 20 per cent said that the service load was about the same while 67 per cent said that their income from servicing had fallen.

When times are hard, the servicing industry has traditionally fared relatively well. People tend to get their equipment repaired rather than replace it. Not this time it seems. The cost of spares and the time required to diagnose and repair faults, compared with the low cost at present of new equipment, appears to have altered the econommic equation. Let's hope, as forecast in various quarters, that the price of new equipment soon rises to a more realistic level. Spares companies and those selling second-hand equipment have also reported poor trading conditions.

NEW FROM FERGUSON

Ferguson's latest CTV chassis, the TX98, has been designed as a successor to the TX99. It's a single-board (two with the c.r.t. base panel) chassis which for the first time incorporates, without extra plug-in boards, remote control, Fastext and scart socket inputs/outputs. Features of the chassis include: frequency-synthesis tuning; 49-programme, 100-channel memory; on-screen graphics plus LED display; a scart socket for audio input/output, video input/output and RGB inputs; automatic switching to standby after ten minutes with no signal; snooze facility that puts the receiver into standby after half an hour; quick view recall of last programme. It's able to drive all current types of 90° tubes.

Ferguson has introduced its first 33in. set, Model 78M5. This high-specification model has a suggested retail price of around £1,300. Features include 40 programme tuning, an interactive menu control system with on-screen graphics, and Nicam stereo sound.

IN BRIEF

CCTV News has been launched as a monthly newsletter to give practical help and information on all aspects of closed-circuit TV. There's an introductory offer at £69.50 for a full year. For further details apply to CCTV News, 33 Duke Street, Kington, Herts HR5 3BL... The 1990 catalogue is now available from ElectroValue, 28 St. Judes Road, Englefield Green, Egham, Surrey TW20 0HB (0784 33603/35353) . . . Astra has set up a UK office at High Wycombe, telephone no. 0494 452

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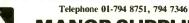
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K40 FOCUS POT	£1.0	_	£11.00		IVERSAL BATTERY TI	ESTER SBC 1695	£5.00	THORN RECEIVER F	PANEL
4.7μ KT3 W/W	10 for £1.	- 0 1 10 10		THORN 850			£2.00	564/314 564/323	
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LARGE Foacs Pots. Fits Pye, 1 8 PUSH BUTTON UNIT for C			75p	G8 SPEAKE			75p	THORN RECEIVER F	PANELS
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9000 SERIES Decoder 01 929		£5.00			20K v/cap type with ban		5p		
		h memory chip and push buttor	n and pots and	KT3 K30 Sp			30p	TX90 MOD 37141B The Sweep Tuning Sys	stern
DED of			£6.00 NEW	-	utton Switch 6 Way		£1.00	TX9 139/001	£5.00
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RANK 718 Foucs Pot 16" LOPT Split Diode 2433481 Ex Panel Split Diodes 2432871	2422001	£6.00 I.A.	100 FRONT ANEL £5	_	Push Button Unit		£1.50	T6070V TX9 Transisto	
Ex Panel Split Diodes 2432871 Split Diode 2433752 T703A LOPT Transformer Ra	ak with Forms Days and Dis-	£5 P £6 £2.00	G8 6 Button	G8 6 Button Unit, New Type £2.00			TX9 90D4-106-004 TX9 90D4-099-001	£1.00 £1.00	
HITACHI Mains Switch	is with rocus roes and Dio	50p	6 of LED D	m LED DISPLAYS, Mixed £1.00			Chopper Transformer	£1.00	
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FIDELITY Panels with I.C. FIDELITY LOPT Split Diode AT 2076/80	AT2076/80 £3.00 £5.00	PHILIPS			ew Power Supply S at 3 amps. Glass Bead	ls 60 e	£4.00 ach, 20 for £1.00	Mains Switch with Sta	nd-by
ITT CVC20 to 45 PANELS Se		111240			output Transformer	- op 6	£5.00	and Lead 3 for £1 o	or 50p each
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WE HAVE OVER 1,000 6 DIC			£15.00		LAYS 4 Bank Displays 2	Z-6042T	25p	UNIVERSAL VIDEO	
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TX10 8 way button unit TX900 with PRR-SR7	£6.00				PANEL PC895A7 LIST OF VIDEO SPARE	es ei	3 to £46 HEADS	Mono 11 Piece Kit Stereo 14 Piece Kit	£8.00
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2432211 2435016 2432301 2433952		36212 33651			RANSFORMERS	AT2048/11 AT2055	AT2076/71T AT2080/15	MSHIFCF09 TX9 LOPT	
2432491 K4 L.O.P.T 2432871 K35 L.O.P.	SPLIT-D	IODE 36072 36362	L.O.P.T.		2-338-30942 £1.00 2-338-30633 £1.00	AT2076/35 AT2076/38	RCO ST CT332 OT2041	់	
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2433212 2432101-2 2433481 TX100 Gree 2434492 Split Diode	n Spot	36831	PHILIPS	3112	2-138-98094 £1.00 2-338-30634 £2.00	CVC 800	2432461 243345	EAUN 002	2-01
2433492 Split Diode 2433581 Orion 65-3N 2433892 GEC 85-979		36832 36833		0,100	2-138-96044 £1.00 2-138-53861 £1.00	Size 6"X5"X21/2"		VIDEO MOTOR for VTS6 VC62DD8	£8.00
2433892 2433452 TX100 THORN ITT Tuner IF CMR8003 £20	L.O.P	.T. 36921/79 36922/79	£10 EAC	312	2-138-98094 £1.75	lamp. Pre-set 3v amp.	-to-12 volts, 1	AMP TUNER IF for VT56 & GEC	8 Hitachi £9.00
ITT TUNER CAN	I.C. Holders	SEND FOR LIST BRI	TISH MADE V.H.S.	VIDEO HEAL	DS from £15 to £20.	SEND FOR LIST	OF VIDEO SPAR	ES, VIDEO LEAD AND	BELTS
CMR 800/3 £20.00	I.O. Holders	SEND FOR DATA 20 A	MP COST OVER £4	100. 30 VOL1	T TO 15 VOLTS FARN	IELL POWER SU	PPLY 19" RACK I	MOUNT POST £8, IN	CASE £20
Decca 100 Lopt Panel and Frame £5.00	DIL - DIL				P POWER SUPPLY W				-
WITH DATA	40 Pin × 4 £1.00 42 Pin × 5 £1.00				ON/OFF SWITCH, NO				100
with co-ax socket UHF v/cap er 40dB gain £1.50 or 10 for £10	28 Pin × 5 80p 16 Pin × 10 70p	1 OFF - NEW F			VISION MODULATOR			I IKANSMII IER £8,0	IUU
Can be adapted for video	24 Pin × 5 75p		1 OFF -	HUMDE & S	CHWARZ EKFZ T.V. I	NUNITURING RE	LICIVER 11,200		
TTT PANEL C 301 CMC 113 CMC 302	14 Pin × 10 70p	SEND7	14001-1-	C CO D'	CHORCTEICH	TON CHO	EDIIDVAE	CC ECCEV C	C2 QAF
C 115 CMC 303 CMC 96/4 £5.00		SENDZ co	MPONENT:	5, 63 BIS	SHUPS I EIGN	IUN, SHO	EDUKTNE	33, E33EX S	SS OAF
CMR 800	DIL - QIL				SAME DAY SE	FRVICE			
Power Supply Switch Mode £5.00	16 Pin × 10 £1.00 18 Pin × 10 £1.00	All jacon	ne cubiact to our				stal Order/Chec	ue with order.	
tt ou	28 Pin × 4 £1.00 AB Mains Switch	£1.00 All rems subject to ava			hen £1 Postage. A			,	
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Interference Problems

Roger Bunney

Those who are interested in DX-TV reception, involving elusive signals that are often at noise level, are all too aware of the problem of r.f. interference. As more and more equipment capable of producing interference is installed the problem has got steadily worse. Many notch, bandstop and bandpass filters have been described in these pages over the years, along with various electrical interference suppression circuits. I recall that we even published a long constructional article on an active phasing system to clear up co-channel interference, making possible a 45dB improvement in the wanted signal.

Perhaps I have been unluckier than most enthusiasts. Living at a town centre location adjacent to a brewery distribution depot, I've experienced the full range of possibilities including interference from industrial and domestic computer installations, fork-lift trucks, heating systems, water pumps, modern digital telephones, cordless phones, baby alarms, CB equipment, overheating electric shaver wall outlet isolating transformers, medical equipment, thermostats and 50MHz amateur radio equipment, not to mention research communications within Band I at Plessey Roke Manor and also occasional Band I activity at Middle Wallop airfield (army helicopter base). Some of these problems were sorted out easily. Others proved more difficult, and on at least one occasion legal pressure was required to reduce VDU radiation.

Interference is of course best sorted out at the originating source, before it starts to radiate. We often find however that the source of the problem cannot be traced, or that the owners of the offending equipment are less than helpful. This means that we have to resort to remedial action at the receiving site, something that's far less effective.

A contact recently told me how he'd successfully managed to suppress interference from a toublesome computer system at home. Since this is a common problem, due to poorly constructed/designed computer equipment, I sought further information and in due course ended up at AKD, Unit 5, Parsons Green Estate, Boulton Road, Stevenage, Herts SG1 4QG (telephone 0438 351 71). I'd been unaware of their extensive range of aerial filter systems, covering from Band I through to the u.h.f. bands, and their helpful leaflets on interference location and suppression.

Of particular interest are their clamp-on r.f. chokes (see Fig. 1) which can be used with computer wiring systems amongst other things. Fig. 2 shows suggested suppression points in a computer system. These chokes provide a considerable improvement. They consist of rectangular-limbed U cores around which the cables to and from the offending hardware can be wound, thus providing a high impedance to r.f. current flow in the cable harness. In most cable harnesses that radiate interference – the cables concerned are those that interconnect the various user items, i.e. the keyboard, VDU, disc drive, printer etc. – the current flow tends to be one way. An unbalanced current of this type doesn't cancel and consequently radiates easily. Peak switching

currents, which are common with computer displays and associated hardware, can be transmitted over a wide r.f. spectrum – and over wide distances.

Ferrite cores have traditionally been used to provide such filtering. When correctly used they are very effective. Adding them to an existing installation can be a problem however as this involves the removal of plugs etc. so that the harness can be threaded around the core. ADK's chokes overcome this problem since the cables can be wound round the U section or sections while they are still connected to the equipment, with the plugs attached. Once the required number of turns has been completed, the bridging U-section return is clamped on. Simple and efficient. The filters can be used with all computer equipment, mains leads, audio wiring, industrial control and related test equipment, feeds to domestic kitchen equipment (washers, fridges, etc.) - in fact wherever a connecting cable could cause radiation. Attenuation figures exceeding 20dB can be achieved. Fig. 3 shows some possible applications.

Depending on the application, a single ferrite toroid with several turns or several toroids with larger turns may be better. Extended r.f. filtering, especially with

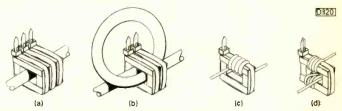


Fig. 1: Clamp-on r.f. chokes available from AKD. (a) A number of ferrite pairs can be assembled over a round cable of up to 9.9mm diameter or in a u-folded ribbon cable of up to 45mm width: the clamps can be joined together with the double-sided adhesive pads supplied. (b) With cables that are flexible but of such size that only a few turns can be encircled additional clamps can be used to obtain the required inductance. (c) With smaller cables an adequate single-layer multiturn winding can be obtained with a single clamp choke. (d) For wider bandwidth with cables of 4mm diameter or less use this low-capacitance "supertoroid" winding arrangement.

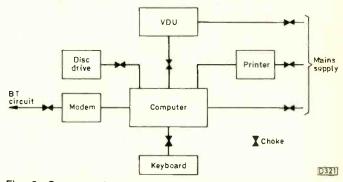


Fig. 2: Suggested suppression choke positions in a computer system. It's not often feasible to fit a choke to the keyboard link but this can be helpful.

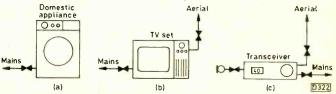


Fig. 3: Suggested uses of chokes (a) with a domestic appliance, e.g. a washing machine, (b) with a TV receiver and (c) with a CB/amateur transceiver or taxi/PMR base.

thin cable, can be achieved by using double winding on a toroid. The AKD literature provides guidance on use. The company has a large range of filtering equipment at reasonable prices for the telecommunications industry, radio/TV applications and the amateur radio field. Aerial Techniques (11 Kent Road, Parkstone, Poole, Dorset BH12 2EH) act as a retail outlet, but queries on the range, uses etc. should be sent to AKD direct (see address earlier). Enclose a stamped, addressed envelo-

Pat Hawker's Technical Topics column in the August 1988 issue of the RSGB's publication Radio Communication provided information on interference from British Telecom telephone units. I recall some years ago an Ambassador phone that radiated interference over several hundred yards, at a frequency within the twometre amateur band. It seems that the problem was caused by lengths of stripline on the phone's internal PCB. Later models didn't have the problem.

We are always interested in any interference problems. Let us know of any interference difficulties you may encounter, and particularly of any techniques you may have used to provide successful suppression so that we can pass these on for the benefit of others.

CD Player Casebook

Reports from Mike Leach, lan Bowden, Alfred Damp and Nick Beer

Technics SL-P350

This machine came to us from another dealer, the symptom being no play. The display came up at switch on but the disc didn't rotate. Checks around the power supply showed that everything was in order here.

On removing the main PCB it was evident that several chips had already been changed. IC301 (84 pins) which controls the EFM decoding, error correction and turntable servo, IC401 (64 pins) the system control microcomputer and various others had been replaced, with the odd blob of solder here and there chucked in for good measure.

After cleaning up the PCB I resoldered several of IC301's pins that were obviously shorting across to one another. The fault symptom remained the same however, no turntable rotation. The question was do we carry on or send it back? As the boss (who controls the pennies) wasn't around at the time I decided to carry on.

Considering the nature of the problem, I got to the bottom of it rather quickly. With the "no light, no spin" rule of thumb in the back of my mind I checked the laser emission with a power meter. There was laser emission and plenty of it. When checking with a laser power meter you usually get about five-seven seconds of light during which to make checks before the system control shuts the laser off because focus hasn't been achieved. I got about five minutes of light emission - it wouldn't shut down!

Checks were next made around the auto power control circuit and the associated AN8370S optical servo chip IC101. Nothing here made any sense at all, the d.c. voltages being way out. A new chip was ordered therefore. When this was fitted the problem had been cured and the machine ran up, but with distorted sound. This problem was due to more poor connections around IC301. This time I resoldered it fully, after which the machine performed perfectly.

JVC XLE300

Intermittent track skipping and TOC reading with this new machine turned out to be due to a faulty laser assembly. A new one was supplied free of charge by JVC.

Technics SL-P10

A customer brought in this big, heavy early machine and wanted it repaired for under £30. Our receptionist gave a little cough when the customer said this and duly noted the details. Intermittent play was the reported fault: sometimes the disc wouldn't rotate.

On test we found that the machine played fine for a short while but when another disc was inserted the turntable wouldn't rotate at all. A quick examination revealed a tight spot in the turntable motor. Out came the manual to obtain the part number for a replacement turntable motor. It seems however that you have to order the complete assembly with laser! We had to advise the customer that he could buy a new machine for less than the cost of repairing his old one.

Denon DCD300

This machine came in for a new loading belt to cure no TOC readout. A belt was fitted, the lens was cleaned and the machine was returned to the customer.

Two weeks later it was back again for skipping and jumping. This time we got the book of words out and set it up. Much better we thought - even played our much abused and scratched Philips 5A test disc. We ran it for a day or two then once more returned it.

A few weeks later it was back again, still skipping and jumping. A look at the r.f. waveform suggested that something was fundamentally wrong. The waveform was very poor and distorted and this time the machine wouldn't set up. We installed the laser assembly from a scrap machine we keep in the workshop for spares. This laser produced excellent results and after setting the machine up again the r.f. waveform display was perfect.

All we've got to do now is to explain to the customer that it didn't just need a loading belt, it also needed a new laser assembly. Are there any good PR men out there?!

Marantz CD45

The complaint with this Philips-based machine was intermittent failure to play. When it did play everything was fine, but occasionally at TOC readout a scraping noise could be heard from within the machine and noughts would appear on the screen.

When I first had this fault on one of these machines some months ago the fault-finding was a bit laborious. The problem is usually caused by a faulty laser assembly however. Changing it cured the trouble in this particular

machine,

Philips usually supply the complete unit for around £40 plus VAT, including the laser and servo board. When you've accumulated a few old ones you can interchange boards and lasers to establish where the fault lies, which in the long run is cost saving since you can use one unit to repair two machines!

M.L.

Pioneer PD-X99

Intermittent failure to play was the complaint with this machine – it wasn't confined to specific discs. With the top cover removed you could see that the optical assembly hunted at TOC readout. The machine would then go into the stop mode. This is a multiplay machine: it's easy to service the mechanical section of the optical unit as this is on the top of the deck assembly rather than underneath as with a conventional machine. When the optical unit was removed a slight film was visible on the lens. After cleaning this then relubricating the worm gear the intermittent operation was cured.

M.L.

Philips FCD463 Midi System

When either the stop or the open/close button was pressed the CD player section of this midi system would spin the disc at a phenomenally high speed, with no brake action. Dry-joints were evident on the servo control chip, which in this machine is on the decoder/power supply panel. Careful resoldering in this area restored normal results.

M.L.

Sharp DX450

The fault report with this popular machine was "no display". Sure enough the player didn't read the TOC, hence no display. With the top cover removed you could see that the disc didn't rotate.

There are many causes of this type of fault, i.e. no laser light, no focus, a faulty power supply or turntable motor or, something that's very common, a faulty microswitch indicating "disc loaded" to the microcomputer. In many machines fitting a new loading belt provides a simple cure. This case was different however. With the disc removed we found that the laser assembly was half way along its track, not close to the turntable for TOC reading. When we stripped the mechanism down we found that the slider motor had seized solid. A tiny drop of oil was applied to the top bearing and worked in. This restored normal operation.

M.L.

B and O CDX

When a disc was inserted and the lid was closed the disc could be seen just to start to spin then stop, the display

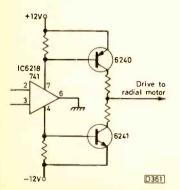


Fig. 1 (left): Radial motor drive circuit used in the B and O CDX player.

Fig. 2 (below): Adding a small magnet in the Pioneer PD-X303 to assist with playability problems.

Spindle Bar magnet

TELEVISION FEBRUARY 1990

showing the ? figure. On examination we saw that the radial arm didn't swing to the centre of the disc to try to read the table of contents. The cause was loss of drive to the motor. The reason for this was evident when we looked at the servo PCB: there was a dry-joint on a through-the-board earthing link, a problem these units suffer from on the decoding board. When this particular link goes open-circuit the earth connection for the radial motor driver operational amplifier chip is lost. As you can see from the relevant bit of circuit (Fig. 1), the i.c.'s output pin is earthed, the two supply connections being used as the outputs to drive the push-pull output transistors. Remove the solder from the hole and insert a single strand of wire through it. Bend the wire over at each end and solder to the print on both sides.

Sony D-10 Discman

The problem was no results when the a.c. adaptor was being used, also the batteries wouldn't charge. We found that R445, a chip resistor, had increased in value from $2 \cdot 2\Omega$ to 60Ω .

Pioneer PD-X303

Playability problems, the machine being very sensitive to mechanical vibration, especially on the clamper arm, are the subject of a Pioneer modification/improvement. The first step to take is to add two strips of felt rubber (part numbers PEB-336 and PNM-054, large and small respectively) to the clamper arm. The second and far more effective step is to add a small magnet (PMF1001) as shown in Fig. 2. Note that the diagram on the modification sheet is incorrect – with the centre of the magnet alongside the motor's spindle the magnet would be ineffective. Another recommended step is to fit modified rubber floats to the mechanism, part numbers PEB-320 and PEB-321. You'll often find that the rubber strips have been added in production.

B and O CDX

The following faults have occurred with several of these machines. A completely dead unit is usually caused by the ICP on the mains input panel being open-circuit. It's a 200mA Wickman fuse, part number 6600061.

For intermittent or permanent loss of one or both channels, suspect breaks in the output lead, usually around the exit from the cabinet.

Pioneer PD7050

There seemed to be no display with this stock machine, though on close examination you could see slight illumination at the bottom right-hand corner of the digitron. The cause of the trouble was absence of the -25V supply. We found that Q18 (2SA1048) and D12 (a $5\cdot1V$ zener diode) were short-circuit (3-5 Ω) all ways round

A point worth remembering with these machines is that if you reassemble the mechanism and find that the tray won't close when the disc clamp is fitted it's likely that ball bearing 04 in the hole in the metal rack at the rear left-hand side of the tray, underneath, has dropped out.

Another weak area is the soldering of the output phone sockets, while if these are handled heavily the print can break.

N.B.

Simple Colour Pattern Generator

Malcolm Burrell

The colour-bar generators advertised in *Television* represent excellent value for money. Nevertheless the need arose for a low-cost unit that could be quickly constructed on a breadboard. The design presented here is no substitute for a professionally produced and field proven one, while the method of construction is more likely to give rise to problems. The unit produces very good results however, is relatively cheap and is an ideal basis for experimenting.

Optimum use is made of cheap TTL gates – a sort of electronic Lego. There's plenty of scope for variation in this part of the design. Two more specialised chips, the ZNA234 sync pulse/pattern generator and TEA1002 PAL colour encoder and video summer, are used. Both are available from Grandata.

The circuit shown (Fig. 1) provides the following: a red raster; a crosshatch pattern; colour bars; a blank black raster; and sound. Two additional switches provide selection of 75 per cent (IBA) or 95 per cent (BBC) colour saturation and colour on/off. These two switches operate with all patterns. Colour on/off is determined by the presence or absence of the colour burst gate pulse.

The heart of the pattern generator is a 10MHz crystal oscillator formed from two not gates (G1 and G2). Its output pulses are fed to a simple divide-by-four circuit, using a 74LS74 chip, whose 2.5MHz output pulses are used to trigger the ZNA234 interlaced sync generator chip IC3. This chip also has facilities to provide crosshatch and dot outputs – the latter is not used in this particular design.

The 2.5MHz pulses are also fed to IC4 (74LS393) which contains two independent divide-by-sixteen counters. These are connected in cascade. The outputs at pins 9, 10 and 11 correspond to inverted green, red and blue bars which, if used, would result in a "reversed" colourbar pattern in order of increasing luminance from left to right on the screen. To preserve the normal convention, these outputs are fed via not gates to the three-input and gates G3, G4 and G5. These provide outputs only when Sla is in the colour-bar position.

The counters in IC4 are reset by inverted mixed sync and inverted mixed blanking inputs from the ZNA234 chip (inversion is carried out by the two gates in the feeds to pins 2 and 12 – note the use of a spare nand gate

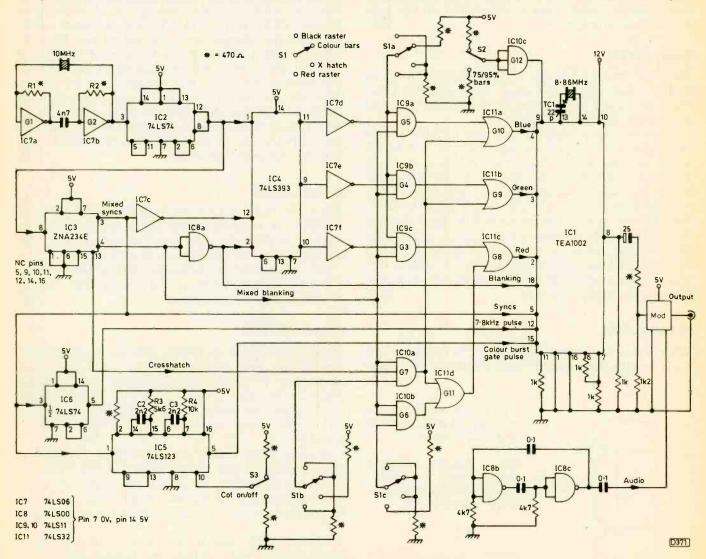


Fig. 1: The pattern generator circuit. 10MHz crystals are available from Maplin.

with the inputs strapped together). IC3's blanking output is also fed to gates G6 and G7. G6 is connected to Slc so that with a positive input a red raster is obtained. Slb is similarly arranged to gate G7 to obtain a blanked crosshatch. If preferred, the dot pattern from pin 12 of the ZNA234 chip could be connected to G7 instead.

The outputs from the gates so far mentioned are combined in the four or gates G8-G11 which consist of a single 74LS32 chip. Note that the fourth position of all sections of the rotary switch SI is connected to chassis to produce a black-level raster.

The TEA1002 provides accurate colour rendition. It carries out all the processing/encoding required, with TTL inputs. It must have a stable 12V supply. Mixed sync, inverted blanking, 7.8kHz (PAL switching) and burst gate pulse inputs are required. The colour subcarrier is obtained from an internal 8.86MHz oscillator.

This chip has been used in its simplest configuration since the optional chroma bandpass limiting (pin 11) is not required. Pin 9 can be used to select either 75 per cent or 95 per cent saturation: this is accomplished by S2 and G12. Almost any gate could be used here or alternatively pin 9 can be earthed to give 75 per cent bars.

The burst gate pulse input is obtained from the 74LS123 dual-monostable IC5. R3 and C2 set the position of the pulse within the back porch period while R4 and C3 determine the pulse width. S3 enables the burst gate pulse output to be disabled by earthing pin 10 of IC5, thus removing the colour.

The 7.8kHz pulses required to trigger the PAL switch in the TEA1002 chip are obtained from half a 74LS74 dual D-type flip-flop (IC6) which is triggered by the mixed sync output from pin 3 of the ZNA234 chip.

A UM1286 u.h.f. modulator was used since this is available cheaply from several sources including Sendz Components. Its Ch. 36 output includes a 6MHz sound carrier which is modulated by a simple multivibrator circuit consisting of two nand gates (IC8b/c). The tone obtained is rather coarse since the signal is an imperfect squarewave but is adequate.

The unit requires a stable 12V supply for the TEA1002 chip and a 5V supply for the rest of the circuit. Decoupling capacitors $(0.1\mu\text{F})$ should be connected across the supply pins of the 74LS393 and TEA1002 chips. Also provide a decoupler at the modulator's supply input to remove any stray pickup.

Battery operation is not recommended since the consumption lies in the region of 250mA – the TEA1002 and ZNA234 chips are both quite "busy" and thirsty.

Testing

An oscilloscope used to monitor the output of the TEA1002 chip shows a very satisfactory waveform. It's interesting to note the changes when the input to pin 9 is altered. Treat the chip with some respect: it's not indestructible, and can partially fail giving symptoms such as no colour, loss of colour sync, poor sync – or simply no output – if abused by the over-enthusiastic experimenter. If a video output is required it's essential to use an emitter-follower buffer stage.

The only adjustment needed is to the 8.86MHz oscillator trimmer TC1. Feed the output to a good receiver via an attenuator and adjust TC1 for locked colour.

The UM1286 modulator and 8-86MHz crystal are available from Sendz Components.

next month in

TELEVISION

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SERVICING THE MITSUBISHI HS304

This popular front-loader was sold in large quantities during the years 1983-4. John Coombes provides a detailed run-down on common problems.

• SATELLITE SIGNAL LEVEL CHECKER

In many parts of the country careful dish alignment for an adequate carrier-to-noise ratio is required if recalls are to be avoided. For the professional, a meter that powers the LNB and gives a direct readout rather than one via the receiver is a considerable time saver. D.J. Stephenson reviews the Maspro LC2E checker, a versatile and easy to use instrument that's also a help for fault diagnosis.

• SERVICING IN THE 90s

The brown goods servicing industry is undergoing a period of rapid and radical change. As equipment becomes more complex and more reliable, the cost of carrying repairs becomes relatively greater. This puts the viability of much work into question and means that careful organisation is required to make the rest profitable. Eugene Trundle gives advice on how to stay in business.

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TV Fault Finding

Reports from Philip Blundell, Eng. Tech., Ian Bowden, Stephen Leatherbarrow, Nick Beer, Hugh MacMullen, J.L. Howard, M.J. Austin and Mike Adye

Salora H and J Chassis

One of each type of set was brought in with the same fault. They were both dead, but with symptoms we'd not come across before. When the sets were switched on you could hear a very faint whistle from the start-up circuit. We found that the 28V supply (at RB554) was at only about 3-4V. This suggested that the fault was on the primary side of the Ipsalo circuit, since even with a shortcircuit across the 28V supply you should expect to hear a loud whine from the combi-transformer due to the action of the start-up circuit. When we set about checking the components in the primary circuit we noticed a small black mark on the lower side of the transformer's primary winding. On removing the transformer we discovered that several turns on the winding had shorted together: the winding's d.c. resistance was about 1.3Ω instead of 3Ω . New transformers in both sets restored normal operation.

Philips K40 Chassis

This is a cautionary tale about jumping to conclusions. The fault report on the note said no sound or vision, but of course the set worked fine and the soak bench was full. A quick look around for dry-joints seemed to be an appropriate course of action and sure enough one was found on L5157. It would have removed the line drive. After resoldering it I was just giving the set a final test when luckily the phone rang. When I returned the line oscillator had stopped – the TDA3576B chip was faulty. Saved by the bell you might say! Needless to say after that the set was given a full eight hour test before being booked out.

P.B.

Philips 2A Chassis

The problem with this set was intermittent loss of raster. When the fault occurred the voltage at pin 7 of the TDA3561 colour decoder chip (contrast control voltage) fell to 0V and a 60V peak-peak signal appeared at R3493. C2496 at the earthy end of the e.h.t. supply was going open-circuit intermittently.

P.B.

Ferguson TX10 Chassis

For intermittent no raster or a dark picture, check the first anode preset control. In the case I had the slider was arcing to the ground pin.

P.B.

Grundig CUC2401 Chassis

Early versions of this chassis used a BU508D line output transistor without the internal resistor between its base and emitter – many replacement BU508Ds do have this resistor. To use a transistor with the internal resistor the following changes have to be made to the base circuit: change R521 from 100Ω to 82Ω ; add a BZX85C5V6 zener diode across R521, with its cathode to pin 1 of the TDA8140 chip; and finally change R523 from 0.15Ω to 0.12Ω .

If the BU508D is getting much too hot, check with a scope that it's being driven at line rate. According to the

nice man at Grundig, when the TDA8140 line drive processor chip fails it can sometimes decide to drive the BU508D at twice the line rate – not something one would normally expect!

For intermittent no sound or picture with this range of sets, suspect the set-e.h.t. control, especially if it's made by Preh.

P.B.

Philips NC3-CR Chassis

When this set was switched on the line timebase made a motorboating noise for the first few seconds then a green raster appeared. On removing the back I noticed that C2483 was dry-jointed, but resoldering it had no effect. With this capacitor out of circuit the voltage had risen, damaging the 78M05 5V regulator which was giving out 6.8V. A new regulator brought the voltage back to normal and cured the other problems as well.

P.B.

Panasonic U4 Chassis

Intermittent tuning problems, with loss of the tuning voltage and/or no search, were traced to the SAB3035 chip. I've had dry-joints cause this problem with both these and certain Zanussi colour sets.

S.L.

Astron/Etron EC142

We found that the line output transistor in this dead colour portable was short-circuit. After replacing it we powered the set via a variac. This revealed that there was no power supply regulation – the 112V supply rose in sympathy with the input voltage. Obvious really: the chopper transistor was short-circuit, but using the variac had enabled us to save the cost of another BU208A. We fitted a new BU326A chopper transistor and again wound the input up slowly. There was still no regulation as the $22k\Omega$ resistor in series with the set-h.t. potentiometer was open-circuit.

Matsui 21in Model

This set was rather poorly. The 4AT mains fuse had blown, the STR58041 power supply chip was short-circuit, its 5.6Ω , 5W feed resistor was open-circuit and a nearby 0.47Ω , 1W resistor was also open-circuit. Thankfully the set worked after replacing these items, as we'd no manual.

As a postscript, I must add that the many STR/STK type power supply/audio output chips have not distinguished themselves with respect to reliability.

S.L.

Philips K35 Chassis

The trouble with this set was slow warm up: for the first five-ten minutes the picture was dark, with a restricted brightness control range. Checks at the relevant colour decoder chip pins showed that there were normal variations as the plus and minus buttons were operated. A scope check then showed that during the fault condition the video drive was very low: as the set

warmed up, the drive increased. Thermal cycling of components brought us to C583 (4.7μ F, 250V) which decouples the 115V supply to the RGB output stages.

S.L

B and O 5102 (77XX Series)

The report with this set said that there was intermittent negative vision. It would have been more appropriate to say that intermittently there was a good picture. Not dryjoints on the i.f. board edge connector this time, a common problem with these sets. There were dry-joints on every earthing lug inside the vision detector can. N.B.

Sanyo CTP6144

This is not a set I know well – we sold very few of them. Due to illness however all sorts of people were making field calls and all manner of gear was coming into the service department. The report on the card said something about the channel indicator flashing 88 or 99, and the engineer had added that the raster became pear shaped. The vital piece of missing information was that the set went off, the reported symptoms being ancillary ones. The cause of the trouble was evident as soon as the back had been removed and the set had been upended – there were dry-joints on all pins of the chopper transformer T301.

Grundig GSC100 Chassis

This 14in. set persistently blew the mains fuse for no apparent reason. It was a difficult one to prove: we never found any signs of an h.t. short-circuit to cause the fuse blowing. On a damp day however I saw the e.h.t. from the cap connector jump across to the degaussing coil. So this was the cause of the persistent failure of the 3·15AT fuse!

H.MacM.

Sanyo CTP6143

The problem with this set was intermittent shut down about ten minutes after switch on. This turned out to be an easy one: there was arcing from the focus spark gap to link J105 immediately beneath it. Examination of the c.r.t. base panel revealed that it had been damaged at some stage by over-zealous use of a soldering iron. A replacement panel provided a complete cure.

J.L.H.

Nikkai Baby 10

Loss of power with a Nikkai Baby 10 was traced to failure of the protection components F402 and D402. The cause had of course been reversed connections to the battery. Make sure that the user understands the importance of correct connection when you get this sort of thing.

J.L.H.

Rank T22 Chassis

This was an unusual fault to say the least. As described by the customer, the fault was as follows. While he was watching ITV the sound for no apparent reason died, to be followed by the BBC-1 sound although the ITV picture was still present. This was followed by various noises, all of which sounded very unpleasant, then finally the picture disappeared.

I'm not sure whether a c.r.t. flashover was the cause, but there was certainly some damage. The c.r.t.'s heater supply was missing, and as the feed resistor on the tube base was o.k. we had to replace the line output transformer. The result was distorted sound but no e.h.t. A check at the collector of the line output transistor produced a reading of 5V, so the transistor was removed and checked with the Avo. It was partially short-circuit, from base-to-emitter, the reading being 80Ω . After fitting a new transistor we had a set that tripped. To cut a long story short, the new transistor was also found to be short-circuit though it gave the same readings on an Avo 8 as a known good one. Whatever next! Following this the whole set had to be retuned and set up.

M.J.A.

Ferguson TX10 Chassis

This set bounced back on us after only a short time and severely upset our early morning coffee and toast break while watching the delights of Anne Diamond and taking a look at the latest porno mag left by our friendly newsagent . . . As usual it was a different fault, though along the same lines as the original one – dry-joints on pins 11 and 18 of the chopper/e.h.t. transformer had been speedily dealt with on the previous Saturday morning. On this occasion however the sound and e.h.t. disappeared intermittently, along with the tuning, producing the usual rushing noise from the loudspeaker.

This time a hot soldering iron and plenty of solder on the joints of the transformer failed miserably and every attempt to provoke the fault also failed. So we hitched an elderly Avo Minor to R666, which provides the 12V feed to the RGB output stages, while attending to other jobs. Shortly afterwards someone came in and breathed on the set and the Avo's needle dropped. I leapt over with another meter to check the supply at source (pin 2 of IC621) and the picture and sound re-appeared.

No fault could be found once normal operation had returned and the set continued to work happily all afternoon. I began to suspect the 22V supply to IC621 and for want of anything better to do monitored this with the original meter. Shortly afterwards success! The picture and sound disappeared but the 22V supply remained intact. The joints around IC621 were then very carefully checked. Using a large magnifying glass I discovered a tiny hairline crack in the solder around pin 2. Once this connection had been stripped down, scraped and resoldered no further trouble was experienced.

Incidentally we've found that for occasional repeated failure of the BU208B line output transistor TR831 the use of mica washers back-to-back provides a solution, assuming that no other cause for the demise of this transistor can be found.

M.A.

Cathay CTV3000

No results with no bias at the base of Q501 was traced to R504 ($150k\Omega$) which was open-circuit. We weren't out of the woods yet however since the set would intermittently shut down and refuse to operate. It belongs to the friendly greengrocer next door and as we always do well there we made a determined effort. After a thorough search we found a crack in the track from D301 to the line output transformer. A nice piece of tinned wire put things right and we had additional celery that weekend.

Test Report: Topward Oscilloscopes

Eugene Trundle

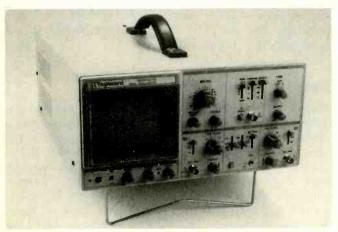
The market for service oscilloscopes is very competitive. Topward, a Taiwanese company, is one of the half dozen leading manufacturers in this field. It has a range of keenly priced instruments whose particularly intriguing feature is a triple-trace system. I selected a couple of bench-type oscilloscopes for review and had them on the bench in everyday service for three months.

Most of the tests were done on Model 7042, a 40MHz triple-trace instrument with 5mV basic sensitivity, a 10 × 8cm screen, a 12kV PDA tube, a delayed timebase and an X-Y facility. It doesn't have the component tester or d.c. output facilities provided by Hameg and Crotech machines, but offers every modern servicing facility as an oscilloscope, with an attractive price.

Y Amplifiers

I'll start with the Y amplifiers. At 42MHz they were 3dB down, which is better than the specification. The gain was within two per cent on most of the attenuator settings, and looking at a squarewave I saw no nasty habits or response inequalities between gain steps. The front panel calibration output waveform at 1kHz/500mV is useful for probe trimmer setting and gain checking. At the rear of the machine there's a Y output socket (BNC) offering a 50mV/div buffered signal from the Y1 channel. This is useful for driving a frequency counter or similar instrument.

The Y1 and Y2 amplifiers have a large output capability and can produce an undistorted drive waveform well in excess of full screen height. The maximum sensitivity at full bandwidth is 5mV/cm, expandable to 1mV/cm at the expense of half the bandwidth. This is similar to the Hameg range. I find that the loss of h.f. response at high gain is not usually a handicap, though I would like to see 1 or 2mV basic sensitivity in a scope. At the other end of the scale the lowest Y gain control setting gives you 5V/cm, corresponding (with a 10:1 probe in use) to 50V/cm and a maximum input signal (full screen deflection) of 400V peak-to-peak. This is more than adequate for audio and VCR servicing, but is rather restrictive when dealing with the line output stages in TV sets and monitors, where peak voltages in



The Topward 20MHz Model 7021, available from Maplin.

excess of 400V are regularly encountered – and need to be measured! There are solutions. You can use a 100:1 probe, which is inconvenient, or turn back the vernier gain control from its click-stop CAL position, though this loss of calibration leaves you guessing about the amplitude of the waveform you're measuring. Other scopes have greater headroom in the Y department: the Hameg types stop at 20V/cm, the Crotech ones at 10V/cm.

There's no delay line in the Y amplifier department, so it's not possible to display a sweep-trigger event. This is seldom needed in everyday servicing however, and its absence helps keep the cost of the instrument down.

What about that third trace? It doesn't have a full-blown Y amplifier like the two main vertical deflection channels. Ch. 3 signals enter via the EXT SYNC socket (BNC) on the front panel and pass through a relatively narrowband channel with two fixed-gain settings (100mV/div and 500mV/div). Ch. 3 is brought into operation by a front panel mounted pushbutton, its screen position being set by a rotary control on the rear panel. With all three traces in use the beam chops or alternates – depending on the CHOP/ALT switch setting – between all three in sequence. As with all multitrace scopes, the more traces you have in use the lesser the brightness of each of them. This is important only at high frequencies, with low duty-cycle displays and with low-voltage monoaccelerator tubes – more about this later.

I found the third trace useful mainly for checking the waveform selected for external sync: this can be done at the touch of a button. Other occasional uses were for looking at three lines of a data bus simultaneously and for monitoring three test points at the same time when soak testing equipment. This latter application can be very helpful.

Timebase

The sweep speeds range from 0.5sec/div to 200nsec/div in twenty steps, which is an adequate range for the Y bandwidth and display tube. There's a vernier control with click-stop CAL position and a times ten magnification facility which gives a maximum sweep speed of 20nsec/div at the expense of brightness. The sweep linearity is excellent.

This 40MHz model has a dual-timebase facility that enables the main sweep to be delayed by a second timebase (TIME B) in order to be able to select and magnify a portion of the trace. This is a useful feature for examining waveforms in modern equipment and works very well here. The main sweep can be delayed by a period which you can preset between 0.5msec and 200nsec per division in twelve calibrated steps, with continuous vernier control between. For presetting you switch in an intensity-modulation system to give a trace bright-up, then adjust the main sweep and delay periods to highlight the section of the waveform you wish to magnify. Selecting the delay mode then fills the screen with the segment chosen.

The bright-up was not very prominent in the review

model, but winding up the B-INT preset control on the front panel made it easier to see. The delay is an analogue one, but I was very impressed with its performance. Jitter is normally a problem with these delay systems, and a cruel test is to delay a single TV line for almost a field period then examine it. Thus set up the trace was rock steady and usable even with ten times magnification. An excellent performance, very little different from that of pulse-counting delay systems which are less versatile.

Triggering

To be able to use these delaying and magnifying tricks you have to have a good trigger selection. The one incorporated here worked very well for me, rigidly locking to any selected polarity or level of the Y signal so long as the trace was more than 1cm high. The sources that can be selected are Y1, Y2, mains (LINE), external and external via a divide-by-five attenuator. Whichever trigger source is selected can be a.c. or d.c. coupled, low-pass filtered or passed through a TV sync separator stage where line or field outputs are selected according to the setting of the main sweep speed. A single knob selects the trigger level and polarity, and I found it very easy to get a grip on almost any signal being displayed, giving a stable and jitter-free display. I even managed to lock steadily to a satellite TV video waveform with inverted line sync!

There's also a hold-off control to help with triggering from complex signals and aperiodic pulse waveforms. In addition a one-shot facility is provided, with reset button and indicator.

My only criticism of this section is that the external sync BNC socket is slap bang in the middle of the control panel so that the plug and lead make seeing and operating the controls more difficult.

Display

It's in the display section that a wideband scope stands out best. It has to have a high-voltage (in this case 12kV)

Table 1: Abridged specification, Model 7042.

Operating modes: Ch. 1, ch. 2, dual, triple with ch. 3. Sum/difference ch. 1 ± ch. 2. X-Y operation. Alternate/chop switching.

Y amplifiers: A.C. or d.c. coupled, response d.c. to 40MHz (-3dB point). 5mV to 5V per division in 10 steps with vernier control. Five times magnification at d.c. to 20MHz. Y1 output facility. Ch. 3 100mV or 500mV per division.

Timebase: 200nsec/division to 0.5sec/division in 20 steps with vernier control and times ten magnification. Sweep delay 200nsec to 0.5msec/division.

Trigger: Auto/normal/one shot from Y1, Y2, external, line. A.C., d.c., LPF, TV sync. Polarity ±. Holdoff variable to four times

X deflection: 5mV to 5V/division, bandwidth 2MHz at the -3dB point.

Z modulation: 3V peak-to-peak, d.c. - 5MHz.

Display: 10 × 8cm screen, 12kV e.h.t., flat face, internal graticule with screen illumination.

Power input: 115-250V, 50/60Hz, 40VA.

Accessories supplied: User's manual, mains cord.

Optional accessories: Attenuator and switched probes.

General: Weight 9kg, size 165mm high, 314mm wide,
425mm deep. Colour cream/grey. Carrying handle and
foldaway prop/stand.

PDA type tube, giving a good brightness reserve and sharp focus. The Matsushita tube used in this model worked better than those fitted in any of the comparable scopes I've seen. Once set, the focus remained correct at all levels up to full brightness, where the trace was pinsharp.

With a single TV line being displayed the trace duty cycle is 625:1. The brightness is reduced by the same factor. Even with this display the tube provided a well-focused image that was bright enough to be seen in a well-lit room. The c.r.t. has an integral graticule, so there's no parallax error. Very good. The e.h.t. regulation is also good, with no perceptible blooming throughout the brightness range.

Screen illumination is controlled by a front panel mounted fader, and this highlights the graticule. It's very difficult to do this well when the lines are printed on the inside of a c.r.t.'s screen, and this one has a rather diffused and uneven illumination.

Summary, Model 7042

I didn't like the user manual. It covers the whole model range of seven instruments and is thus full of ifs, buts and conditionals. It doesn't include a circuit diagram, alignment instructions or parts lists, though I'm assured by the importers that they can obtain parts and will be able to carry out repairs throughout the instrument's life. A look inside was reassuring. The power supply is based on a big, cool mains transformer, and in general the standard of construction is high, with adequate switches and potentiometers (the main items that wear) and glass-fibre PCBs.

None of the criticisms made above are serious ones, and I feel that at £434.74 (attenuator probes not included) this instrument offers very good value for money. Its main competition is the Philips PM3209 at about £595 and the RS Components Model 2225 (made by Tektronix) at £750, both of which are dual-trace instruments. These figures are all exclusive of VAT.

A protective front cover is not available, so if you buy this scope for use in the field you will have to devise some form of transit protection for the very vulnerable front panel.

20MHz Model 7021

The 20MHz Model 7021 is almost identical in construction and appearance to the 40MHz instrument. It has a less busy control panel, missing out on the delayed timebase, but retains the three-trace feature and excellent triggering facilities.

This model is fitted with a Toshiba 2kV monoaccelerator type display tube, of the same size and with the same type of built-in graticule as in the 40MHz scope. As with all similar 20MHz scopes, this one lacks the brightness and sparkle of the more expensive model, and at high frequencies and with short display duty cycles it runs out of brightness very quickly. The one thing that would have helped with this, a viewing hood, is not available as an accessory.

On test I found that it performed, within its bandwidth and brightness limitations, in similar fashion to the 7042. Most of the previous remarks, good and bad, apply equally to this model. It shares the same sweep generator and thus has a wider sweep range than most comparable 20MHz types and, I'm convinced, has a

better trigger performance, especially at field rate from the Y channels.

In view of this and the three-beam capability I believe that it offers, at £249.57 plus VAT, probably the best value for money to be had in this class, which includes the Hameg 2036 (with component tester) at £314, the Philips PM3208 at £349 and the RS Components 9020 (Beckman made) at £357.60.

Availability

Both models are available from Maplin Electronics, PO Box 3, Rayleigh, Essex SS16 8LR (telephone 0702 554 161). The catalogue number for the 7042 is XJ60Q, price £499.95 including VAT, while the catalogue number for the 7021 is XJ61R, price £287.49 including VAT.

My thanks to Maplin for the loan of the review models.

Letters

COMPACT DISC QUALITY

I'd like to add a few points to the current discussion on the quality of compact discs. Like S. Kearson, I'm wondering how Les Sage measured his signal-to-noise ratio? The standard method is to record a tone, say 1kHz, at maximum recording level and set up the playback measuring system to read 0dB on an a.c. voltmeter. The recording is then continued with the tone switched off and the level of noise below the 0dB reference is measured. This figure is the signal-to-noise ratio expressed in dBs. It's impossible to quote precise figures unless you have a precise measurement method, and I don't know of any compact discs, tapes or vinyl discs that include a 1kHz reference level track. There are however ways of assessing the signal-to-noise ratio, based on experience. I'll come to these in a moment.

Here are some basic figures to bear in mind. The signal-to-noise ratio with a vinyl disc is typically 40-50dB - if the disc is in pristine condition. Typical stereo separation is around 35dB, perhaps a bit better or worse depending on the pickup, its arm, the tracking weight, etc. Studio master tapes generally have a signal-to-noise ratio of around 60-70dB. This figure is 20dB better than that for a vinyl disc and some 20dB worse than that for a compact disc system. Putting it another way, the vinyl disc degrades the performance of an analogue master tape while the analogue master tape degrades the potential performance of a compact disc by about the same amount. It's thus easy to see why modern recordings, for making CDs, are generally done with a digital master tape. The signal-to-noise limits are then set by the analogue part of the system (microphones etc.) and we can get nearer to the quoted 93dB signal-to-noise ratio of the CD. Stereo separation is also 93dB of course, and this makes for a much firmer stereo image than is usually achieved with a vinyl disc.

If you want to get a feel for the sound of a 20dB signal-to-noise degradation, find a weak stereo f.m. broadcast which is hissy on mono. Then switch to stereo. The signal-to-noise ratio degradation is approximately 22dB. Expressed in these terms, it's easy to understand why we can often hear the noise from an analogue master tape when playing a CD but not when playing a vinyl disc. If

you played the master tape itself, you probably wouldn't be able to tell the difference between it and a CD made from it. Thus as Brian Renforth pointed out any deterioration in an old master tape becomes quite obvious, but be assured that it's the best you can get and is purely a function of the master tape and any digital remastering techniques employed.

Before leaving the subject of CDs, I'd like to say how much I am enjoying Joe Cieszynski's series of articles. Being so lucid, they are a great source of instruction and enjoyment from which I've learnt a lot.

Finally a few words in praise of Les. I visited him on a couple of occasions over the years – the visits duly reported in Les's column – and found him and HB both charming and hospitable. I think we can all empathise with Les because he is honest about his strengths and weaknesses. Most of us have had difficult times or done daft things, but few are as open as Les in admitting to them. His honesty deserves our praise and admiration and I guess we all wish him well for the future.

Keith Cummins, Holbury, Hampshire.

A VERY INTERMITTENT ONE

Here's an interesting case that had several engineers baffled. The set was an ITT CT600/1, a 22in. model fitted with the 80 series 90° chassis, power/deflection board CVC823P. It suffered from a very intermittent fault that had been present for about eighteen months. As the customer was a friend I decided to use the set at home – otherwise I might never have seen the fault. The symptom was line pulling or jitter: the picture moved about 1cm horizontally, two or three times a second. This sometimes lasted only briefly, at other times for a few seconds. I also noticed that sometimes only part of the picture would move horizontally, usually the top third or middle section. Most of the time the set worked perfectly, the fault not putting in an appearance for several weeks.

Use of heat and freezer would neither clear the fault nor make it occur more frequently. The line generator and sync circuitry is contained in a TDA9503 chip, IC711. Various items in this area were suspected and checked but this didn't solve the problem because, as it transpired, I was concentrating on the wrong part of the set.

To cut a long story short, one day the fault occurred for a longer period and I found that the picture was stable only when the VCR button was pressed. A careful check on the voltage at pin 9 of IC711 with the VCR switch open and closed revealed that it varied as the fault came and went. When I examined the switch I found that there was black grease on the contacts. Since cleaning the switch the set has worked for several months without any trouble.

The fault would not have occurred in the VCR mode of course, but the customer didn't have a VCR. If he had used one, tracing the cause of the fault might have been easier. One wonders how the grease got there and whether other sets could be affected in this way.

A.R. Day,

Hull, North Humberside.

SAFETY OF SATELLITE TV INSTALLATIONS

I work for a county council audio-visual unit whose main purpose is to maintain equipment installed in schools and public buildings throughout the county. We are also responsible for the safety testing of this equipment.

I was recently asked to tune a satellite TV system, used in a language laboratory, to bring in other satellites now available. As signals from the West German DBS satellite were required I had to adjust the easterly limit of this Salora system. On attempting to do this the dish began to move then jammed. The entire system shut down after this.

So it was up on to the roof to inspect the dish assembly. I found that the dish mounting was badly corroded and that the bearings had seized up, with the result that the dish had turned on the two bolts that pass through the bearings. These bolts had worked loose and the dish was being held by only a couple of threads on the bolts.

The bolts that attach the mast assembly to the mounting bocks were also corroded, and had started to eat into the stand. I've since heard of other systems where the picture is lost when a high wind blows – they obviously require attention.

I eventually managed to free the bearings by using penetrating oil and leaving it to soak for a few days. I then oiled the bearings and coated the bolt heads with a liberal amount of grease. All that remains is for the rust to be removed from the stand and for it to be repainted.

It's important to inspect these installations on a regular basis as they can become potentially dangerous very quickly. I would also like to see a safety chain attached to the stand in case the aerial blows over at any time in a high wind. I would like to hear from anyone who has come across an installation in a dangerous state. The one mentioned above was just over a year old.

Jim Fenton, 14 Faircourt,

Orchard Park Estate,

Hull, N. Humberside HU6 8BG.

IMPROVED FIELD BLANKING

Our old ITT CVC5 still gives a fine picture, but suffered from secondary emission reflections from teletext and showed wandering flyback lines when used with a VCR. Inspired by readers' success stories with the Rank A823 chassis I thought I'd try my hand at curing the problem.

The GEC pulse stretcher circuit shown in S. George's article on multivibrators in the February 1983 issue was a great help. It requires a positive input pulse and provides a positive output pulse with adjustable length. The CVC5 requires a negative-going field blanking pulse of about 170V peak-to-peak amplitude – waveform (23). I

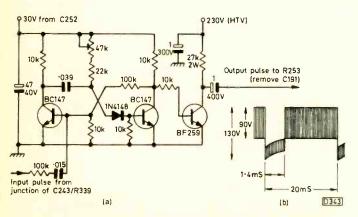


Fig. 1: Pulse stretcher circuit for use with the ITT CVC5 chassis (a), waveform at the junction of D32h/R254h (b).

found a suitable positive input pulse at the junction of R339f and C243f. Connecting this to the multivibrator input (see Fig. 1) via a $100k\Omega$ resistor produced only a very slight disturbance that was easily corrected by means of the linearity controls. To invert the output, a BF259 transistor is used, fed from the 230V h.t. rail (V). A 2W $27k\Omega$ collector load resistor runs almost cold. The output is taken via a $1\mu F$, 400V capacitor to the C191h end of R253h – remove C191h as the original 170V blanking pulse in no longer required.

The circuit shown was built on a piece of Veroboard mounted, component side down so as not to foul the cabinet back, on the top left (looking from the back of

the set) chassis member.

To set up the $47k\Omega$ preset, turn it first to minimum resistance. Reduce the height so that the teletext lines are visible, then advance the setting of the $47k\Omega$ potentiometer until all the teletext lines are blanked out. Finally readjust the height for a normal picture.

The arrangement described works very well with our set, completely eliminating all teletext and flyback lines. Although 1.4msec of blanking is sufficient, the circuit can be adjusted to give up to 2msec.

David Martin,

Bishop's Stortford, Herts.

HELP WANTED

I have been trying for some time to obtain a remote control kit for a Philips VR2020 VCR. The kit consists of a handset, a plug-in IR sensor and a power supply. So far I've had no success. Could any reader supply a new or second-hand kit?

Paul Hardy, 43 Sheridan Avenue, Caversham, Reading, Berks. RG4 7QB.

Could anyone supply any information on the Hartley TP13A oscilloscope, such as a circuit diagram, operating instructions, etc.? Any expense involved would be paid. L. Heald, 3 Poplar Street, Chorley, Lancs PR7 3EN.

I have an intercom system that consists of an anodised aluminium outside unit and an internal handset. The only identifications are a logo made up of a telephone handset with the letter E between the ear and mouthpieces and, on the back of the internal handset base, the words "URMET Made in Europe". Can anyone supply the manufacturer's name and address, a circuit diagram (the amplifiers are in the outside unit) and connection details?

S. Shaw, PO Box 1404, Randfontein, 1760, S. Africa.

Could anyone suggest where I can obtain a pinout diagram and/or a replacement or good substitute for the UM2128-1 used in the Tatung 80 video card?

K.J. West, 3 Kennedy Drive, Walmer, Deal, Kent CT14 7TQ.

I'm seeking information on the Sony Model 9-90UB. First either a circuit or a manual (a photocopy would do). Secondly modification details (a) for positive/negative switching (for the French system, for v.h.f. and u.h.f. retaining the a.m.) and (b) for using the Band I/III tuner with 625-line transmissions.

Mike Evans, 120 Loughton Way, Buckhurst Hill, Essex IG9 6AR.

VCR Clinic

Reports from Philip Blundell, Eng. Tech., Eugene Trundle, Chris Plaice, Mick Dutton, Stephen Leatherbarrow and Nick Beer

Grundig VS340

When the tape was ejected there would occasionally be a loop left out of the cassette. This is usually due to a dead spot on the capstan motor, but a scope check on the motor seemed to show that this was not the case. Just then the capstan stopped. Some careful waggling of the wires showed that there was a dry-joint where the capstan motor wires are soldered to the small PCB at the back of the deck.

P.B.

Philips VR6660

The magnets on the threading motor sometimes fall out, the result being that the deck doesn't initialise. If you can find the lost magnet, it does matter which way round it goes. You need to have the N pole pointing outside with one magnet and the S pole pointing outside with the other one.

P.B.

Philips VR6362

One of the dealers we do work for regularly sends us repairs with no indication as to the fault. Luckily with this range of machines a look at the error memory usually gives a clue. Not this time however – the CMOS RAM battery was flat! The machine played all right but when I tried to tune in a station the picture was overlaid with diagonal black-and-white bars (like a monochrome barber's pole). A panel swap proved that the fault was on the signals panel P306. We found that the play supply switching transistor T7304 was short-circuit. P.B.

Philips VR6660

This machine would intermittently stop playing. If the tape deck test was called up it said that one of the tacho signals was missing – though a visual check showed that the reels, the capstan and the head drum were all rotating when the fault occurred. Scope checks revealed that the wind tacho signal was going missing. When the reel was removed you could see that the reel magnet rubbed on the Hall sensor: as the magnet wasn't glued to the reel it would stop rotating while the reel kept going. The sensor wasn't sitting correctly in its slot as a wire had been trapped underneath it.

P.B.

Grundig VS400

I had just fitted a new mode control switch because the machine looped the tape on eject. When play was selected however noise bars ran through the picture as there was no output from the control track. A scope check showed that the control head's earth connection was floating, though the fault would clear if the chassis was disturbed. The cause of the problem was eventually traced to a poor connection at plug A3 on chassis board 1.

P.B.

Philips VR6185

After a few minutes' use the E-E signal would fade off, leaving just snow on the screen. A scope check on the

frequency divider signal at pin 13 of the tuner showed that it gradually got smaller and smaller until it reached 0.2V, when the picture went off. The U744 tuner was faulty.

P.B.

Toshiba V55

For an intermittently dead machine – even the clock goes off – check for dry-joints at the a.c. input to the power supply module.

P.B.

Sanyo VHR1100

If you come across a dead VCR of this type, one which will not eject a tape, perform any deck functions or respond to the remote-control handset, the likelihood is that its on/off key is stuck in. If so it will come up on "operate" (rather than standby) as soon as the machine is plugged into the mains supply. The cause is usually physical, the on/off button being stuck, jammed or gunged up. Check by removing the front cover.

E.T.

Akai VS425

I've often found when working on the bench with these machines that the remote control operation is intermittent or doesn't work at all. This is not a fault: if the handset is too close to the machine there's no response. At normal operating distances you'll find that the outfit works perfectly.

The head drum motors in these machines can give trouble ranging from erratic speed and phase to a runaway condition in which the drum continues to whiz at high speed even when the rest of the deck has shut down in the stop mode.

E.T.

Sharp VC486 etc

The service manuals for Sharp VCRs of this period don't give a setting up procedure for the mode switch. Though it's more reliable than the ones in Panasonic and some other makes of machine, it can fail and be in need of replacement. Don't pay attention to the notch in the rotary part. With the deck mechanics in the stop or eject mode, carefully turn the pinion (several turns if necessary) until you get a short-circuit reading between the lead-outs. Fix the switch in place in this position.

E.T.

Ferguson 3V30/JVC HR7300 etc

The symptoms sometimes found with this range of machines are no E-E signals and no tuning signal though the r.f.-through signal is o.k. and the deck mechanics all work. In these circumstances check for a dry-joint at the always 9V regulator transistor Q101.

Sanyo VHR1100

We've had more than one of these VCRs with the following fault: while the clock/display works all right the machine won't switch on. Checks have shown that

the power supply and the syscon microcomputer chip were doing their stuff, the cause of the problem being that the 12V switch transistor Q5006 is open-circuit. The equivalent books say that a BC328 can be used as a substitute. In practice we've found that this transistor is not man enough and recommend that the correct type is ordered and fitted.

E.T.

Baird 8940/JVC HR7350

The complaint with this machine was that it had snapped four of the customer's tapes (will some people never learn?!). The cause was a badly fitted cassette lamp. It was so far down its holder that the sensor received no light when the leader appeared. Thus the tape got ripped out of its clip on the supply spool.

Here are a few other faults we've had with this model:
(1) Intermittent loss of playback picture was caused by the track of the noise-cancelling potentiometer R208

(470 Ω) being open-circuit.

(2) No E-E sound. Q11 was open-circuit.(3) No sound erasure. Q10 was short-circuit.

(4) No capstan motor operation. C62 and Q8 were both short-circuit.

The above component reference numbers were taken from the JVC HR7350 manual. C.P.

Time-saving Tip

Here's a time-saving tip, even if it seems a bit obvious. To insert those very tight self-tappers that screw into plastic, put a drop of oil on the screw first. It will then go in almost by finger pressure only.

C.P.

Grundig VS180

This machine was dead, with just a momentary twitch of the capstan motor at switch on. The power supply is commendably simple and I soon found that D425 was short-circuit. A BY299 was used as a replacement. This made it possible to play back a tape to check the deck functions. No recording was possible however as there were no signals. The main 33V supply was missing at the relevant power supply pin, a short to chassis being recorded at this point. It was due to the 33V zener diode on the front panel.

S.L.

Tatung TVP1311

This VCR was dead with F2 (2A) very definitely blown. As there was no obvious short-circuit we fitted a new fuse. When we switched on again the machine came to life for several seconds then the fuse once more blew. Several fuses later we found that there was a dead short across the 12V rail. This was pinned down to the servo board, then to the deck connection PCB. By further disconnection we isolated the fault to the reel sensor. When this was examined we found that a blob of solder shorted out the printed track to the metalwork. How the machine could have worked from new we were unable to see.

M.D.

Sharp VC381

The complaint with this machine was that most functions didn't work. A quick check on the power supply showed that the 13V and 12V outputs at pins 1 and 8 were missing. When the power supply was taken apart we

were able to check back through the regulators. This revealed that there was no output from the 2SD1308 14V regulator transistor Q01. I ordered a replacement and fitting this cured the problem. After a few weeks however the machine returned with the complaint that it would load but nothing else worked. This was the case and in addition the loading was very slow. A check on the power supply showed that while the 13V output was correct off load it dropped to 3V when a cassette was being loaded and the motor was running. It turned out that our new 2SD1308 transistor was faulty, though this was not obvious at the time due to the difficulty of taking measurements with the power supply apart.

M.D.

Hitachi VT120

The customer complained that there had been intermittent problems for some time. Now none of the operation keys worked and the clock display was random. We found that there was no 5V supply at pin 32 of the timer control and operation (key scan) chip IC751. This supply follows a very devious route: we eventually found that circuit protector IC805 on the VS tuning PCB was open-circuit.

M.D.

Philips VR6467

The complaint was no playback video. There was a healthy f.m. signal output from the head but no video output from the Y/C processing board. The f.m. signal entered the TDA3730 chip IC7351 at pin 17 but didn't reappear at pin 16 as it should have done. This was not surprising as the supply to this chip was missing. It comes via a BC238 series regulator transistor T7304 which we discovered had gone short-circuit base to collector. This was not the end of the story since there was still no output when we'd replaced this transistor. It turned out that C2329 (330 μ F, 16V) was also dead short. M.D.

Ferguson 3V57

The following note could apply to any of the machines in this range. The symptoms were not uncommon – clock alight but the machine wouldn't switch on. This is usually due to the absence of one or more of the switched supplies because of an open-circuit ICP in the power supply. In this case however the ICPs were intact, but the switched lines were missing because the power supply CRTL line at pin 9 of CN3 remained high at 3.2V. This high came from pin 1 of the syscon microcomputer.

The power switch input to pin 17 of the microcomputer chip was very low but was being earthed as the switch was pressed. The same applied to the timer input at pin 20. Separate pull-up resistors are used, so the fault had to be in the supply. In fact the unswitched 5V line was missing. It's obtained from the unswitched 12V supply via a regulator on the main panel (not the PSU). The 12V supply was present here but the regulator transistor Q602 was not being biased on as there was a 90Ω leak from its base to chassis. We found that the culprit was not the zener diode, as expected, but the parallel 0.022μ F ceramic decoupler C6050. The interesting point was that the fault had been reported as intermittent some days earlier. We'd returned the machine with a "no fault found" note under the assumption that a mains lock-out had occurred, something that's not uncommon N.B. with these machines.

The Room at the Back

J. LeJeune

A lead-grey sky greeted Sid as he left home on his ten minute walk to work. A stiff breeze flapped the legs of his trousers and infiltrated the sleeves of his raincoat. He shivered and lengthened his stride.

Sid's bones ached by the time he reached the workshop. Inside, the old building smelt damp and the 1930s valve radio wheezed away relentlessly, 2kHz out of tune since the frequency changes introduced a few years ago. But no one seemed to mind – even if they noticed. Trade was slack and Ralph was miserable. He mooched around

turning off any unwanted lights.

Norman was making something: two steel rods with tapered ends angled at 45° were taking shape. "What on earth are they?" asked Sid. "Cabinet braces" replied Norman. "One end goes in the screw hole at the top of the cabinet and the other goes in at the base. The idea is to stop those new skeletal plastic cabinets wobbling too much. They scare me the way they flex."

Gareth wandered in from the shop. "Electronic vandals struck last night" he said. "They used a remotecontrol handset to turn up the volume of all the TVs in the window. The row could be heard at the other end of

the street!'

"They were at it the other night as well" said Sid. "We'll have to disable the remote systems." Sid went into the showroom and studied the window display. He stepped carefully around the items on show: it was a simple matter to rearrange the price cards to cover the infra-red windows of the sets affected, and in ten

minutes the job was done.

Back in the workshop Sid encountered super-salesman Terry Green. He was bemoaning the lack of customers. No one seemed to want a satellite installation or a new set. They weren't even coming in for batteries. Gareth was fiddling with a microwave oven that had failed a leakage test. He was renewing the r.f. gasket on the door. "That's it!" cried Terry. "We'll offer everyone a free safety check on their household electrical goods. Check the fuses in the plugtops, for frayed cables, microwave leakage - that sort of thing! Should generate a bit of interest."

Gareth's next job was a Ferguson 51A2 - the TX100 chassis. There was absolutely no sync, neither line nor field, yet in every other way the set worked perfectly. He pored over the circuit diagram for several moments, then switched the set off and removed the TDA2578A line and field processor chip IC4. After fitting a new one and switching on again the fault was still there. "It's as though someone has shorted the set line sync pins together" he said to Norman. "Hang on!" Norman replied, "there's a capacitor across those pins, C63 better check it." Gareth soldered a new 150pF capacitor in place and that was another problem solved.

Norman had prised the back off a 1930s valve radio. Until yesterday it had been serenading the mechanics at the Mogul Garage just down the road. Now it hummed loudly and did little else. Peering into its dusty interior, untouched for possibly more than thirty years, Norman could make out the rectifier valve. It was a full-wave type but only one half was working. The other heater had gone out. "Where do I get a UU5?" he asked. For once he was at a complete loss.

Gareth looked up from a half dismantled Fidelity ZX3000. "My mate renovates old valve radios" he said. "When he can't get a full-wave rectifier valve he fits two silicon rectifiers with series 470Ω resistors in its place."

Norman thought this a good idea and decided to try a couple of 1N4007s. He busied himself removing the UU5's base and finding the components for the modification. "Have to be careful" he muttered. "I'll get instant h.t. with no load on it. Have to make sure the electrolytics can stand it."

He stood back as he finished the job and switched the set on. After fifteen seconds it sprang to life. As good as new, except for the layer of grime and spray-drift that

covered it. Better than the workshop one.

"Got that ZX3000 working yet?" he asked Gareth.

"I've replaced the TDA4600 chip and the BU426A chopper transistor and its base circuit components D9, R90 and C93" said Gareth. "It works at switch on but I'm not happy with it." At that point the set went off, with F2 flashing its destruction. The BU426A had gone short-circuit collector to base.

"Probably excessive current" said Norman. "Now as I recall R91 to pin 4 of the chip has a lot to do with it. We've had similar problems with the same resistor in

Grundig and Ferguson sets."

Gareth set to with the solder pump and soon had the $270k\Omega$ resistor between the probes of his bench Avo. "It's gone high" he announced, "will that be all?"

"R91 sets the current limit" Norman replied. "When it goes high the BU stays on too long. You'll have to

replace all the other items as well."

Norman's current problem was a 20in. Ferguson TX9 set. There were all the appearances of someone having had a go and put back the leads to the c.r.t. base incorrectly. Norman checked, but they hadn't been changed. The colours were entirely wrong though - the greens were red, the reds were blue and the blues green. Purples were cyan, cyans were yellow and yellows purple. He fed in a red raster from the pattern generator. It came up green tinged with red and yellow in three corners and along the lower edge. He decided to phone the owner.

"We're puzzled by your set, Mr. Knowles. Did you drop it by any chance? . . . I see. I'm afraid it'll need a new tube. About £150." There was a long pause. "I'll see

what I can do" Norman eventually said.

He went back to the TX9, switched off and began to interchange the leads, green to blue, red to green and blue to red. When he switched on there was a reasonable colour picture with micoloured patches. They said they'd try it, so Norman asked Gareth to deliver the set.

Andy was out in the rain, somewhere in the hills. A farm generator had gone crazy and seen off an old TV set that was its principal load each evening. Norman turned to a refurbishment job on a loan set that had seen better days. The chassis was willing but there was more tube trouble - the A56-120X was tired and Norman was trying to coax more life from it.

"This sort usually comes up a treat" he said to Sid, who was taking an interest. "But it refuses to budge a microamp." Sid bent over the Cathode Cruncher. "Does seem pretty lifeless" he agreed, but I can't believe the tube is all that flat. Maybe something's wrong with the booster."

Andy, rain soaked and breathing hard, muttering imprecautions about heathen hill farms, backed through the double doors and dumped the abused TV on the floor. "They'll have a new set up at Pickersgill Craggs" he told Sid. "Send them one with a wide mains input range – that generator has a will of its own!"

"Only because Arthur Longbottom insists on fiddling with it" Sid replied. "But we could do with the sale. I'll take one up later." Meanwhile he took the covers off the booster. Overheated resistors and a disintegrated capacitor greeted him. "Even the perishin' test gear needs repair in this dump" he moaned, then went on to disembowel the booster with gusto.

Norman left him to it and, while Andy turned his attention to a record turntable with a linear tracking system fault, took a look at a Ferguson SRA1 satellite TV receiver that had come in because of random remote control operation. The customer's complaint was that it had switched itself off once, gone into standby several times, and had changed channel on a couple of occasions. Not unusual with TV sets, but satellite TV receivers were still something of an unknown quantity in the workshop.

Norman took off the covers and snapped on the bench lamp. After an hour on the bench nothing had happened. "I might as well link it up and watch something" he muttered. He fetched a spare TV set from the soak bench and connected it to the SRA1, then plugged in the lead from the dish on the roof. Things soon began to happen, just as the customer said. By luck the unit sent itself into the sound mute condition. During the sudden silence a slight sizzling noise could be heard. Norman doused the bench lights to look for telltale sparks. Sure enough there were some on the underside of the board, near the IR receiver. He disconnected the unit from the mains and investigated.

The SRA1 has a three-cored mains lead and is thus earthed. The PCB is earthed to the metal case at only one point, near the IR receiver. This point was making poor contact. The arcing was due to the non-isolated aerial socket used with the TV set's isolated chassis allowing line-frequency currents to flow in sufficient quantity to cause a small spark at the indifferent earth connection. Norman felt pleased with himself.

Andy's problem turned out to be caused by a defective motor. Shortly afterwards Mr. Knowles was on the phone to thank them for their trouble and to say that the picture was splendid.

"Makes you wonder what some peoples' eyesight is like" was all that Norman could say.

What will 1990 Bring?

Les Lawry-Johns

Not a lot, I suppose. But at least we're still here. So many seem to have popped off recently. It makes you feel you're cheating by keeping going, but I suppose that there's still room for us even if we have to do without some of the things we'd become used to. As I sit here I'm crowded in by three dogs and a bird: dogs on the left, bird on the right. I don't know which is worse. The dogs keep quarrelling (quietly though) while the bird runs around her cage as though there's someone after her. Honey Bunch has gone out to do some shopping and, no doubt, gossiping. I mustn't say too much, because she'll read this before I send it in. But, good lord, don't I gossip as well?

There's not a lot to tell you about sets. That Fidelity VCR is still playing up. First there was no sound, now it buckles the tapes. However, we've still got the Sony Betamax machine, though the heads have needed cleaning several times – after a certain tape has been played I think. I clean the heads with my finger sprayed with Aero-Clene. A lazy man's way of doing it no doubt, but it seems to work. Sorry about that . . .

Some TV sets have been attended to, and that seems to be about all I've been capable of recently. A shorted diode in a Ferguson portable had blown the mains fuse, and there was a far eastern set with a faulty line output transformer. I couldn't do this one because I didn't have the transformer to fit in it. Anyway, it was only a few months old so still under guarantee.

The owner's complaint about an ITT set was that the aerial socket needed fixing because the picture and sound kept failing. I repaired the socket but the signals

kept going because, as I found out after a while, of a dryjoint at the base of the tuner unit. It didn't look as though it was dry, but it responded to tapping. So I scraped it clean and resoldered it carefully. The signals didn't go off after that.

You may wonder how I can do these jobs. It's because the shop still hasn't been sold. It went into auction the other day, but hardly a sale was made (few reached the required price, including mine). So I suppose I'll have to keep hoping that someone will come along to clear my enormous bank overdraft. I've had offers, but they wouldn't clear my debt to the bank. When I look round at the dogs, cat and bird I wonder if they know more than us. They seem to get along without all the worry and trouble we've made for ourselves. We have to be clever and keep on inventing things like TV sets and so on. Where do we end up? Up to our ears in debt, that's where . . .

I've recently had a couple of jobs from the same house. One was a Grundig set that I had to cart off to the shop. There was reduced field scan at the bottom of the raster, but when I got the set on the bench nothing seemed to be wrong. I stripped it down and resoldered everything to do with the field output stage. After that I couldn't make the set do anything wrong however much I probed around. So in the end I took it back and explained the situation to its owners.

They asked me to look at another set of theirs, upstairs. Up I went to look at a dead HMV receiver, one fitted with the Thorn 9500 chassis. The mains input was o.k., so I went along the back to the red button cutout. This was open-circuit and I just happened to have a spare one in my case. After fitting it the set came on all right. I charged them £15 for the trouble and they paid up happily. I've been expecting them on the phone ever since about the Grundig receiver, but I've not heard so far. Maybe the soldering has been successful.

Well that's all for now. My best wishes to you all for 1990.

The Ferguson SRA1 Satellite TV Receiver

Nick Beer

The operation of the Ferguson SRA1 satellite TV receiver was described in the November issue. We've sold a number of Ferguson Astra installations. Only a modest number, since the satellite TV market here in North Devon has been somewhat cautious, but the results have been superb. The receiver is easy to operate and to install. Reliability however has been disappointing. We've had problems with about a third of the receivers. In the September issue (page 852) I commented on the high running temperature and the use of rivets to connect the regulators to the heatsinks. While not all problems are attributable to these arrangements, you can't say that I didn't warn you!

Absence of signals is usually due to no supply to the LNB. You will usually find that the fusible resistor R145 in the relevant supply has gone open-circuit due to an excessive load. There have been several versions of the receiver and the value of R145 varies with the different versions: fit the same value as a replacement. Naturally it should also be a fusible type. Common reasons for the failure of this resistor are: connection and disconnection of the LNB cable while the receiver is powered, thus inadvertently placing a short across the d.c. output to the LNB; the LNB cable being cut while the unit is powered during installation, with the same result; a faulty LNB, which is the Marconi combined feedhorn/polariser/LNB; breaking of the F connectors or ingress of water into them - outdoor connections should be waterproofed to prevent this. The point to remember is that the supply to the LNB is present even when the receiver is in the standby mode.

We've also had breaks in the print and plug leads to the LNB supply regulator REG3, type 340AT.

Failure to switch polarity, i.e. only one polarity being available (half the channels), has in our experience usually been due to a defective LNB. The less common cause is failure of the switching transistor Q32 (BC547).

The receiver does buzz, as there's a fairly large mains transformer while the unit's case is small. A faulty transformer can be the cause of excessive noise however and will have to be replaced. Little by way of sealing can be done to quieten the transformer as it's an encapsu-

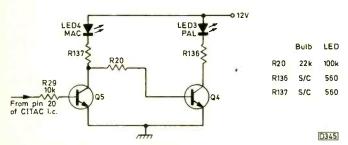


Fig. 1: The PAL/MAC bulb/LED circuit.

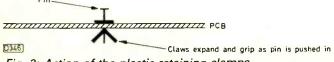


Fig. 2: Action of the plastic retaining clamps.

lated type. On one occasion we found that the transformer was not sitting flat on the board at one side: putting this right quietened it down a bit.

Intermittent no go has been traced to dry-joints on the mains transformer, but on one occasion relay RL1 was faulty. This relay switches the 12V and 5V supplies when the unit is brought on from standby. The symptoms were that the standby LED went out but the PAL LED didn't come on: there was no sound or picture, just a black raster. A sharp tap on the top of the relay's case would bring the LED on and restore normal operation. This relay is also an encapsulated device, so it had to be cut open to reveal the cause of the fault – some of the potting compound was across the contacts. A new relay was thus required.

Some units use bulbs instead of red LEDs as indicatdors, though the circuit reference is still LED1 etc. We've had these bulbs fail, and you cannot replace the PAL bulb say with the MAC one as the latter is used in the switch biasing arrangement for the PAL bulb – see Fig. 1. LED3 is on for PAL operation because Q4, which is biased on by LED4 (the MAC bulb), R137 and R20, links its cathode to chassis. For MAC operation the CITAC chip switches Q5 on with the result that LED4 glows and Q4/LED3 switch off. Thus both bulbs must be intact for LED3 to come on. Interesting that instead of holders blobs of silicone rubber are used to support the bulbs!

Dry-joints on R149 in one of the 12V feeds to the u.h.f. modulator have been the cause of splashing.

Access for service is achieved by removing the five case screws and pulling off the top cover, thus allowing the Perspex front to fall off. Depending on the version, the PCB will be held in by screws or plastic clamps. As well as the ones through the board there are two plastic clamps to hold each scart socket. Fig. 2 shows the action of these clamps.

RIP

The deaths of several prominent people in our industry have recently been announced. Max Grundig died at Baden Baden on December 7th, aged 81. He founded Grundig in 1945, concentrating initially on radio sets in kit form in order to get round regulations imposed by the allies. The kits were a runaway success and started the rapid growth of Grundig to become West German's largest consumer electronics company. Grundig ran into difficulties when competition from the Far East intensified, and in 1984 Philips took control of the company.

Harold J. Leak, founder of one of the best known post-war UK hi-fi firms, has died in the Channel Islands aged 82. His famous Point One amplifier, introduced in 1949, was claimed to be the first commercial amplifier with a total distortion figure of less than 0·1 per cent.

M.G. Scroggie, B.Sc., M.I.E.E., who wrote numerous well-known books including *Television* in 1935 and *Foundations of Wireless* in 1936, and continued until recently to write for *Electronics and Wireless World* under the pen-name Cathode Ray, has died aged 87.

More on the Ferguson ICC5 Chassis

J. LeJeune

My article in the July issue of *Television* provided a conducted tour of Ferguson's top-of-the-range ICC5 chassis. We subsequently received requests for further information on some of the less usual circuitry. So here goes.

Video Circuitry

One area that calls for a more detailed look is the colour decoding and RGB output circuitry. Decoding and video signal processing are carried out by two chips, the AN5620X PAL decoder IV01 and the HA11498 processor IV21.

The PAL Decoder

Fig. 1 shows a block diagram of the PAL decoder chip IV01 which receives the chroma input at pin 1 and provides demodulated R - Y and B - Y outputs at pins 10 and 11 respectively. Prior to entering at pin 1, the video signal is filtered to attenuate frequencies below 3.5MHz. The initial amplifier is provided with automatic chrominance level control to ensure that a constant level of signal is fed to the chroma delay line and the rest of the chip. A.C.C. bias is obtained by peak rectification of the 7.8kHz PAL ident signal that's present at the output of the burst phase detector. This signal is directly proportional to the burst signal which is held at a constant level at the transmitter. The a.c.c. system is capable of maintaining a 600mV peak-to-peak burst signal amplitude at pin 4 despite a 26dB change in the input level.

Undelayed chroma tapped from the slider of PV09

re-enters IV01 at pin 8 while the delayed chroma enters at pin 9, with LV06 providing phase correction. The delayed and undelayed signals are summed prior to application to the two synchronous demodulators, colour-killing being undertaken at this point. The action of the summing circuitry corrects phase errors and also separates the V (weighted R-Y) and U (weighted B-Y) components of the chroma signal. Use of synchronous demodulation ensures maximum separation of the two colour-difference signals.

The undelayed chroma signal is also fed to the burst phase detector which is gated on during the burst period by the uppermost level of the sandcastle pulse. It provides an output to phase lock the voltage-controlled 4-43MHz crystal oscillator whose outputs are, via the phase-shift systems required, used to drive the two synchronous demodulators. A 90° shift is included in the feed to the U demodulator while a switched 0/180° shift is included in the drive to the V demodulator. The PAL switch is reset by the ident signal to ensure correct phase switching on alternate lines. Presence of the burst and ident signals means that the transmission is in colour and is therefore used as the basis of the colour-killing system to prevent coloured noise interference with a monochrome transmission.

All this is standard PAL signal decoding practice of course, but you don't often see it explained nowadays. The R-Y and B-Y outputs are buffered by emitter-followers within the chip and are then applied to external filters to remove unwanted products of the demodulation process. They are then passed to the processing chip IV21. This is where the less usual arrangements are to be found. A detailed block diagram of this chip was

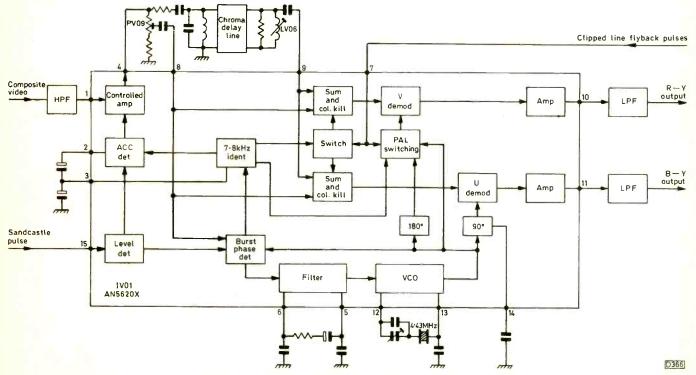


Fig. 1: Block diagram of the AN5620X PAL decoder chip.

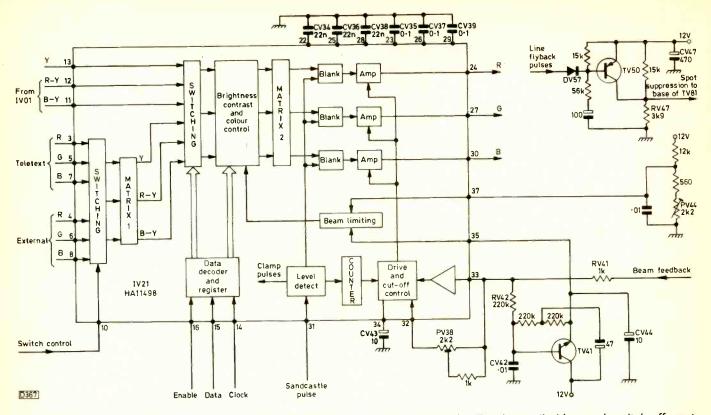


Fig. 2: Simplified block diagram of the HA11498 video signal processing chip. The beam limiting and switch-off spot suppression circuits are also shown. During normal operation TV50 is held cut off by the positive voltage at its base, produced by rectification of line flyback pulses by DV57. At switch off the line pulses cease and the voltage retained by CV47 brings TV50 into conduction: the increased voltage across RV47 then cuts off TV81 (see Fig. 4).

shown in Fig. 3 of the July article. Fig. 2 shows a simplified block diagram to clarify the processing, also the external circuitry associated with the beam limiting and automatic grey-scale correction processes.

Video Processor Chip

IV21 caters for teletext and external RGB signals as well as the luminance signal and the colour-difference outputs from IV01. The RGB inputs have to be converted to luminance/colour-difference form to enable brightness, contrast and colour saturation control to be carried out. This conversion is done by the block marked matrix 1. Matrix 2 converts the signals, from whatever source, back to the RGB form required to drive the tube's cathodes.

Sandcastle Pulse Use

Sandcastle pulses are coupled into IV21 at pin 31. The maximum level of this composite pulse, at about 11V, is used for clamping/gating. The middle section at about 4.5V, derived from a clipped line flyback pulse, is used for line blanking. The lowest level, at 2V, provides field blanking and, as it signals the start of the field flyback, it's also used to reset the internal counter within IV21.

Auto Grey-scale Correction

The counter provides timing for blanking and pulse insertion on lines 17 to 23 inclusive. The c.r.t. drive and cut-off pulses inserted are as follows, see Fig. 3: green white level line 17, red white level line 18, blue white level line 19, beam cut-off line 20, green dark level line 21, red dark level line 22 and blue dark level line 23.

Fig. 4 shows one of the RGB output stages. All three are identical and incorporate two emitter-followers, TV70 and TV71 in this case (blue output stage). The collector currents of TV71/61/51 are monitored by DV75/65/55 respectively. The cathodes of these diodes are linked via the 15V zener diode DV95 to RV95 which acts as a common summing point load. Feedback to pin 33 of IV21 is taken via RV41 (see Fig. 2) from the junction of DV95/RV95.

During lines 17-23 this feedback is sampled in sequence within the chip and compared to an internal reference voltage. The internal switching presents a low sampling impedance during lines 17, 18 and 19, when the drive level applied to each gun is measured in sequence and set for $500\mu A$. This is done by adjusting the charge carried by the drive error-voltage storage capacitors CV34/36/38 (red, green and blue respectively). The charge set in this way adjusts the gain of the relevant drive amplifier.

On line 20 the c.r.t. is blanked off and only leakage current flows. The sampling impedance within IV21 is raised to a high value that allows for sensing of currents in the region of 25μ A. CV43 provides charge storage in this case.

Dark-level pulses are applied to each c.r.t. gun in turn during lines 21-23. The corresponding cathode currents are measured and the resulting voltages are compared with the voltage at pin 34 (across CV43). The differences between these voltages are compared with an internal reference supply, the resultant error voltages being used to adjust the charges carried by CV35/37/39 for red, green and blue respectively. The voltages developed across these capacitors set the d.c. pedestal for each channel.

The ICC5's automatic grey-scale correction system

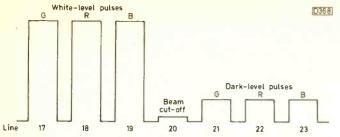


Fig. 3: The drive and cut-off pulses inserted on lines 17-23 for automatic grey-scale correction.

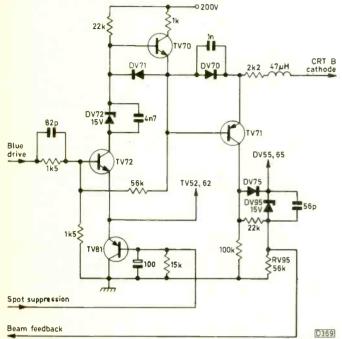


Fig. 4: The blue output stage circuit. Transistor TV81 is common to the three RGB output stages: it provides switch-off spot suppression. The feedback voltage developed across RV95 is used for automatic grey-scale correction during the field blanking period and for beam limiting.

ensures good tracking over the entire brightness range and avoids the need to measure very low c.r.t. gun cutoff currents.

Beam Limiting

The voltage at pin 33 of IV21 is determined by the total beam current at any instant. This voltage is applied via RV42 to the base of TV41, which sets the voltage developed across CV44 at pin 35 of IV21. The voltage at pin 35 is compared with an adjustable voltage that's applied to pin 37. Beam limiting is initiated when the total beam current rises to 70 per cent of the maximum permitted value. Contrast reduction of 50 per cent is employed initially: if this fails to bring about sufficient beam current reduction, the brightness is also reduced. This is done by modifying the d.c. pedestals – the levels of the control pulses on lines 17-19 are raised to bring this about. The time-constant of RV42/CV42 is such that short-term high-current transients are ignored. Thus picture highlights are not affected.

Switch-off Spot Suppression

TV50 is used to suppress the undeflected spot at switch off. It operates in conjunction with TV81 (see Fig. 4) on the c.r.t. base panel. At switch off the charge on

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CV47 keeps TV50 conductive with the result that TV81 switches off, blanking the c.r.t. until its supplies have decayed sufficiently.

The Power Processor Chip

The "power processor" chip IL14 (type TEA2029C) was considered in some detail in the July article. It provides line drive pulses, a field-frequency sawtooth to drive the EW correction circuit, a pulse-width modulated drive for the chopper transistor and drive for the field output thyristor (again pulse-width modulated, for "class D" operation). Soft-start and safety shut-down circuitry are included.

IL14's chopper control action is particularly impor-

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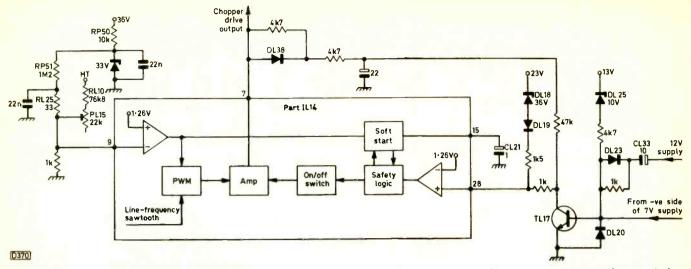


Fig. 5: Block diagram of part of the TEA2029C power processor chip, showing the monitoring arrangements for regulation and for protection against various fault conditions.

tant and deserves some further description. Our experience with the power supply circuitry in the ICC5 chassis has been very good, possibly due to the control arrangements within IL14. These provide comprehensive protection of the receiver and its power supply.

For supply regulation IL14 monitors the h.t. and 36V rails. This monitoring is carried out at pin 9, which is one input to an operational amplifier. Fig. 5 shows this part of the circuit. The other input to the operational amplifier is an internal 1·26V reference. RL10 and PL15 (set h.t.) sample the h.t. line while RP50, RP51 and RL25 provide a link to the 36V rail. The principle reason for monitoring the 36V rail is to prevent excessive modulation of the h.t. supply by the audio module under high drive conditions.

On no account should any attempt be made to measure the voltage at pin 9 when the receiver is in operation. The input impedance at this pin is very high and the application of any kind of meter probe here will cause instant failure of the power unit. If the voltage at pin 9 must be monitored, the use of an oscilloscope

CORRECTION

Satellite TV Filter

In the June issue (page 603) I reviewed the Phantom IFP70 variable i.f. bandpass filter available from Micro-X. I indicated that the filter requires a 12V d.c. supply. In fact the filter requires a 12V a.c. input, which is rectified and stabilised internally. If a 12V d.c. input is provided, the internal l.t. supply will be only 9V, though a 15-16V d.c. input will be o.k. Several commercial d.c. mains units – of the type integrated with a 13A plug – give 16V on the 12V setting. This type of PSU should be suitable, but check the output on load.

My Phantom filter was an early import. Those currently supplied by Micro-X come with an a.c. adaptor that produces 12V a.c. from a 115V input, i.e. US standard. I've tried using this via a 240-115V step-down transformer. This works but after an hour the a.c. adaptor runs hot enough to heat the average living room! Far better I think to run the filter from a 6-0-6V UK transformer that runs cool.

R.B.

should be considered – but switch off the receiver while the connection is being made. Pin 19, which links crystal QL07 to the internal 500kHz voltage-controlled oscillator, is also sensitive. Use of a meter probe here could stop the oscillator, the result being destruction of the chopper transistor TP24.

The operational amplifier's output is a voltage that moves in the opposite direction to any variation in the supply rail voltages. This voltage is used to set the switching point of the pulse-width modulator, whose second input is a line-frequency sawtooth.

Soft Start

The soft-start circuit holds the operational amplifier's output high at switch on. By discharging CL21 it allows the operational amplifier's output voltage to fall gently to normal, thus bringing up the power gradually.

Protection Arrangements

Protection is provided by monitoring the conditions at pin 28 of the chip. Once again an operational amplifier is used, and this time three separate sources are monitored. During normal operation of the receiver transistor TL17 is conductive with the result that pin 28 is held at approximately 0V. Excess current in the 7V supply or a downswing in the line-flyback derived 12V supply (the latter is a.c. coupled to TL17's base) will result in TL17 turning off. The voltage at pin 28 of the chip will thus rise to about 6V. The third source, the 23V supply used by the field output stage, is monitored via the 36V zener diode DL18 (in the event of field drive failure the 23V rail can rise to 200V).

When the voltage at pin 28 rises above 1.26V a signal is sent to the safety logic system which inhibits the line, field and chopper drive outputs. An internal counter is activated, allowing three cyles of trip and soft-start before all drives are finally shut down. At this stage the voltage at pin 15 of the chip will be about 1.4V. To restart the receiver, you have to switch it off at the mains then back on again, thus resetting the internal logic.

As we saw in the July article, protection against excess chopper transistor current is built into the chopper circuit itself. The standby system and the vital role of the 5V supply were also described.

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1 N5404 1N5408 1N914	0.10 0.15 0.04	2SC2009 2SC2029 2SC2028	0.34 2.33 2.11	AN340P AN355 AN362	1.53 2.95 1.50	BC328 BC337 BC338	0.11 0.09 0.12 0.19	BF177 BF178 BF179 BF180	0.55 0.40 0.36 0.36	BU508 BU705 BU806 BU807	1.85 2.50 1.83 1.40	HA1406 HA1452 HD14538 HD38702 A2	2.07 0.85 2.07 7.95	ME8001 ME0411 MJ2501 MJ3001	0.34 0.75 3.30 1.43	SKE2F1/04 SKE2G3/04 SKE4F1/06 SKE4F2/08	0.85 0.30 1.07	T9011V T9013V T9014V T9016	1.40 4.95 2.42 1.02	TD3F800R TD3F900H TDA1001B TDA1003A	4.78 5.36 2.31 3.16	TIC106M TIC44 TIC45 TIC47	0.77 0.72 0.55 0.77
1S1555 1S44 1S921 2N2219A	0.31 0.10 0.10 0.37	2SC2063 2SC2078 2SC2073 2SC2085-0	0.99 3.39 1.54 1.65	AN370 AN5111 AN5120N AN5132	3.95 3.43 4.50 4.42	BC368 BC440 BC441 BC454	0.69 0.46 0.36	BF181 BF182 BF183	0.32 0.34 0.39	BU826A BUW84 BUX84	1.95 0.66 0.50	HD38750A53 HD38750A-7 HD38800A50	5.77 7.25 14.09	MJ481 MJE2955 MJE3055	1.53 3.30 1.25	SKE4F2/06 SKE4F2/10 SKE4G2/02	0.80 1.33 0.96	T9019W T9034V T9035V	1.98 1.45 6.65 7.70	TDA 1005A TDA 1006A TDA 1010AF	7.00 4.25	TIP120 TIP110 TIP112	1.55 0.35 0.45
2N3053 2N3054 2N3055	0.35 0.99 0.66	2SC2091 2SC2141 2SC2166	1.30 2.44 0.87	AN5250 AN5610 AN5612	4.40 7,43 2,20	BC460 BC461 BC462 BC463	0.42 0.47 0.51 0.30	BF184 BF185 BF194 BF195	0.43 0.39 0.14 0.14	BUX85 BY126 BY127 BY133	0.69 0.13 0.13 0.10	HD44801A05 HISH1010 HISH1004 HISH1002	12.50 14.60 6.00 9.50	MJE520 MJE520 ML231 ML2328	0.49 0.49 0.99 3.01	SKE5F3/10 SKS1/10 SL1310 SL1430T	1.36 2.15 3.14 2.31	T9051 T9054V T9057V T9062V	6.43 2.77 0.49	TDA1011 TDA1010 TDA1011A TDA1028	1.14 1.05 1.51 2.45	TIP117 TIP121 TIP126 TIP132	0.95 0.40 0.38 0.99
2N3442 2N3702 2N3703 2N3705	1.16 0.14 0.18 0.16	2SC2216 2SC2233 2SC2236 2SC2278	0.68 1.20 1.69 1.14	AN5613 AN5630 AN5701N AN6250	4.20 3.95 1.66 1.75	BC478 BC479 BC532	0.32 0.41 0.28	BF196 BF197 BF198	0.17 0.24 0.17	BY164 BY176 BY179	0.44 0.52 1.42	HM6231 HM6232 HM6251	9.50 7.20 5.69	ML237B ML238 ML923	1.95 5.77 3.10	SL414 SL432A SL439	3.69 3.44 2.48	T9064 TA7027 TA7050	4.20 4.80 1.74 1.74	TDA1034B TDA1035S TDA1035T	2.42 2.95 1.85	TIP137 TIP29 TIP2955	0.96 0.84 0.86
2N3706 2N3707 2N3711	0.14 0.16 0.11	2SC2314 2SC2335+Kit 2SC2551	0.87 7.00 1.26	AN6300 AN6310 AN6340	4.40 4.54 6.46	BC546 BC547 BC548	0.17 0.10 0.10	BF199 BF200 BF218 BF224	0.17 0.37 0.36 0.17	BY182 BY187 BY189 BY198	1.05 0.77 1.76 1.62	HM7103 HM9032 HM9012 HM9015	4.85 4.00 3.22 3.24	ML926 MM5314N MM5316N MM5318N	3.58 8.99 3.50 3.11	SL471 SL480 SL490 SL901B	2.13 3.14 2.37 8.32	TA7051 TA7054 TA7060AP TA7061AP	2.55 0.71 1.27	TDA1037 TDA1037D TDA1044 TDA1047	1.60 2.05 2.10 3.25	TIP29A TIP29B TIP29C TIP29D	0.46 0.63 0.40 0.75
2N3771 2N3772 2N3773 2N3819	1.56 1.55 1.95 0.40	2SC2565 2SC2570 2SC2577 2SC2578	3.84 0.80 1.60 6.75	AN6341 AN6363 AN6531 AN6551	2.22 16.00 1.95 0.50	BC549 BC550 BC556 BC557	0.10 0.10 0.11 0.10	BF237 BF240 BF241	0.65 0.19 0.17	BY207 BY208 BY210-400	0.22 1.15 0.18	HT4207 HT4208 KA2101	13.25 20.65 1.00	MM5369N MM5387AA/N MM5841N	2.01 6.20 6.64	SL918A SN16861AN0 SN16862AN	9.07 0.82 2.98	TA7069 TA7070P TA7072P	3.13 1.83 2.57	TDA1059B TDA1054M TDA1060	0.80 1.21 2.60	T1P3055 T1P30A T1P30C	0.66 0.41 0.40
2N3823 2N3904 2N3908	1.17 0.15 0.62	2SC2671 2SC288A 2SC3153	0.91 1.85 6.50	AN6552 AN6610 AN7111	0.68 1.63 1.25	BC558 BC559 BC560C	0.10 0.10 0.14	BF245 BF245B BF246A	0.50 0.49 2.52	BY210-600 BY210-800 BY223	0.31 0.19 1.25	KC581C KC582C L200CV	7.75 4.85 1.69	MN1409VL MN1405 MN1435VX	13.65 7.92 9.50	SN16966N SN29717N SN29716N SN29715N	7.19 3.66 6.04	TA7074P TA7076P TA7089P TA7092P	7.50 3.10 9.94	TDA1082 TDA1151 TDA1190 TDA1190Z	3.25 0.95 1.27 2.48	TIP31A TIP31B TIP31C TIP32A	0.34 0.38 0.30 0.35
2N4101 2N4240 2N4444	1.33 1.95 1.66	2SC372 2SC373 2SC383	1.40 1.16 1.33	AN7115 AN7145 AN7146 AN7151	2.52 2.80 9.90 2.37	BC635 BC636 BC637 BC639	0.34 0.20 0.24 0.15	BF255 BF256 BF257 BF258	0.20 0.28 0.34 0.33	BY224-600 BY226 BY227 BY228	2.60 0.15 0.20 0.60	LA1201 LA1210 LA1230 LA1320	0.75 1.56 1.18 2.87	MP1192 MP2794 MP2812 MP8512	5.07 4.00 5.07 1.57	SN29722 SN29723AN SN29764AN	11.95 8.77 2.60	TA7093P TA7102P TA7108P	3.99 5.88 1.61	TDA1200 TDA1235 TDA1236	1.51 3.80 4.30	T1P32B T1P32C T1P33	0.46 0.28 0.85
2N5293 2N5294 2N5296 2N5297	0.50 0.50 0.50 0.50	2SC388 2SC394V 2SC403C 2SC458	1.27 0.81 0.60 0.34	AN7156 AN7158 AN7218	2.85 2.10 0.80	BC640 BCX34 BD115	0.24 0.55 0.36	8F259 8F262 BF263	0.34 0.57 0.57	BY229-1000 BY229-600 BY255	1.12 1.20 0.13	LA1357N LA1363 LA1364	9.00 1.05 3.02	MPC596 MPF256C MPS6570	2.13 0.60 0.48	SN29767 SN29770BN SN29772BN	3.90 3.69 5.75	TA7109 TA7122B/P TA7124P	3.71 0.87 2.34	TDA1270 TDA1327A TDA1412	3,74 6.93 1.08	TIP33A TIP33C TIP34	1.02 0.95 0.75
2N5298 2N6109 2N6130	0.81 1.58 0.85	2SC495 2SC515A 2SC535	0.92 1.85 0.79	AN7223 AU107 AU110	4.55 6.77 5.69	BD116 BD124 BD131	0.70 1.31 0.42	BF271 BF273 BF274	0.34 0.20 0.20	BY295-600 BY298 BY299 BY407	1.23 0.20 0.60 0.90	LA1365J LA1385 LA1387 LA3350	1.45 1.53 5.95 1.43	MPSA42 MPSA56 MPSA92 MPSU05	0.15 0.08 0.30 0.86	SN29771BN SN29791 SN29798N SN2709	5.59 1.67 5.56 0.44	TA7129P TA7130P TA7136AP TA7137P	1.90 1.27 1.89 0.58	TDA1420 TDA1440 TDA1470 TDA1470P	1.52 3.45 2.90 4.25	TIP41A TIP41B TIP41C TIP42A	0.36 0.31 0.60 0.39
2N6133 2N6180 2N6292	1.25 0.73 1.60	2SC536 2SC537 2SC605L 2SC620	0.06 0.54 1.16 1.46	AU113 AY105K AY106 BA524	14.63 2.08 2.80 8.94	BD133 BD135 BD136	0.42 0.53 0.36 0.36	BF324 BF336 BF337 BF338	0.23 0.33 0.31 0.40	BY409 BY448 BY713	1.49 1.40 1.12	LA3361 LA3390 LA4032P	1.60 5.52 2.35	MPSU10 MPSU56 MPSU60	1.70 0.60 1.33	SN7400N SN7401N SN7402N	0.61 0.36 0.65	TA7141AP TA7146P TA7148P	3.87 7.83 1.67	TDA1506 TDA1510 TDA1512	5.74 4.60 2.89	TIP42B TIP42C TIP47	0.79 0.50 0.65
2SA1006 2SA1011 2SA1015 2SA1012	1.50 1.65 0.20 1.25	2SC643A 2SC668 2SC6681	1.54 0.67 4.40	BA310 BA1310 BA1320	0.14 1.50 1.38	BD137 BD138 BD139	0.41 0.28 0.24	BF355 BF362 BF363	0.48 0.60 0.50	BYX55-600 BYX71-600	0.14 0.23 0.85	LA4100 LA4101 LA4102	1.25 1.30 0.75	MR818 MR854 MR914	0.33 0.50 1.20	SN7404N SN7408N SN7410N	0.52 0.27 0.27	TA7149P TA7152P TA7161P TA7162P	3.26 2.98 4.50 3.61	TDA1515 TDA1559 TDA1670 TDA1770	2.55 3.15 4.48 2.88	TIS43 TIS90 TL011CP TL494CN	1.43 0.21 1.65 8.77
2SA1020Y 2SA1027R 2SA473	0.80 0.45 0.75	2SC682 2SC684 2SC693	1.65 0.63	BA1322 BA1330 BA145	3.95 2.75 0.19 0.25	8D140 8D144 8D150 BD157	0.35 1.43 0.75 0.67	BF371 BF391 BF417 BF418	0.50 0.25 0.84 1.87	BYX71-350 BYY56 BZY93C30 C106D	0.88 1.48 1.86 0.37	LA4112 LA4125 LA4138 LA4140	0.86 2.25 4.98 0.70	MSM5816RS MSM5840H MVS460-02 NF542	17.35 14.45 0.34 2.75	SN74121 SN7413N SN74141N SN74151AN	1.60 0.37 2.65 1.51	TA7172P TA7176P TA7193P	1.41 1.75 4.80	TDA1905 TDA1908 TDA1940	1,27 2,55 5,20	TL072CP TMP4320 TMS1024NLL	1.45 15.00 6.50
2SA766S 2SC1173Y 2SC1474 2SC1509	4.95 1.25 1.25 1.35	2SC710 2SC711A 2SC717 2SC734	1.15 0.50 1.28 1.43	BA148 BA154 BA155 BA156	0.40 0.12 0.05	BD160 BD163 BD166	1.60 0.71 0.69	BF422 BF423 BF450	0.18 0.33 0.35	C106M CA3046 CA3089	0.76 1.55 0.83	LA4192 LA4220 LA4420	1.50 1.25 1.72	NE555 NE566 NP1106	0.19 0.65 11.51	SN74154N SN74190 SN7420N	1.27 1.35 0.34	TA7204P TA7206P TA7207P TA7208P	1.95 12.49 1.40	TDA1950 TDA2005 TDA2006	2.50 1.30 1.35	TMS1025N TMS3720ANS TMS3748NS	11.95 S 5.25 17.70
2SA1095 2SA1103 2SA329	3.00 6.00 0.40	2SC783 2SC790Y 2SC828	3.90 1.85 0.20	BA159 BA182 BA222	0.09 0.19 1.66	BD175 BD179 BD181 BD182	0.28 0.30 0.99 0.99	BF451 BF457 BF458 BF459	0.29 0.41 0.49 0.26	CA3090A0 CA3094 CA3131EM CD4001	3.25 2.20 2.95 0.24	LA4422 LA4430 LA4440 LA4445	1.00 2.88 2.50 1.80	0A202 0A47 0A91 DA95	0.11 0.16 0.14 0.09	SN7430 SN7440N SN7472 SN7474N	0.49 0.27 1.54 0.44	TA7210P TA7214P TA7215P	2.15 1.45 3.63 2.58	TDA2004 TDA2002 TDA2003 TDA2030	0.99 0.90 1.00 1.05	TMS3755 TMS3894NL TMS5102NLL TUA2000	13.65 19.25 6.25 8.90
2SA489 2SA490 2SA493 2SA567	1.17 1.32 2.25 0.57	2SC867A 2SC876 2SC930 2SC935	3.04 0.96 0.54 4.13	BA302 BA311 BA312 BA313	1.24 0.65 1.45 0.76	BD183 BD184 BD187	0.99 1.21 0.80	BF460 BF469 BF470	1.63 0.33 0.26	CD4002 CD4008 CD4011	0.27 1.35 0.20	LA4460 LA4461 LA5112N	1.50 1.60 1.18	0C28 DC29 0C36	2.52 2.15 7.53	SN7490AN SN74LS26N SN76001N	0.75 1.45 1.65	TA7217AP TA7222 TA7226	1.45 1.95 3.57	TDA2140 TDA2150 TDA2151	2.14 6.20 1.30	TY6010B ULN2204 UPA53C	2.97 8.50 4.94
2SA564 2SA614 2SA628	0.62 4.80 0.37	2SC940 2SD1128 2SD1138	4.68 2.90 0.94	BA317 BA318 BA328	0.04 0.09 1.85	BD189 BD190 BD201	0.55 0.55 0.49 0.60	BF471 BF472 BF479 BF480	0.25 0.33 0.61 0.89	CD4012 CD4013 CD4016 CO4017	0.24 0.33 0.25 0.40	LA7020 LA7025 LA7027 LA7040	13.86 11.97 10.92 9.20	0C44 0C45 0C72 0C75	1.95 0.18 0.44 0.44	SN76013ND SN76023N SN76023ND SN76033N	3.50 2.97 3.91 5.54	TA7229P TA7230P TA7233P TA7240AP	4.66 1.35 3.61 2.55	TDA2160 TDA2161 TDA2170 TDA2270	4.01 5.11 4.75 2.50	UPC1003 UPC1009C UPC1025H UPC1028H	5.95 6.32 2.90 2.00
2SA639S 2SA659 2SA673 2SA684	1.75 0.49 1.50 1.20	2SD1273 2SD1453 2SD152K 2SD198	1.48 1.33 2.64 3.87	BA333 BA335 BA5102A BA511	1.37 6.27 2.15 1.95	BD202 BD203 BD204 BD207	0.46 0.41 1.73	BF491 BF506 BF532	0.50 0.43 0.24	CD4020 CD4021 CD4023	0.75 0.39 0.28	LA7042 LA7800 LA7801	3.90 1.30 3.21	DN236 ON 782 OT 121	1.06 1.65 1.45	SN76110N SN76115AN SN76131	0.90 1.61 0.82	TA7245P TA7310P TA7313AP	1.95 2.15 0.65	TDA2520 TDA2522 TDA2524	2.25 11.20 4.50	UPC1032H UPC1042C UPC1156H	0.82 8.95 3.94
2SA697 2SA699 2SA715	0.80 1.25 4.95	2SD234 2SD235 2SD24	0.47 0.60 2.29	BA514 BA521 BA524	1.00 1.20 8.94	BD208 BD222 BD225	1.23 0.45 0.46	BF596 BF597 BF694	0.18 0.27 0.22	CD4025 CD4028 CD4040B	0.64 0.84 0.45 1.06	LB1274 LC7800 LD3120 LD3150	3,61 9,20 1,13 2,75	PT6042 PT8504 R1038 R1039	3.25 5.13 2.19 2.19	SN76227N SN76226DN SN76228N SN76242	2.45 2.90 3.27 5.23	TA7314 TA7323P TA7325P TA7339P	3.50 3.15 1.15 1.85	TDA2525 TDA2532 TDA2530 TDA2541	5.50 2.50 2,20 1.00	UPC1161C UPC1182H UPC1186H UPC1181H	4.98 2.06 1.05 1.35
2SA748 2SA817 2SA835 2SA836	1.95 0.18 2.50 0.89	2SD257 2SD292 2SD313 2SD325D	1.98 4.09 2.92 2.26	BA526 BA527 BA532 BA536	7.98 2.98 1.20 0.99	BD228 BD229 BD232 BD234	0.63 1.05 0.49 0.42	BF757 BF759 BF761 BF762	0.59 0.47 1.05 0.34	CD4047 CD4049 CD4052 CD4066	0.24 0.33 0.23	LM1017N LM1877 LM2808	1.81 2.95 5.94	R2008B R2009 R2010B	1.33 1.98 2.98	SN76243 SN76396 SN76533N	5.23 2.90 2.47	TA7340P TA7607AP TA7609	5.95 1.30 2.35	TDA2540 TDA2545Q TDA2560	1.95 5.94 2.50	UPC1185H UPC1188 UPC1212C	2.10 8.77 0.80
2SA844 2SA872 2SA884	0.65 0.59 2.15	2SD350 2SD353 2SD389	3.05 7.50 2.41	BA6209 BA656 BA7100	3.21 1.00 11.35	BD237 BD238 BD239 BD240	0.36 0.28 0.45 0.57	BF869 BF870 BF959	0.49 0.30 0.42	CD4069 CD4070 CD4081	0.29 0.25 0.14	LM2877 LM317CKC LM324N	7.45 1.08 0.98	R2029 R2030 R2257	1.33 1.33 2.35	SN76532N SN76545 SN76546N SN76549	0.91 4.87 3.47 2.45	TA7611AP TA7616P TA7622AP TA7628P	2.32 5.25 8.94 1.40	TDA2575A TDA2578A TDA2576A+ TDA2581	0.50 2.95 Kit 12.35 1.60	UPC1225H UPC1230 UPC1238 UPC1278H	2.55 1.88 2.10 5.95
2SA937R 2SA940 2SA940-2	0.97 2.23 2.14	2SD401 2SD414 2SD471	1.40 1.98 2.13 2.95	BA841A BA843 BA854 BAV18	28.98 3.96 5.76 0.06	BD241 BD242 BD243A BD243C	0.39 0.50 0.39 0.50	BF960 BF970 BFR39 BFR61	0.59 0.50 0.44 0.92	CD4093 CD4511 CD4528 CD4556	0.40 1,10 0.37 1.47	LM339N LM340K LM348N LM380N	0.41 11.85 2.15 1.50	R2265 R2305 R2322 R2323	1.49 1.18 0.67 0.76	SN76570 SN76611 SN76620	3.08 2.59 2.59	TA7629P TA7630P TA7640AP	7.50 0.95 2.40	TDA2582 TDA2591 TDA2594	1.35 2.15 3.40	UPC1351C UPC1350C UPC1353	1.81 1.40 1.63
2SA950 2SA951 2SA966-Y 2SA999	0.72 1.75 0.85 0.75	2S0566 2SD600 2SD601R 2SD613	2.98 0.65 1.03	BAV19 BAV20 BAV21	0.11 0.36 0.12	BD244C BD245C	0.42 0.72 0.75	BFR62 BFR79 BFR81	0.50 0.29 0.29	CR02AM-8 CV12E CX095D	1.70 4.62 3.14	LM567CN LM6402/011 LM6402A093	1.71 10.23 10.15	R2354A R2354B R2443	0.64 2.01 1.36	SN76660N SN76666N SN76708	2.48 1.20 4.86	TA7672P TA7676P TA7726P TAA320A	2.75 2.81 10.25 1.27	TDA2593 TDA2595 TDA2600	3.40 3.84 7.00 2.80	UPC1355C UPC1363 UPC1362	2.13 4.20 1.80
2SB1774 2SB185 2SB375	0.65 1.13 3.67	2SD636 2SD639-R 2SD655	0.40 0.72 0.98	BAW62 BAX12 BAX13	0.11 0.49 0.11 0.00	BD246C BD253 BD278A BD317	0.85 1.05 0.70 1.20	BFR86 BFR89 BFR90A BFX29	1.08 1.63 0.85 0.34	CX104 CX108 CX109 CX130	8.77 12.48 7.20 8.76	LM748 LM8360 LM8361 LR3419	0.69 3.87 2.95 9.37	R2461 R2540 R2540X R2615	1.50 1.91 3.30 0.67	SN76709N SN76707N SN76705N SN76730	9.63 1.23 2.97 5.54	TAA350A TAA570 TAA621AX1	0.89 1.85	TDA2611A0 TDA26120 TDA2611A TDA2610	4.68 1.25 2.79	UPC1365C UPC1366 UPC1360C UPC1378H	2.59 1.65 4.51 1.95
2SB400 2SB405 2SB511 2SB54	0.40 1.03 2.65 1.39	2SD657 2SD661A 2SD731 2SD773	2.80 0.80 2.11 0.60	BAX16 BC107B BC108B BC189B	0.11 0.15 0.14	B0318 BD375 BD380 BD410	2.72 0.42 0.76 0.49	BFX84 BFX85 BFX86	0.37 0.31 0.36	CX134 CX136 CX139	4.50 11.49 11.83	LR3471 LU1141 LU52012	9.37 7.27 5.95	RCA2060 RGP01-15 RGP10	2.00 0.70 0.23	SN76810N SN76832N SN94041	0.60 1.35 5.54	TAA661B TAA691 TAA700	0.95 8.58 2.37 4.87	TDA2620 TDA2630 TDA2631	1.96 2.50 2.73	UPC141C UPC1458 UPC151C	4.95 2.00 2.95
2SB546 2SB56 2SB618A	0.56 2.80 7.22	2SD811 2SD823 2SD837	7.63 1.98 1.48	BC113 BC119 BC126	0.14 0.36 0.20	BD433 BD434 BD435 BD436	0.44 0.45 0.49 0.74	BFX87 BFX88 BFX89 BFY50	0.55 0.34 0.44 0.30	CX157 CX158 CX177 CX187	5.52 10.45 8.80 5.26	LU52011 LU03112 M193 M21C	14.95 12.37 6.83 1.10	RGP30M RT402 RT905A S1299	0.28 1.58 3.28 5.34	SN94042 SPS5384 ST1702L STA401	4.35 1.98 0.99 2.49	TAA930 TAA970 TAG626-600 TBA120AS	2.83 0 1.20	TDA2653	3.80 9.62 3.16 4.73	UPC2002 UPC30C UPC324C UPC32C	1.48 2.51 4.70 4.95
2SB631 2SB643 2SB669 2SB681	2.00 0.50 3.67 3.96	2SD857Q	1.75 1.00 1.84 1.15	8C132 8C135 8C137 BC138	0.14 0.14 0.18 0.34	BD437 BD438 BD441 BD442	0.45 0.52 0.59 0.50	BFY51 BFY52 BFY79 BFY90	0.33 0.27 0.49 0.42	CX755 CX885A E1222	12.95 6.85 0.40	M23C M293 M51102L	1.98 6.71 2.77	\$28000 \$2802 \$2818 \$3702\$	1.50 2.90 4.05 5.21	STA441C STA471C STK0029	3.10 8.70 9.55	TBA120SB TBA120T TBA120U	0.40 1.75 2.50	T0A2670 TDA2680 TDA2740	2.48 3.20 10.14	UPC339C UPC41C UPC4558C	4.35 2.99 1.24
2SB695 2SB774 2SB819	1.90 0.65 1.13	2SD894 2SD898 2SK105H	1.75 0.82 2.15	BC139 BC140 BC141	0.33 0.30 0.20	BD509 BD510 BD519	1.64 0.75 0.98 0.94	BLY49 BR100 BR101 BR103	2.20 0.23 0.78 0.66	E5024 E5386 GD243 GF758	0.28 9.25 1.95 8.84	M5115P M51203L M51231P	5.24 3.15 0.95 4.13	\$40W \$6080B \$A8063	13.10 9.98 5.17 1.85	STK016 STK022	7.85 6.91 8.95 12.95	TBA120A TBA1440 TBA1441 TBA395	1.05 1.94 1.95 1.10		0.84 2.78 1.81 13.25	UPC474 UPC554C UPC575C2 UPC580C	5.11 1.85 1.55 6.60
2SC1096 2SC1104 2SC1106 2SC1114	1.16 3.90 4.54 3.25	7808 7812-T022	0.63 0.45 0.35 0.64	BC142 BC143 BC147 BC1488	0.37 0.34 0.14 0.13	B0529 B0530 B0533 B0534	0.99 0.67 0.52	8R303 BRC84 BRX44 BRX49	1.15 2.08 0.60 0.34	HA11215 HA11211 HA11225 HA11229	1.75 2.53 4.29 3.46	M5134-9341 M51353P M51381P M51393AP	5.25 5.98 4.50	SAA1020 SAA1025 SAA1024 SAA1075	4.76 4.40 2.50 4.25	STK040 STK054 STK058	13.34 9.35 27.50	TBA400 TBA4400	1.20 2.39 2.34	TDA33008 TDA3330 TDA3506	5.98 3.26 4.40	UPC587C2 UPC592H UPC595 UPC596	1.34 2.15 2.95
2SC1116 2SC1124 2SC1129 2SC1131	4.95 1.25 1.85 8.64	7905 AD140 AD143	0.80 1.06 1.93	BC148C BC149B BC153	0.11 0.13 0.14	BD535 BD536 BD537 BD538	0.45 0.50 0.50 0.67	BRY39 BSS38 BSTBD1400	0.65 0.67 4.93	HA11235 HA11124 HA1125	1.95 5.25 4.29	M51394P M5142P M5144P	14.50 6.85 4.27	SAA1121 SAA1124 SAA1130	7.44 2.60 6.69	STK1039 STK2110	9.28 5.75 7.33 16.95	TBA480Q TBA510 TBA520 TBA530	1.30 1.37 1.20 1.30	TDA3500 TDA3510	5.50 4.25 5.95 9.71	UPD1514C UPD2819C UPD553-164 UPD8049C-1	1,58 4,76 4,58 19,52 11,58
2SC1158 2SC1162 2SC1172 2SC1175	3.33 0.55 2.22 6.09	AD161 AD162 AE114	1.60 0.64 0.45 2.47	BC154 BC159 BC160 BC161	0.14 0.16 0.40 0.28	BD544B BD677 BD679 BD680	0.75 0.33 0.57 0.52	BSTC0246 BSTC0233 BSTC00143 BSTD1043	5.99 6.12 3.07 2.85	HA1137W HA1138 HA11414 HA1156	1.36 3.75 4.20 1.16	M51513L M51515BL M51517L M5192	2.55 2.75 2.90 3.13	SAA1250 SAA1251 SAA1351	7,77 3.95 3.20 8.11	STK2240 STK2250 STK3042	16.65 18.95 5.63	TBA540 TBA560C TBA570Q	1,72 1.40 1,60	TDA3540 TDA3541 TDA3560	2.20 2.22 5.83	X0022CE X0029CE X0031CE X0035TA	5.75 7.09 6.32 6.18
2SC1213 2SC1226 2SC1293 2SC1306	0.89 1.46 9.90 1.90	AF115 AF118 AF127	0.90 1.20 1.00	BC168 BC169C BC170 BC171	0.36 0.16 0.16 0.11	BD681 BD696 BD699 BD700	1.48 2.47 1.85 3.70	BSV57B BSW68 BSX19 BSX20	3.91 0.60 0.34 0.19	HA1160 HA1166X HA1167 HA11706	5.79 6.60 6.60 3.61	M5194AP M5231L M53274P	5.74 1.50 1.33	SAA5000 SAA5010 SAA5012	2.71 3.25 3.50 5.50	STK4019 STK433 STK4332	5.75 9.29 4.78 4.75	TBA570A TBA673 TBA700 TBA720	1.71 2.60 1.85 2.95	TDA3576 TDA3590	3.63 7.48 6.79 6.45	X0040TA X0042CE X0043CE	4.50 4.35 2.75 6.25
2SC1317 2SC1364 2SC1383	0.50 0.49 1.20	AF139 AF178 AF179	0.40 1.45 0.55 8.55	BC172B BC173 BC174B BC177	0.27 0.17 0.27 0.35	B0707 B0709 BD710 B0809	0.60 0.80 0.80 0.45	BSY52 BSY79 BT108 BT119	0.50 0.51 1.45 1.76	HA11705 HA11703 HA11701 HA11710	8.00 3.45 3.57 3.45	M54532P M54544L M58478P M58485P	1.50 2.97 6.75 14.05	SAA5020 SAA5030 SAA5050 SAB1009B	5.78 6.33 4.90 5.98	STK435 STK4352 STK436 STK437	7.12 1.95 5.95 6.50	TBA730 TBA7500 TBA760	3.55 2.50 1.71	TDA3652 TDA3651A0 TDA3651	2.45	X0057GE X0065CE X0074GE	6.00 5.77 15.29
2SC1391 2SC1398 2SC1413A 2SC1446	2.45 0.59 2.10 1.25	AF181 AF186 AF239	0.53 0.53 0.53	BC178 BC179 BC182	0.26 0.26 0.09 0.14	BD819 BD879 BD895 BD901	0.57 0.74 2.18 0.55	BT120 BT121 BT123 BT151-800F	2.17 2.48 1.98	HA11713 HA11711 HA11715 HA11714	2.90 3.10 9.99 7.76	MA06 MA8001 MA8003 MB3705	1.07 0.82 1.16 1.98	SAB3011 SAB3013 SAB3021	7.34 4.37 3.95 6.36	STK4372 STK460 STK466	13.13 8.74 10.10 9.52	TBA810S TBA810T	1.00 1.61 1.75	TDA3651A TDA3950 TDA4050B TDA4280	2.50 4.50 3.40 7.20	X0079CE X0092CE X0096CE	14.60 4.95 4.95 6.20
2SC1447 2SC1475 2SC1506 2SC1514	2.07 0.60 1.00 1.37	AN115 AN155 AN206	0.88 3.90 1.89 2.58	BC184 BC184LB	0.09 0.13 0.26	BD902 BDW83C BDW84C BDX32	0.55 0.56 0.99 6.99	BTT6018 BU106 BU108 BU109	2.42 2.48 1.50 2.25	HA11716 HA11725 HA11725M	13.10 18.26	MB3712 MB3713 MB3730	1.85 1.69 1.75 3.86	SAB3209 SAB3210 SAF1032P	5.82 3.21 3.58 1.95	STK501 STK502	6.32 7.25 11.50 3.20	TBA820M TBA820M TBA890 TBA920	0.66 0.63 3.30 1.63	TDA4400 TDA4420 TDA4420	1.95 4.90 2.30 8.32	X0109CE X0113CE X0195CE X0204CE	9.48 9.60 8.74
2SC1573Q 2SC1583 2SC1617	1.63 0.34 3.89	AN210 AN211	1.55 2.28 3.25	BC187 BC204	0.25 0.28 0.35	BDX53A BDX53B	4.93 3.35	BU110 BU125	5.69 2.48	HA11781 HA1180	21.15 5.15	MC1310P	1.95 1.33	SAS5010 SAS560S	8.35 1.91	STK7216 STK772	14.90 3.71	TBA940 TBA950	1.87 1.55	TDA4427S TDA4431	9.00	X0261CE ZPY120	3.25

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JVC (see also Ferguson) Machine Nos.: HP4000 HR2200 HR3	300 HR3320 HR3330 HR3350		SONY Head Part Nos.: A676 Machine No.: SL3000	62 044A, 044B, 05	4A, 147A	7MF	BETA A	01X0 082 001 01X0 083 063 PHILIPS	£46.02 £66.03
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MITSUBISHI Machine No.: HS200 HS700 HS303 HS304		VHS A VH700	Machine No.: SLC20, SLF1, F30, HF72, T20 Please see next col.), 130	44		BETA W	691 201 66 691 201 78 691 202 87	£61.93 £49.96 £55.37
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SHARP

VID36 VID37

RMOTP1029 RMOTV1008 NIDL0006 NIDL0005 NIDL0004 Capston motor 73/9300 Reel motor VC9700 Idler VC387H etc VID29 VID30 VID31 VID32 VID33 Reel idler VC9300 etc Idler wheel VC2300

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Servicing Compact Disc Players

Part 12: Servo Systems – 3

Joe Cieszynski

Last month we took a preliminary look at the CD player's disc servo, in particular the action of the run-up (rough) servo. As our main example we took the system employed in the Sony CX23035 chip. Fig. 1 shows in block diagram form the disc servo system used in this chip. During normal operation the disc motor is under the control of the section identified as the PLL servo. We will now look at this in greater detail.

PLL Servo Action

I've come across a number of sources which gloss over this by saying that the 4.3218MHz off-disc data is compared with a 4.3218MHz reference signal from a crystal oscillator, and that when the disc speed is incorrect the data rate shift with respect to the reference results in an error signal that the servo uses to provide the necessary correction. As an over-simplified explanation, this is correct. Circuit design is not so straightforward however. First of all we cannot feed in 4.3218MHz data "straight off the disc" because there isn't any: not at 4.3218MHz, anyway! If we recall the EFM rule (see Part 5, July 1989, page 694), there must be at least two zeros between consecutive ones. Remember also that only ones are stamped on the disc, the zeros being clocked in by the player's decoder. Thus the highest possible offdisc data frequency will occur with a signal consisting of 100100100 etc. The r.f. signal will then be at 4.3218/3 = 1.5MHz. In other words, the highest possible frequency in the off-disc information is 1.5MHz, and this is present only on occasions.

Clearly then it's not the raw off-disc data that's used as the servo's sample but the reconstituted data stream produced by the phase-locked voltage-controlled oscillator in the decoder section of the player. This VCO operates at 8.6436MHz, its output being divided by two to produce a 4.3218MHz data rate. This data is passed to the frame sync detector and timing generator 1 blocks in Fig. 1. The timing generator consists of a series of dividers. These reduce the data rate to 7.35kHz and lock this to the frame sync signal. The 7.35kHz signal thus produced is called the WFCK (write frame clock) signal. It acts as the disc speed sample for the servo and is also fed to the control microcomputer to assist in the timing of this and of the decoder and RAM operations.

The WFCK signal is compared with the divided down output from a free-running 8.4672MHz crystal oscillator. Timing generator 2 is responsible for this division, the output being referred to as the RFCK (read frame clock) signal. It may also be used by the microcomputer for timing purposes. It's worth noting that in some players the WFCK and RFCK signals are further divided by four or eight before comparison in the PLL servo, these signals being identified as "1/4 WFCK" or "1/8 WFCK" etc.

One might have expected the crystal oscillator to run at 8.6436MHz, i.e. twice the data rate. In some cases it does, for example in the CX7934 chip used in early Sony players. Reducing the frequency to 8.4672MHz assists with correct phase detector operation by introducing a

90° phase difference between the two signals.

Having seen how the sample and reference signals are obtained we can now look at a typical PLL/rough servo system. Fig. 2 shows an example, as used in the Pioneer CDX1 and similar players. It shows more clearly the operations carried out by the timing generators in Fig. 1. You will see that the speed (coarse) error detector compares a 1.8kHz data signal with 1.8kHz from a crystal oscillator while the phase (fine) error detector compares much lower frequency inputs, i.e. 612.5Hz.

Fig. 2 also shows how the disc speed is altered fractionally in order to keep the audio data RAM approximately half full. If the RAM begins to under or over fill, the RAM address generator shifts the division by 576 by ± 1 , slightly altering the disc's speed.

Engineers familiar with VCR servos will know that the techniques used to achieve correction differ from model to model. For example, with some machines the tracking control acts on the capstan servo while in others it acts on the drum servo. The same applies with the disc servos used in CD players. The arrangements shown in Figs. 1 and 2 have served to illustrate the basic principles. While all disc servos rely on the same basic reference and sample sources, the way in which these are used and compared in various machines can differ.

The Fast Servo

The fast servo shown in Fig. 1 is used during large track jumps. If the optical assembly is moved across the disc in one second it will cross the track say 20,000 times, with the result that the mirror surface of the disc will produce a 20kHz signal that's superimposed on the EFM. During this time the normal disc servo will have unlocked due to the interruption of the guarded frame sync. The rough servo will try to take over control but since the 20kHz signal will obliterate the sync signal it will be unable to function. To overcome this situation the control microcomputer will switch in the fast (high-speed access) servo when a large track jump is selected.

The fast servo is not used in all players that employ the CX23035 chip. With players that use a conventional sled motor the track jump feature is not particularly fast, so that the rough and PLL servos are able to cope. Players that use a linear sled motor or a radial tracking arm are capable of very fast access times when performing track

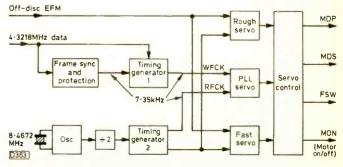


Fig. 1: Block diagram of the disc servo section of the Sony CX23035 decoder/servo chip.

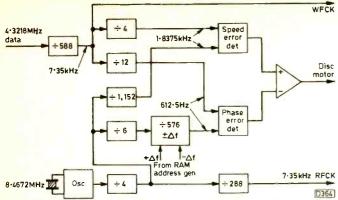


Fig. 2: Block diagram showing the detailed operation of a typical disc servo system. This particular arrangement is used in the Pioneer CDX1 and similar players that use the TC9178F decoder/disc servo chip. The frame sync (GFS) input to the disc servo is not shown above but is present in the main circuit diagram: the actual point at which it is injected is not clear from the information available.

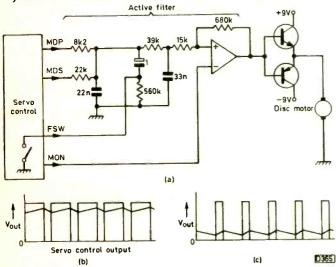


Fig. 3: Active low-pass filter used to convert the pulse-width modulated output from the servo into an analogue signal for motor control. (a) Block diagram/circuit configuration. The d.c. output obtained depends on the mark-space ratio of the p.w.m.: as shown at (b) a high mark-space ratio produces a high d.c. output while a low mark-space ratio, as at (c), gives a low d.c. output. When the filter switch FSW is closed the damping action of the 1 µF capacitor is increased. This reduces the effect of sudden changes in the servo's p.w.m. output so that, during the run-up and speed correction periods, the servo action is "coarse".

search and jump operations. It's then that the additional servo is required. The action of the linear sled motor will be considered next month when we examine track search and jump techniques.

Motor Control

The MDS and MDP outputs from the servo control block shown in Fig. 1 are in the form of pulse-width modulation and must be converted to analogue form before they can be used for motor control. This is done by passing the p.w.m. outputs through an active low-pass filter that's usually based on an operational amplifier. As the mark-space ratio of the p.w.m. shifts, the d.c. output from the filter changes.

The motor drive speed and phase control outputs (MDS and MDP) require different filter values. This is the reason for the FSW (filter switching) output, which is

used to switch the filter components. Fig. 3 shows a typical circuit. When the rough servo is in operation there will be an MDS output: the FSW switch closes, shorting out the $560 \mathrm{k}\Omega$ resistor in series with the $1\mu\mathrm{F}$ capacitor in the filter circuit. During normal play when the PLL is in control the MDP output will be present: the FSW switch opens, increasing the sensitivity of the servo action to give better phase control.

It will be apparent from Fig. 3 that the motor drive circuit can run the motor in either the forward or the reverse direction. Reverse drive is used purely for braking purposes since there's no reason why we should ever wish to run the disc backwards.

Fault Conditions

It's worth mentioning that I have on a number of occasions encountered a faulty player that rotates the disc backwards even though with adequate control microcomputer programming the player should cut out before this can happen. With some models the microcomputer programming is such that if data is not found during the initial run-up sequence the brake is applied (reverse current through the motor) and, because an r.f. signal is present and possibly the rough servo is able to detect the frame sync signal, the microcomputer maintains the brake current, running the motor in the reverse direction for a period.

My experience indicates that if the disc runs in the reverse direction after first attempting to run forwards the fault is never in the disc motor drive stage. The usual cause has turned out to be misadjustment in the focus or tracking servos. Some early players had an offset adjustment to balance the PLL servo. If this is incorrectly set the disc may run backwards, the difference in this case being that the disc doesn't attempt to run in the forward direction initially.

Apart from the common causes of disc reverse rotation just mentioned, any faults in the motor drive stage or its supplies will result in the disc either failing to start to rotate or immediately running up in either the forward or the reverse direction. Such faults are few and far between but are generally easy to diagnose. Just remember that the disc shouldn't run up until the FOK (focus o.k.) signal has appeared – this takes a brief period from the time when the disc is loaded. If the disc is keen to rotate when first loaded it's worth checking the motor drive stages first.

The only other problem encountered in the area of the disc servo is failure of the motor itself. I've come across players in which everything seems to be o.k. but there's no sound output and the usual checks in the focus and tracking servos have been fruitless. A more careful check on the disc in its tray shows that it's rotating slowly. The fault has been that the motor is unable to reach full speed.

Finally, beware of the player in which the disc fails to rotate at all. Before you spend a lot of time checking whether the laser is lit and the focus search, FOK, power supply and disc motor drive stages (as I did when still inexperienced) do check the obvious: is the disc able to rotate freely in its tray? If not, the disc motor spindle height is probably set wrongly or the clamp arm has seized. These are fairly common faults which we'll look at in more detail when we come to consider player mechanisms.

Next month we'll look at a different aspect of the disc servo, the track search and skip features.

Long-distance Television

Roger Bunney

November again produced quite remarkable DX-TV results. F2, Sporadic E, tropospheric and auroral activity was present on many days and there were reports of quite spectacular reception. We'll start off with the UK SpE log:

4/11/89 RTP (Portugal) ch. E3; TVE (Spain) ch. E4.

5/11/89 TVE E2; DR (Denmark) E4.

6/11/89 TVE E2, 3, 4; RAI (Italy) IA; TDF/Canal Plus (France) L2, 3; ARD (W. Germany) E2.

7/11/89 TVP (Poland) R1; RAI IA; TDF L2.

8/11/89 TSS (USSR) R1.

9/11/89 TVE E2.

10/11/89 TVE E2.

16/11/89 TVE E2.

17/11/89 TVE E2; NRK (Norway) E2, 3, 4.

18/11/89 TVE E2.

19/11/89 TSS R1, 2; YLE (Finland) E3; TVE E2; also unidentified signals.

20/11/89 TVE E2.

21/11/89 TSS R1.

22/11/89 TSS R1.

28/11/89 TVP R1, 2; TDF L4; TSS R1.

29/11/89 TVE E2.

That's a fairly good log for November, and makes up in part for the rather poor showing this year of the November Leonids meteor shower.

Tropospheric activity similarly had its moments. A settled high-pressure system lifted tropospheric activity during several days, with thick fog. The best spell was from the 12th through to the 20th, the peak activity being on the first three days. Bands I/III/IV/V were wide open during the period, giving reception in the UK of signals from Norway, Sweden (SVT), Denmark, the GDR, West Germany and the Benelux countries. Interesting that the SAT-1 service was seen on chs. E12 and E52. Simon Hamer (Powys) and David Glenday (Arbroath) sent in quite exceptional legs, resembling transmitter lists! F.M. radio reception was also very active - Simon logged signals from four BFBS (UK Forces) transmitters in W. Germany. The longest haul signals were perhaps on the 15th, when Simon received TVP (Poland) ch. R35 in North Wales. Meanwhile Tim Anderson (St. Leonards) noted Bands III/IV/V jammed with signals from W. German and French transmitters. Other unusual catches were American Forces transmissions on chs. A33 and A80. Conditions faded on the 20th, though signals from W. and E. Germany and Denmark were noted on that day.

A further tropospheric lift occurred on the 26/27th, with signals from the nearer French, Danish and W. German transmitters in Band III and at u.h.f., also extensive reception from RTE (Ireland) in the same bands.

The main excitement was produced by the F2 propagation associated with increased solar activity. Reception of exotic signals was noted throughout the UK and

Europe, from Band I transmitters as far away as China and Australia! The F2 log is as follows:

4/11/89 Iran (IRIB) ch. E2; TSS R1; weak ch. A0 (Australia) pictures in the UK at 0800 GMT.

5/11/89 TSS R1; Iran and Dubai E2; RTM (Malaysia) E2; Australia ch. 0 – pictures with line pairing, i.e. two transmitters, at 0830 GMT. The m.u.f. rose to ch. E3, with unidentified pictures. At midday several ch. E2 PM5544 patterns, a FUBK pattern and Arabic captions were seen, all co-channel, many without VITS. F2 backscatter was also present. The best catch was China ch. C1, with a caption, noted by Simon Hamer at 0830 GMT. An outstanding day.

6/11/89 Iran and Dubai E2; TSS R1.

7/11/89 Iran and Dubai E2; TSS R1; ch. A0 received at scanner level at 0940 GMT, the measured carrier frequency being 46·172MHz.

8/11/89 Iran E2; TSS R1.

9/11/89 TSS R1; unidentified ch. E2 signal.

10/11/89 Iran E2; TSS R1.

11/11/89 TSS R1; RTM E2; ZTV (Zimbabwe) E2; weak ch. A0 pictures; floating weak ch. E3/A2 pictures at 1400 GMT.

12/11/89 TSS R1; unidentified E2 signals.

13/11/89 TSS R1; Iran E2; suspected China C1.

14/11/89 TSS R1.

15/11/89 TSS R1; unidentified ch. E2 signal; a weak ch. A0 video carrier buzz was heard.

16/11/89 Ch. A0 pictures at 0845-0850 GMT (carrier at 46·172MHz).

17/11/89 TSS R1; a ch. R1 525-line crosshatch pattern was received at 0900 GMT – it's been seen before, can anyone help with this mystery?

18th through to the 21st: Weak TSS R1 and ch. E2 signals.

22/11/89 TSS R1; Iran E2.

23/11/89 Strong ch. E2 and R1 pictures; a strong ch. A0 signal was seen at 1000 GMT, with positive syncs and a weak picture.

24/11/89 TSS R1; unidentified E2 signal.

26/11/89 Unidentified E2 signal.

27/11/89 Unidentified E2 signal.

28/11/89 TSS R1; unidentified E2 signal.

29/11/89 TSS R1.

30/11/89 TSS R1; unidentified E2 signal.

Auroral signals were received by Iain Menzies (Aberdeen) on the 9th, 11th, 12th, 13th, 15th, 16th, 17th, 25th and 26th. On the 17th he noted Band I signals at up to ch. R3, with TSS and SVT identified. There were observable effects in the southern UK on the 17th.

It was certainly an eventful month then, with some excellent F2 reception. On the 13th I was lucky in having a day without the presence of 49MHz baby alarm signals and measured an incoming TSS ch. R1 signal from a two-element aerial without amplification: it peaked at 0.45mV.

Tim Anderson points out that Iran uses the PM5544 (for short periods) and the FUBK patterns. The FUBK one is often present at 0700 when propagation from the Middle East starts, though much of the Iranian morning transmission time is taken up with low-frequency bars/colour bars. Late morning brings repeating pages of Arabic script – often the SECAM colour will lock with very weak signals and no VITS are included (Dubai uses simple VITS). The St. Leonards Radio Club recently had a talk by Ken Willis, G8VR who suggested that despite this year being the peak of the sunspot cycle we may, over the next two years, enjoy more F2 activity than at present due to reduced Polar Absorption (in turn

due to fewer flares). It seems that after the last sunspot cycle peak there was better transatlantic 50MHz communication for up to two years.

Many thanks to the following for sending in reception reports/logs: David Oliver (Birmingham), Peter Schubert (Rainham), Iain Menzies (Aberdeen), Cyril Willis (King's Lynn), Tim Anderson (St. Leonards), Roger Fussell (Torpoint), David Glenday (Arbroath) and

Simon Hamer (Powys).

Anthony Mann has sent in a report from Perth, Western Australia, covering October/November. He heard or saw European TV signals on November 2nd and 5th, though perhaps the most dramatic reception was on October 31st when ch. E2 signals were received from Muro, Portugal. The pictures showed a studio scene at 1759, a caption with five or six large letters at the top of the screen and then a female announcer with dark, shoulder length hair and white jacket, followed by programme material. A scanner check showed that the carrier frequency was 48.247MHz nominal. The Perth to Europe opening was confined to an arc from the UK/ Holland to southern Sweden. An opening on October 28th produced Chinese signals at up to ch. C4 (77.25MHz). Lower frequency Chinese signals are commonly received in Australia via F2/TE openings.

On the space front Iain Menzies has bought an Amstrad package and reports a degree of success in receiving several satellites apart from the intended medium-power Astra. John Standen of North East Satellite Systems, Cropton, Pickering, N. Yorkshire has available at £50 each, buyer collects, a quantity of new spun-aluminium 1.5m dishes in black. Mounting hardware can be arranged. Write or phone 0751 5598.

News Items

USA: The US Information Services' Tele-Marti project was due to start test transmissions from Cudjoe Key off Florida in January. The idea is to broadcast a TV service to Cuba from a helium-filled balloon at 10,000ft (with a backup balloon moored at ground level). The balloon carries a ch. A13 1kW transmitter that feeds a directional aerial providing an e.r.p. of 33kW. Signals are uplinked at a microwave frequency. To date some \$8m has been spent on the project, which has been criticised mainly on the grounds of possible co-channel interference to US domestic terrestrial transmissions.

France: Antenna-2 has decided to adopt Ceefax on a permanent basis. Due to the incompatibility between Ceefax and the French designed Antiope system, both will continue in use, the idea being to change eventually to Ceefax only. The TDF-1 satellite also uses Ceefax. All current production French teletext sets are now capable of handling Ceefax.

Satellite TV

Yet another Swedish cable channel is to start in autumn 1990, called Nordisk Television (TV4). The West German Screensport programme "Sportkanal GmbH" is to have national carriage on cable: CNN's operations have been stalled by a dispute over fees between CNN and the Bundespost. Iran intends to have a satellite with twelve TV channels in operation by 1995. Certain adult film offerings from RTL-Veronique at 19.2°E are now scrambled – but can be seen clear at 13°E!

Five transponders were seen testing, on carrier only,



at 41°W on November 9th. The frequencies were 10.9975, 11.0735, 11.1541, 11.4913 and 11.6144GHz, with vertical polarisation and power levels up to 50dBW. It has been difficult to establish which craft transmitted the signals for a whole evening – they've not been seen since. One suggestion is that they originated from the NASA TDRS-D craft.

MAC signals with the caption "SG SUCCE" were seen at approximately 11·02GHz from 27·5°W in mid-November. Following the caption the signals went to scrambled MAC. Their source is not known. Another Dutch transponder has been seen on test at 13°E, with the caption "HOL 2" – frequency 11·13GHz with horizontal polarisation. The "PTT NEDERLAND" transponder has been seen in the half-transponder mode, with one half taking RTL-V and the lower half taking news feeds from Sky and others. The situation at the Berlin Wall brought many OB circuits into action, mainly via ECS at 7°E though the BBC was seen at 27·5°W.

NRK (Norway) has gone from the 10°E craft – Spanish corporate video servicing and other OB material has been seen at 11·2GHz, vertical. NRK has also disappeared from Intelsat 1°W at 11·684GHz, being replaced by a series of unknown sourced test patterns without scrambling. Both these feeds had been in D-MAC.

For real US TV watch PanAmSat at 45°W. Its downlink to the London Teleport carries NBC and CBS programming, apparently intended for Sky News, at varying power levels on 11.639GHz.

Remote Imaging Group

This group has been in touch with us recently. It

specialises in weather satellite reception and issues an excellent newsletter that contains much information on orbital data, constructional and practical projects, details of commercial equipment, etc. The group has over 1,000 members and liaises with the European Space Agency, NASA, the Meteorological Office and the DTI. If you are interested in reception from this type of satellite, write including an A5 SAE to Des Watson, Norton, Gote Lane, Ringmer, Nr. Lewes, East Sussex BN8 5HX.

1990 Meteor Shower Dates

Our thanks to George Spalding of the Meteor Section, British Astronomical Association, for once again providing details of the MS periods for the coming year:

Meteor Shower	Pe <mark>rio</mark> d	Peaking
Lyrids	April 19-25	April 22 at 0800
May Aquarids	May 1-10	May 5
Delta Aquarids	July 15-Aug 20	July 29
Perseids	July 25-Aug 20	Aug 12 at 2000
Orionids	Oct 16-27	Oct 20-23
Taurids	Oct 20-Nov 30	Nov 1-10
Leonids	Nov 15-20	Nov 17 at 2100
Geminids	Dec 7-16	Dec 14 at 0300
Ursids	Dec 17-25	Dec 22-23

With the Orionids there's a fairly flat peak in activity over two-three days. The weak Taurids shower provides long activity with a flattish peak over ten days. The Ursids shower is usually weak. For various reasons UK activity times may vary. For example, the Leonids will not be visible in the UK at the peak time, so a pre-dawn check should be made.

Receiver Review: Supra Model STV660

Aerial Techniques has recently started to market the Supra Model STV660, a triple standard, PAL/SECAM receiver with a six-inch screen. It's a lightweight v.h.f./ u.h.f. receiver capable of operating with system B/G, I or D signals. The tuning scale is arranged vertically on the right-hand side and the case is remarkably well ventilated.

The control system is versatile. At the lower left-hand side there are user controls for vertical hold, colour, brightness, picture (contrast) and slide switches for PAL/ SECAM and systems B/G (CCIR), I (UK/HK) and D (OIRT - East Europe). These controls are recessed and don't protrude, which is important with a portable receiver. At the front there's a horizontal on/off switch below the tuning scale. At the top there are, from front to rear, pushbuttons for v.h.f./u.h.f. and for video input/ off-air selection, then a series of phono sockets for audio and video inputs and outputs. A rear 3.5mm jack allows earphone monitoring. The large volume control knob is to the front upper. At the very rear the nine-section telescopic aerial reaches to 37in, when fully extended. On the right-hand side there are a very large tuning knob towards the front, a conventional recessed 75 Ω coaxial socket, an a.f.c. on/off slide switch and, via a 2.1mm socket, provision for a 12V d.c. input. Presets accessible via small holes adjacent to the left-hand side user controls cover a great range of adjustments. A tilt-out stand beneath the set lifts it an inch upwards at the front.

Tuning coverage is 46·25-66·5MHz, 162-228MHz and 472-860MHz. When tuning from Band I to Band III

there's automatic changeover. The 2in. vertical v.h.f. scale is calibrated chs. E2/3/4 in Band I and chs. E5/7/10/11/12 in Band III. The u.h.f. scale length is 2.5in., the calibration being every five channels from 21 to 69.

The set can be powered from the mains or a 12V car battery or dry cell. It comes with a large 13A plug integrated power supply that provides a 15-16V d.c. output at 1·2A. This is the usual Far East black-blob type power supply that runs warm after half an hour, though it's far cooler than some I've met.

I feel that the receiver's most useful feature is the provision for video and audio inputs and baseband outputs from the received signals. At v.h.f. there was a lack of snow on the screen: I like to see a receiver with a "lot of go", and this lack of displayed noise was not to my liking. I felt that the v.h.f. sensitivity is low. Matters improved at u.h.f., with snow visible on the screen. though again difficulty was experienced in displaying local signals received via the integral telescopic aerial. With a large, external aerial connected excellent quality pictures were displayed. The selectivity under these conditions is such that with adjacent channel signals present (here at Romsey LWT ch. 23 and the local BBC-2 ch. 24) there were no "floating" pictures. I feel that the tuning knob has too much slackness and backlash: circular packing beneath the knob would remove the wobble and make tuning easier.

The results with a baseband video input were excellent. Note that the SECAM colour option does not include the French System L.

It's an attractive set, though for me lacking in gain. It works well as a cheap off-air receiver with strong signals and as a monitor for baseband signals such as the output from a satellite TV receiver.

A Satellite TV Patterning Problem

In many domestic satellite TV receivers the u.h.f. output carries the local TV channels as well as the satellite TV tuner's output, which is typically at around ch. 35-40. This is done by feeding the output from the terrestrial TV aerial to a diplexer within the satellite TV receiver. Unfortunately wideband diplexing is used. As a result, if a signal from the terrestrial aerial is on the same channel as the satellite TV tuner's output the two will be mixed and patterning will appear on all the satellite TV channels.

A changeover switch could be incorporated, but there's a simpler way of overcoming this problem. Obtain a Band IV or V RSPK notch filter (single notch with 25dB depth) or a Band IV or V double-notch filter (40dB depth) in the TFV range. Both have in-line metal housings, the single-notch type being alloy based and lightweight. A Band IV filter is tuned to ch. 35 by screwing the brass slug out while for Band V you screw the slug into the housing. Fit the filter at the receiver's output, tune the TV set to satellite TV then adjust the brass slug slowly until the picture becomes snowy, i.e. is attenuated. Tune for maximum attenuation. When this tuning position has been found, remove the filter and insert it in series with the input from the terrestrial TV aerial, at the point where it plugs into the satellite TV receiver. Thus fitted the filter will attenuate any terrestrial signal interference to the satellite TV tuner's output. Remember that during periods of tropospheric enhancement channels that are normally empty can be filled with Continental signals, providing interference for hours or days.

Service Bureau

Note: the Query Service has now ended.

PHILIPS 2A CHASSIS

The picture is marred by a grid of parallel vertical lines that cover the whole screen area. Alternate lines appear to be broken, giving the impression that the picture is being viewed through a lace curtain. The lines are stationary and do not interact with the picture content, which is excellent. With a VCR input however the lines are sometimes curved, mostly on the left-hand side, and tend to move, but again don't interact with the picture.

The 2A chassis uses a self-oscillating power supply that normally runs at about $40 \, \mathrm{kHz}$ and is not tied to the line frequency. It seems that this frequency is breaking through into the signal circuits. Prove it by comparing the spacing of the interfering lines at very low and very high brightness levels. If the spacing changes, power supply hash breakthrough would seem to be confirmed. Possible causes are failure of reservoir/smoothing capacitors on the secondary side of the chopper transformer; faulty isolating components 2691 (33pF), 3691/2 (both $3.9 \mathrm{M}\Omega$); dry-joints in the power supply or earthing/screening problems in this area.

HITACHI CPT1444

The problem is that the picture flickers from colour to black-and-white. This occurs randomly though frequently and is not modulated by the sound. A replacement crystal in the colour decoder section has not improved matters and there don't seem to be any dry-joints in this area.

Ensure that a variable colour control voltage is present at pin 5 of the TDA3562A colour decoder chip and that C507 (2·2μF) which decouples this potential is o.k. Also check that the sandcastle pulse at pin 7 is present and correct. If the problem persists the chip itself is suspect.

SANYO VHR1100

The head drum intermittently fails to rotate – unless pushed! When the machine is playing the verticals are corrugated and the picture moves from side to side a few times per second. The colour stays on. Finger pressure on top of the drum momentarily cures the corrugated verticals but as the head slows down line lock is lost. The voltages around IC4003 are correct.

We suggest that you apply a variable voltage of about 4.4V from a stabilised source to pin 11 of IC4003. If you can momentarily get a steady picture by varying this voltage, suspect the servo circuit centred on IC4002. If not, try replacing IC4003 before suspecting the head drum motor.

ITT CVC25 CHASSIS

There's a curious effect like a hum bar except that the light and dark bands relate to colour saturation instead of brightness. They drift slowly upwards and are most noticeable on a colour-bar display with the luminance

switched off. With this display the colour can disappear altogether in the dark bands, whose width is about one third of screen height. There's no hue distortion: only the saturation varies. The fault appeared after attention to other problems.

We suggest that you check the earthing of the decoder screening can and the earth print to the metal chassis and earth lands of the main chassis. Check also that the metal chassis frame is well soldered to the main print. Then try applying a smooth (externally derived) saturation control voltage to pin L6 on the decoder module. If this cures the problem, check for 50Hz leakage in the customer control panel and the cableform dressing.

AMSTRAD CTV1401

The problem is erratic tuning drift. At switch on, with any channel selected, there's no signal. After a few minutes the station may appear for two-three minutes then drifts off channel. Retuning helps for a while but the station drifts again. The whole of the area near the tuner seems to be heat sensitive. The channel switch contacts have been replaced.

The tuner itself is almost certainly responsible for the problem. Before you replace it, use a high-impedance voltmeter to check that the voltage at the tuner's tuning voltage pin doesn't vary widely. If it does, check the tuning potentiometer bank and the 33V stabiliser.

GRUNDIG CUC220 CHASSIS

The problem with this set is that the sound and raster switch off from time to time. They come back suddenly if the set is left on. The picture seems to get weaker before going off.

Intermittent switch-off problems with CUC series chassis are commonly due to failure of R646 ($270k\Omega$) or the TDA4600 chopper control chip. It's also worth replacing and resetting the h.t. preset control R647 ($2.5k\Omega$). Before embarking on component replacement, check thoroughly for dry-joints in the power supply and line output sections of the chassis.

AMSTRAD VCR4500/4600/9000

We've had the same trouble with all these machines. The problem is tape damage: the tape is pulled down across the audio/control head, damaging the bottom edge. Replacing the pinch wheel and slackening the tension spring to the pinch wheel assembly has been tried without success. The problem does not occur with all tapes.

This is a common problem with these machines. It's caused by a faulty reel-drive clutch, item 301. The part number is 150873.

SAISHO CM145R

Something keeps on destroying the M491 tuning/memory chip IC501. The first symptoms are a gradual loss of programme numbers, followed by an erratic display of numbers when pressing the channel change control. Also the memory cannot be held. A replacement restores normal operation after reprogramming for anything between a couple of days to several months. I've increased the value of the decoupling capacitors in the supply to the chip and checked the 12V and 5V lines, which-are correct.

The almost certain cause of your problem is flashover somewhere in the high-voltage section of the set. First check that the 125V h.t. supply is not excessive. If it is, replace the STR3125 regulator chip Q801. If not, check the e.h.t. and focus connection areas of the c.r.t. and the tube base spark gaps. Ensure that the tube's Aquadag coating, the spark ring and chassis ground are correctly bonded together. If all these things are o.k. we would suspect the diode-split line output transformer T444.



326

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

We find Bill indispensible: he combines the virtues of a field technician, delivery man, diplomat and trouble-shooter. On these cold mornings he's as likely to be found in wellies as with a soldering iron and meter. Though not fully qualified, Bill is determined to sort out any problems that arise, with his own equipment at least – and there's a lot of it.

Some years back Bill had invested in a hi-fi VCR. It had seen much use since then but had lately developed a problem in the hi-fi sound department. The sound quality with the machine's own recordings had deteriorated. Prerecorded tapes, whether purchased or rented, gave good results (except for those badly duplicated tapes that give trouble with any VCR) provided the tracking was carefully adjusted. With its own recordings the sound reproduction was patchy, with spasmodic signal dropout, often a high level of background noise, critical setting of the tracking control and an undue fussiness regarding tapes – some makes and grades gave better results than others.

Bill's first action was to clean the tape path thoroughly, including all the heads in the drum. This brought little relief to the sound problem. It didn't cure the machine's tendency to produce very slight black streaking from white verticals either. These things all suggested worn heads, but after checking on the price (even the trade price!) of a new upper drum assembly Bill resolved to exhaust all other possibilities first. The wages in this trade do not permit you to throw money about . . .

With a borrowed manual, oscilloscope, alignment tape and other essential gear he got to work on the living room carpet. First came a careful check on the tape path – this was perhaps a little misguided since the sound tracks of prerecorded tapes played back well. As this bore no fruit he went on to the hi-fi audio recording section, where his first check was on the writing current. The scope showed a slightly high audio recording current level, which was restored to normal by a small adjustment, but a record-and-playback test with a particularly

critical make of tape showed very little improvement.

Next day Bill borrowed a frequency counter with which to set the carrier frequencies: 1.4MHz for the left channel (ch. 1) and 1.8MHz for the right channel (ch. 2). They were so nearly correct that there was little point in readjustment. He reasoned that problems prior to the f.m. modulators would be unlikely to produce the symptoms, especially the sensitivity to tracking errors. So the head must be faulty: after perusing all the catalogues and price lists for the best terms, Bill ordered a head drum.

The test gear was borne home for the weekend to help with the fitting and alignment of the new drum assembly. The old one was carefully removed and the new one was fitted meticulously. All the relevant setting-up procedures in the video, servo and hi-fi departments were then followed – for the hi-fi adjustments a test tape made in the workshop on a brand new hi-fi machine was used. All went well – though many hours were spent doing it! – and at the end of the operation the faults had been cured. The machine's own recordings gave excellent playback sound and vision with all makes and types of tape.

Bill told Workshop Sage about it. Sage's opinion however was that head replacement may not have been necessary – yet. So strong was his conviction that, under Sage's supervision, the original drum was replaced in the machine. It lasted another nine months! What did he do to put matters right? For the answer see next month.

ANSWER TO TEST CASE 325 - page 223 last month -

The tiny viewfinder on the operating table last month gave every indication of having a fault in its line output stage. The output voltages, such as the e.h.t. and focus potentials, were low and the scan was of reduced amplitude.

The clue that the technician had overlooked was the combination of a short flyback period and low-amplitude, misshapen pulses in the line output stage. Such a situation could have been caused by a defective line output transformer, but if the technician had checked his oscilloscope's timebase setting he would have noticed that he was getting five pulses across the screen instead of the normal three at the usual 20µsec/division sweep setting. The problem was that the line oscillator was running at about 23kHz. At this frequency the line output stage was a mile off tune. The image displayed by the viewfinder was too blurred to show the mass of horizontal lines that would have indicated where the cause of the trouble lay.

In this particular viewfinder the line oscillator, and much else, is buried in an AN2510S chip, which is a surface-mounted device. When the peripheral components relevant to the line speed had been checked and found to be in order the chip itself was declared to be faulty. A new one restored correct operation. Does anyone want to buy a Sharp viewfinder line output transformer in good order?!

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GENUINE	BELT	KITS
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NV2000, NV2010	£6.50	NV200
NV7000. NV7200		NV700
NV333, NV366		NV333
NV370, NV830, NV850		NV860
NV688		Fergu
NV777, NV788		3V00,
NV8600, NV8610		3V23
NV730		3V29.
NV230, NV430, NV870	£3.20	3V35.
NV870, NV810		Sanve
Ferguson		VTC50
3V00, 3V16, 3V22	£6.50	VTC5
3V23		VTC93
3V29, 3V30		Sony
3V35, 3V36, 3V38, 3V39	. £2.90	SLC5,
Sanvo		SLC6.
VTC5000, VTC5150	£1.99	SL800
VTC5300, VTC5400	£4.50	Sharp
VTC9300		VC730
Sony		VC830
SLC5, SLC7	£6.50	VC910
SLC6	£7.50	VC381
SL8000, SL8080	£6.50	Hitaci
Sharp		VT500
VC7300, VC7700, VC7750	£6.50	VT800
VC8300 VC9100, VC9300, VC9500	£6.50	VT930
VC9100, VC9300, VC9500	£6.50	VT11E
VC381, VC383, VC386	£6.50	VT33E
Hitachi		Akai
VT5000, VT5500		VS970
VT8000, VT8300, VT8500	€2.90	VS2, V
VT9300, VT9500, VT9700	£3.30	VS930
VT11E, VT14E, VT17E, VT19		Many o
VT33E	£6.50	
Akai		All Par
VS9700		All Fer
VS2, VS3, VS4, VS5		Sharp
VS9300, VS9500, VS9700	£6.50	Sharp
Many others available		Amstra
		All Hits

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PINCH ROLLERS

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NV2000, NV2010, NV7000, NV7200 . NV333, NV366, NV370, NV430 NV730	£4.95 £4.95 £7.95
Ferguson/JVC 3V00, 3V16, 3V22, 3V23 3V24	£4.95 £4.95 £4.95 £4.95
Sanyo VTC9100, VTC9300 VTC5000, VTC5150, VTC5300, VTC5400	£4.95 £4.95
Sony SLC5, SLC7	£5.95 £5.95 £5.95
\$harp VC7300, VC7700, VC7750 VC8300 VC9100, VC9300, VC9500 VC381, VC383, VC386 VC651 etc.	£4.95 £4.95 £4.95 £4.95 £4.95
### Hitach# VT5000, VT5500 VT8000, VT8300, VT8500 VT9300, VT9500, VT9700 VT11E, VT14E, VT17E, VT19 VT33E	£5.95 £4.95 £4.95 £4.95 £5.95
Akai VS9700 VS2, VS3, VS4, VS5 VS9300, VS9500, VS9700	£6.95 £6.95 £4.95

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Ferguson 3V00, 3V16, 3V22	£3.50
3//22	£2.90
31/20 31/30	€3.50
3V23 3V29, 3V30 3V35, 3V36, 3V38, 3V39	£2.90
Sanyo VTC5000, VTC5150 VTC5300, VTC5400 VTC9300	
VTC5000, VTC5150	£1.00
VTC5300, VTC5400	£1.00 £2.50
VTC9300	£4.25
Sony SLC5, SLC7. SLC6	
SLC5, SLC7	£3.60
SLC6	£4.95
SL8000, SL8080	£4.25
Sharp VC7300, VC7700, VC7780 VC8300 VC9100, VC9300, VC9500	
VC/300, VC/700, VC/780	£3.50 £3.90
VC9300, VC9300, VC9500	£3.90
VC381, VC383, VC386	£3.90
V/T5000 V/T5500	£4.50
VT5000, VT5500 VT8000, VT8300, VT8500 VT9300, VT9500, VT9700 VT11E, VT14E, VT17E, VT19	£1.50
VT9300 VT9500 VT9700	£1.50
VT11E VT14E VT17E VT19	€3.90
VT33E	€3.90
Akai	
	£3.90
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V59300, V59500, V59800	£3.50
Many others available	
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All Panasonic	€0.65
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Sharp VC7300 etc.	£2.90 £1.80
Sharp VC9300 etc. Sharp VC7300 etc. Amstrad 7000	E2.30
Amstrad 7000	E2.30
Amstrad 7000	£2.30 £1.80
Amstrad 7000	£2.30 £1.80
Amstrad 7000 All Hitachi SENSOR L.E.D.'s All Panasonic. All Ferguson/JVC	£2.30 £1.80 £2.90 £2.90
Amstrad 7000. All Hitachi SENSOR L.E.D.'s All Panaconic All Ferguson/JVC. All Hitachi	£2.30 £1.80 £2.90 £2.90
Amstrad 7000. All Hitachi SENSOR L.E.D.'s All Panasonic. All Ferguson/JVC. All Hitachi END SENSORS	£2.30 £1.80 £2.90 £2.90 £5.75
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Amstrad 7000. All Hitachi. SENSOR L.E.D.'s All Panasonic. All Ferguson/JVC. All Hitachi END SENSORS Hitachi VT64E REEL MOTORS Sharp VC9300, VC381 elc. Amstrad/Saisho elc.	£2.30 £1.80 £2.90 £2.90 £5.75 20 each
Amstrad 7000. All Hitachi. SENSOR L.E.D.'s All Panasonic. All Ferguson/JVC. All Hitachi END SENSORS Hitachi VT64E REEL MOTORS Sharp VC9300, VC381 elc. Amstrad/Saisho elc.	£2.30 £1.80 £2.90 £2.90 £5.75 20 each
Amstrad 7000. All Hitachi. SENSOR L.E.D.'s All Panasonic. All Ferguson'JVC. All Hitachi SEND SENSORS Hitachi VT64E REEL MOTORS Sharp VC9300, VC381 etc. Anstrad'Saisho etc. Panasonic NY333, NV366. Sanyo VTCS000, 5300, 5400.	£2.30 £1.80 £2.90 £2.90 £5.75 20 each £18.20 £16.80 £9.90
Amstrad 7000. All Hitachi. SENSOR L.E.D.'s All Panasonic. All Ferguson/JVC. All Hitachi END SENSORS Hitachi VT64E REEL MOTORS Sharp VC9300, VC381 elc. Amstrad/Saisho elc.	£2.30 £1.80 £2.90 £2.90 £5.75 20 each
Amstrad 7000. All Hitachi. SENSOR L.E.D.'s All Panasonic. All Ferguson/JVC. All Hitachi SEND SENSORS Hitachi VT64E REEL MOTORS Sharp VC9300, VC381 etc. Amstrad/Saisho etc. Panasonic NV333, NV366. Sanyo VTC5000, 5300, 5400. Panasonic NV7000, 7200.	£2.30 £1.80 £2.90 £2.90 £5.75 20 each £18.20 £16.80 £9.90
Amstrad 7000. All Hitachi. SENSOR L.E.D.'s All Panasonic. All Ferguson/JVC. All Hitachi SEND SENSORS Hitachi VT64E SEL MOTORS Sharp VC9300, VC381 etc. Amstrad/Saisho etc. Panasonic NV333, NV366. Sanyo VTC5000, 5300, 5400. Panasonic NV7000, 7200. DRUM MOTORS SERVINCON/JVC 31/20 etc.	£2.30 £1.80 £2.90 £2.90 £5.75 20 each £18.20 £16.80 £9.90 £19.80
Amstrad 7000. All Hitachi. SENSOR L.E.D.'s All Panasonic. All Ferguson/JVC. All Hitachi SEND SENSORS Hitachi VT64E SEL MOTORS Sharp VC9300, VC381 etc. Amstrad/Saisho etc. Panasonic NV333, NV366. Sanyo VTC5000, 5300, 5400. Panasonic NV7000, 7200. DRUM MOTORS SERVINCON/JVC 31/20 etc.	£2.30 £1.80 £2.90 £2.90 £5.75 20 each £18.20 £16.80 £19.80
Amstrad 7000. All Hitachi. SENSOR L.E.D.'s All Panasonic. All Ferguson/JVC. All Hitachi SEND SENSORS Hitachi VT64E SEL MOTORS Sharp VC9300, VC381 etc. Amstrad/Saisho etc. Panasonic NV333, NV366. Sanyo VTC5000, 5300, 5400. Panasonic NV7000, 7200. DRUM MOTORS SERVINCON/JVC 31/20 etc.	£2.30 £1.80 £2.90 £2.90 £5.75 20 each £18.20 £16.80 £9.90 £19.80
Amstrad 7000. All Hitachi SENSOR L.E.D.'s All Panasoni/JVC. All Hitachi END SENSORS Hitachi VT64E REEL MOTORS Sharp VC9300, VC381 etc. Amstrad/Saisho etc. Panasonic NV333, NV366. Sanyo VTC5000, 5300, 5400. Panasonic NV7000, 7200 DRUM MOTORS Ferguson/JVC 3V00, 3V22, etc. Sharp VC7300, VC7700 Sharp VC8300.	£2.30 £1.80 £2.90 £5.75 20 each £18.20 £18.20 £19.80 £29.90 £29.40 £26.44 £26.44
Amstrad 7000. All Hitachi SENSOR L.E.D.'s All Panasonic. All Ferguson'JVC All Hitachi END SENSORS Hitachi VT64E ELL MOTORS Sharp VC9300, VC381 etc. Anstrad'Saisho etc. Panasonic NV333, NV366 Sanyo VTC5000, 5300, 5400 Panasonic NV7000, 7200 DRUM MOTORS Ferguson'JVC 3V00, 3V22, etc. Sharp VC7300, VC7700 Sharp VC7300, VC7700 Sharp VC8300.	£2.30 £1.80 £2.90 £5.75 20 each £18.20 £18.20 £19.80 £29.90 £29.40 £26.44 £26.44
Amstrad 7000. All Hitachi. SENSOR L.E.D.'s All Panasonic. All Ferguson/JVC. All Hitachi. END SENSORS Hitachi VT64E REEL MOTORS Sharp VC9300, VC381 etc. Amstrad/Saisho etc. Panasonic NV333, NV366. Sanyo VTC5000, 5300, 5400. Panasonic NV7000, 7200. DRUM MOTORS Ferguson/JVC 3V00, 3V22, etc. Sharp VC7300, VC7700 Sharp VC8300. Hitachi VT5000 CAPSTAN MOTORS Sharp VC9200.	£2.30 £1.80 £2.90 £2.90 £5.75 20 each £18.20 £18.20 £19.80 £29.90 £26.40 £25.80
Amstrad 7000. All Hitachi. SENSOR L.E.D.'s All Panasonic. All Ferguson/JVC. All Hitachi. END SENSORS Hitachi VT64E REEL MOTORS Sharp VC9300, VC381 etc. Amstrad/Saisho etc. Panasonic NV333, NV366. Sanyo VTC5000, 5300, 5400. Panasonic NV7000, 7200. DRUM MOTORS Ferguson/JVC 3V00, 3V22, etc. Sharp VC7300, VC7700 Sharp VC8300. Hitachi VT5000 CAPSTAN MOTORS Sharp VC9200.	£2.30 £1.80 £2.90 £5.75 20 each £18.20 £18.20 £18.20 £18.80 £19.90 £19.80 £26.44 £26.44 £25.80
Amstrad 7000. All Hitachi. SENSOR L.E.D.'s All Panasonic. All Ferguson/JVC. All Hitachi. END SENSORS Hitachi VT64E REEL MOTORS Sharp VC9300, VC381 etc. Amstrad/Saisho etc. Panasonic NV333, NV366. Sanyo VTC5000, 5300, 5400. Panasonic NV7000, 7200. DRUM MOTORS Ferguson/JVC 3V00, 3V22, etc. Sharp VC7300, VC7700 Sharp VC8300. Hitachi VT5000 CAPSTAN MOTORS Sharp VC9200.	£2.30 £1.80 £2.90 £2.90 £5.75 20 each £18.20 £18.20 £19.80 £29.90 £26.40 £25.80
Amstrad 7000. All Hitachi. SENSOR L.E.D.'s All Panasonic. All Ferguson/JVC. All Hitachi. END SENSORS Hitachi VT64E REEL MOTORS Sharp VC9300, VC381 etc. Amstrad/Saisho etc. Panasonic NV333, NV366. Sanyo VTC5000, 5300, 5400. Panasonic NV7000, 7200. DRUM MOTORS Ferguson/JVC 3V00, 3V22, etc. Sharp VC7300, VC7700 Sharp VC8300. Hitachi VT5000 CAPSTAN MOTORS Sharp VC9200.	£2.30 £1.80 £2.90 £2.90 £5.75 20 each £18.20 £18.20 £16.80 £9.90 £19.80 £26.44 £26.44 £25.80 £39.90 £29.30 £24.75 £34.50
Amstrad 7000. All Hitachi. SENSOR L.E.D.'s All Panasonic. All Fanasonic. All Fanasonic. All Hitachi SEND SENSORS Hitachi VT64E REEL MOTORS Sharp VC3300, VC381 etc. Amstrad/Saisho etc. Panasonic NV333, NV366 Sanyo VTC5000, 5300, 5400 Panasonic NV7000, 7200 DRUM MOTORS Ferguson/JVC3V00, 3V22, etc. Sharp VC7300, VC7700 Sharp VC8300 Hitachi VT5000 CAPSTAN MOTORS Sharp VC8300 Sharp VC7300, VC7700 Perguson/JVC 3V00, 3V16, 3V22 Ferguson/JVC 3V929, 3V30 Ferguson/JVC 3V929, 3V30 Ferguson/JVC 3V929, 3V30 Ferguson/JVC 3V925, 3V36, etc.	£2.30 £1.80 £2.90 £5.75 20 each £18.20 £18.20 £16.80 £19.80 £29.90 £26.44 £25.80 £39.90 £29.90 £20.30 £20.30 £20.30
Amstrad 7000. All Hitachi SENSOR L.E.D.'s All Panasonic. All Ferguson/JVC. All Hitachi END SENSORS Hitachi VT64E E1. REEL MOTORS Sharp VC9300, VC381 etc. Panasonic NV333, NV366. Sanyo VTC5000, 5300, 5400 Panasonic NV7000, 7200 DRUM MOTORS Ferguson/JVC 3V00, 3V22, etc. Sharp VC7300, VC7700 Sharp VC8300. Hitachi VT5000 CAPSTAN MOTORS Sharp VC8300. Sharp VC7300, VC7700 Sharp VC7300, VC7700 Sharp VC7300, VC7700 Ferguson/JVC 3V00, 3V16, 3V22. Ferguson/JVC 3V00, 3V16, 3V22. Ferguson/JVC 3V29, 3V30. Ferguson/JVC 3V35, 3V36, etc. Hitachi VT5000	£2.30 £1.80 £2.90 £5.75 20 each £18.20 £18.20 £16.80 £9.90 £26.44 £26.44 £25.80 £39.90 £29.30 £24.75 £34.50 £25.80
Amstrad 7000. All Hitachi SENSOR L.E.D.'S All Panasonic. All Ferguson/JVC. All Hitachi END SENSORS Hitachi VT64E EREEL MOTORS Sharp VC9300, VC381 etc. Amstrad/Saisho etc. Panasonic NV333, NV366 Sanyo VTC5000, 5300, 5400 Panasonic NV7000, 7200 DRUM MOTORS Ferguson/JVC 3V00, 3V22, etc. Sharp VC7300, VC7700 Sharp VC7300, VC7700 Sharp VC8300 CAPSTAN MOTORS Sharp VC8300 Sharp VC7300, VC7700 Ferguson/JVC 3V20, 3V16, 3V22 Ferguson/JVC 3V29, 3V30 Hitachi VT5000	£2.30 £1.80 £2.90 £5.75 20 each £18.20 £18.20 £19.80 £19.80 £26.44 £25.80 £39.90 £24.75 £34.50 £25.80 £25.80 £32.80
Amstrad 7000. All Hitachi SENSOR L.E.D.'S All Panasonic. All Ferguson/JVC. All Hitachi END SENSORS Hitachi VT64E EREEL MOTORS Sharp VC9300, VC381 etc. Amstrad/Saisho etc. Panasonic NV333, NV366 Sanyo VTC5000, 5300, 5400 Panasonic NV7000, 7200 DRUM MOTORS Ferguson/JVC 3V00, 3V22, etc. Sharp VC7300, VC7700 Sharp VC7300, VC7700 Sharp VC8300 CAPSTAN MOTORS Sharp VC8300 Sharp VC7300, VC7700 Ferguson/JVC 3V20, 3V16, 3V22 Ferguson/JVC 3V29, 3V30 Hitachi VT5000	£2.30 £1.80 £2.90 £2.90 £2.90 £5.75 £18.20 £18.20 £19.20 £19.80 £19.80 £26.44 £26.44 £26.45 £25.80 £25.80 £25.80 £25.80 £25.80 £34.50
Amstrad 7000. All Hitachi. SENSOR L.E.D.'S All Panasonic. All Ferguson/JVC. All Hitachi END SENSORS Hitachi VT64E EREEL MOTORS Sharp VC9300, VC381 etc. Amstrad/Saisho etc. Panasonic NV333, NV366 Sanyo VTC5000, 5300, 5400 Panasonic NV7000, 7200 DRUM MOTORS Ferguson/JVC 3V00, 3V22, etc. Sharp VC8300. Hitachi VT5000 CAPSTAN MOTORS Sharp VC8300. Sharp VC8300. Sharp VC8300. Ferguson/JVC 3V00, 3V16, 3V22. Ferguson/JVC 3V30, 3V36, etc. Hitachi VT5000 Hitachi VT5000, etc. Hitachi VT5000, etc. Hitachi VT9000, 9500, etc. Hitachi VT9300, 9500, etc. Hitachi VT11, VT114, VT17	£2.90 £1.80 £2.90 £2.90 £5.75 £0 £0 £0 £0 £0 £0 £0 £0 £0 £0 £0 £0 £0
Amstrad 7000. All Hitachi. SENSOR L.E.D.'S All Panasonic. All Ferguson/JVC. All Hitachi END SENSORS Hitachi VT64E EREEL MOTORS Sharp VC9300, VC381 etc. Amstrad/Saisho etc. Panasonic NV333, NV366 Sanyo VTC5000, 5300, 5400 Panasonic NV7000, 7200 DRUM MOTORS Ferguson/JVC 3V00, 3V22, etc. Sharp VC8300. Hitachi VT5000 CAPSTAN MOTORS Sharp VC8300. Sharp VC8300. Sharp VC8300. Ferguson/JVC 3V00, 3V16, 3V22. Ferguson/JVC 3V30, 3V36, etc. Hitachi VT5000 Hitachi VT5000, etc. Hitachi VT5000, etc. Hitachi VT9000, 9500, etc. Hitachi VT9300, 9500, etc. Hitachi VT11, VT114, VT17	£2.90 £1.80 £2.90 £2.90 £2.90 £1.80 £2.90 £2.90 £1.82
Amstrad 7000. All Hitachi SENSOR L.E.D.'s All Panasonic. All Ferguson'JVC All Hitachi END SENSORS Hitachi VT64E EREL MOTORS Sharp VC9300, VC381 etc. Anstrad'Saisho etc. Panasonic NV333, NV366 Sanyo VTC5000, 5300, 5400 Panasonic NV7000, 7200 DRUM MOTORS Ferguson'JVC 3V00, 3V22, etc. Sharp VC7300, VC7700 Sharp VC7300, VC7700 Sharp VC7300, VC7700 Sharp VC7300, VC7700 Perguson'JVC 3V20, 3V16, 3V22 Perguson'JVC 3V20, 3V16, 3V22 Perguson'JVC 3V29, 3V30 Perguson'JVC 3V29, 3V30 Perguson'JVC 3V29, 3V30 Perguson'JVC 3V20, 3V16, 3V22 Perguson'JVC 3V20, 3V30, etc. Hitachi VT5000 Hitachi VT5000 Pitachi VT5000	£2.90 £1.80 £2.90 £2.90 £5.75 £0 £0 £0 £0 £0 £0 £0 £0 £0 £0 £0 £0 £0
Amstrad 7000. All Hitachi. SENSOR L.E.D.'S All Panasonic. All Ferguson/JVC. All Hitachi END SENSORS Hitachi VT64E EREEL MOTORS Sharp VC9300, VC381 etc. Amstrad/Saisho etc. Panasonic NV333, NV366 Sanyo VTC5000, 5300, 5400 Panasonic NV7000, 7200 DRUM MOTORS Ferguson/JVC 3V00, 3V22, etc. Sharp VC8300. Hitachi VT5000 CAPSTAN MOTORS Sharp VC8300. Sharp VC8300. Sharp VC8300. Ferguson/JVC 3V00, 3V16, 3V22. Ferguson/JVC 3V30, 3V36, etc. Hitachi VT5000 Hitachi VT5000, etc. Hitachi VT5000, etc. Hitachi VT9000, 9500, etc. Hitachi VT9300, 9500, etc. Hitachi VT11, VT114, VT17	£2.90 £1.80 £2.90 £2.90 £2.90 £1.80 £2.90 £2.90 £1.82

REPLACEMENTS
Panasonic

Panasonic	
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NV7000, NV7200(Genuine)	€2.90
NV333, NV366(Genuine)	€2.90
NV370, NV230, NV430 (Genuine)	€4.50
NV777, NV788(Genuine)	£4.50
	£4.50
NV730	
3V00, 3V16, 3V22 (Large clutch)	£5.95
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VTC5000 Reel drive pulley	€6.50
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Sony	
SLC5, SLC7 Rewind kit	£4.95
SLC6 Rewind kit	£4.95
Sharp	
VC9100, VC9300, VC9500 (Genuine)	£3.90
VC381, VC383, VC386 (Genuine)	£3.90
VC482, VC483, VC581 (also Saisho) (Genuine)	£3.90
VC482 etc. (Equivalent)	£2.98
VC9300, 381 etc. (Equivalent)	£2.98
Hitachi	
VT8000, VT8300, VT8500	
VT9300, VT9500, VT9700	
VT11E, VT14E, VT17E, VT19	
VT33, VT63, VT64, VT65	£3.96
Akai	
VS2, VS3, VS4, VS5	£4.50
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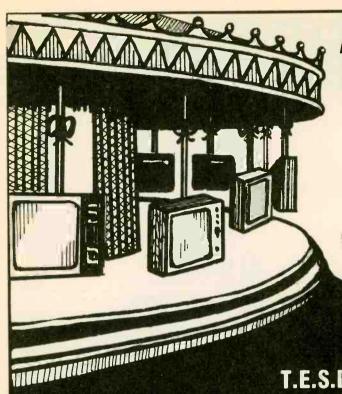
JAPANES	SE BRAND NEW REPLACEMENT VID	EO HEADS
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	HRP-50 £22	69
ALBA	HRS-10 £22	
4000 £23.25	UNIVERSAL3HSSV £11	95 VHR1100
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AMSTRAD	LOGIK	VHR1500 £39.50
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EEDOUGON	VX500/600/800/810/880/770/773£21	16 0111 00
FERGUSON	VCRL-3/VX730/730A/735/735A/755 £22	
UNIVERSAL (3HSSV) £11.95		VC105/108/205/208/400/405/408/500/582/583
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3V43 £47.97 3V48 £39.98	TOTAL	VC6000/6300/7300/7700/7750/8300 BRASS £38.95
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3V53 £47.97	VH-3/555/600/700/844/900/1000 £21	
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FV10/11/20/21/26 £31.00	NV300/333/2000/7000/8600 Etc £11.	
FV12 £38.00	NV330/600/777	26 V21/31/33/50/51/53/9600 £17.86
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	NV370/380£14	50 V93£22.50
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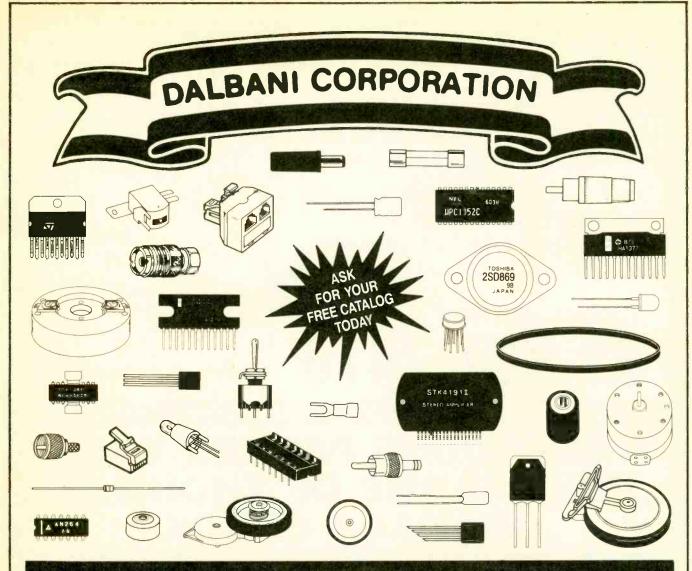
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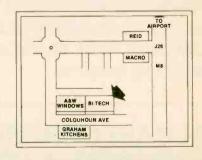
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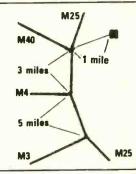
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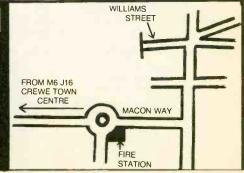
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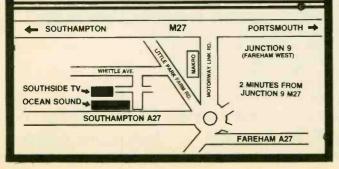
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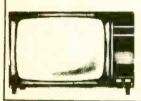


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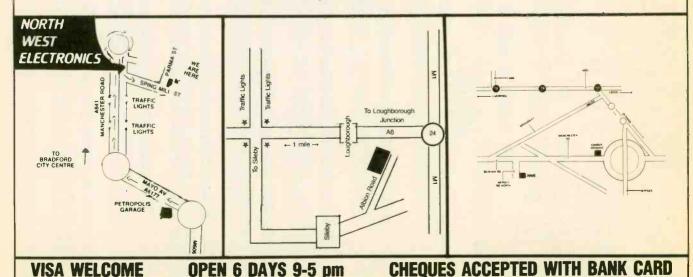
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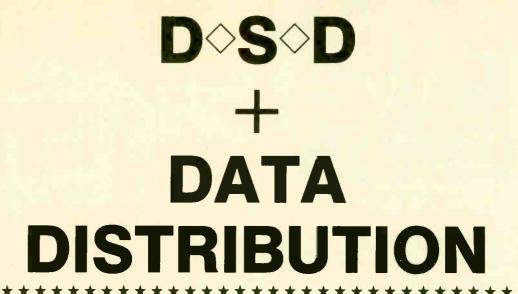
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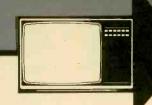
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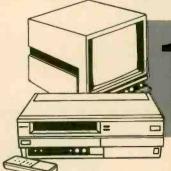
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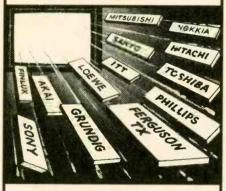
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MS0441/550 £1 M58658P £1 Receiver TX100 Panel I.C. No. SAB3035 —MAB8440P D066 £6 —SAA1060 —PCR8571P New Model Philips Meter £25.00 C. Cam Decoder with TDA3591 £5 Toshiba VHF/UHF EG522F £6	K4 Focus Pot £1.00 Fidelity Tube Base with transitor & focus pot £1.50 Bush Tube Base on panel £1.00	220m 385v £1. 240m 400v £1. G11 470m 250v £2. 400m 400v £1.			Hand Sets — Fidelity £15.00 to £35.0
Receiver TX100 Panel I.C. No. SAB3035 —MAB8440P D066 —SAA1060 —PCR8571P New Model Philips Meter £25.00 C. Cam Decoder with TDA3591 £5 Toshiba VHF/UHF EG522F £6	pot £1.50 Bush Tube Base on panel £1.00	G11 470m 250v £2. 400m 400v £1.	0 470/100	20p 75p	Philip New A/V Hand Set £1
I.C. No. SAB3035 —MAB8440P D066 £6 —SAA1060 —PCF8571P New Model Philips Meter £25.00 C. Cam Decoder with TDA3591 £5 Toshiba VHF/UHF EG522F £6	Bush Tube Base on panel £1.00		0 47/160	10p	ITT 8 and 6 Push Button £1.0 Pye 725 LOPTs £6.0
—SAA1060 —PCF8571P New Model Philips Meter £25.00 C. Cam Decoder with TDA3591 £5 Toshiba VHF/UHF EG522F £6		175m/100m/100m 350v £1,	0 800/160	80p 50p	Pye 731 LOPTs £6.0 Thorn 8500-8800 LOPTs £5.0
New Model Philips Meter £25.00 C. Cam Decoder with TDA3591 £5 Toshiba VHF/UHF EG522F £6	TX10 Tube Base on Panel £3.00	TX9 500m + 500m 175v £1.	.1/250 Pulse 2,2 250v	5p 10p	CMC 301 front panel £5.0 CMC 303 front panel £5.0
C. Cam Decoder with TDA3591 £5 Toshiba VHF/UHF EG522F £6	1100 L.O.P.T. Green Spot	G8 LOPT Panel £7. G8 Tuner Unit + Panel £4.		15p 10p	CMC 302 Panel with TC mains switch
Toshiba VHF/UHF EG522F £6	TX100 Thorn	G8 IF & Chroma £6. G8 Chroma £3.	0 .33/250V	20p	etc £5.0 CMD 800 Decoder £8.00
	Line Transformers G8 Lopt £5.00	Ge Cilionia 25.	4n7/250 tested 5KV	15p 25p	C7 Hand Set £6.00
Mitsumi MEC1-F51 £5	G9 Lopt £4.00 6 Diode Tripler, Mullard 75n	G11 Chroma Panel £4. G11 LOPT Panel £6.	n 47/250	15p 10p	3 I.C. Power Supply G11 Full Remote
Thorn Spares 1 New 9000 Decoder £8.50 1	Line O.P. Trans. Mono T.X. 12"-14" Philips G8	G11 IF Panel £5.		20թ 60թ	Receiver Panel £3.00 Meters Hills 520 £17.00
9000 Cyclops panel £1.50 4	27482 £10 4822 £10 10273 £10	G11 IF Detector £3.	700/250	£1 10p	Meters Hills 420 £10.00 Hills HD5000 Digital Meter 1000V DC
8500 convergence panel £6	Thorn 1690 LOPT £7.50 2 J/Pots 3,500 1 off each type £3.00		3 300+300 MFD 350v	£1.00	750AC 10 Amp 20 MRG Rangers £23 HT100 Multimeter £6.73
1600 Mains lead, switch	G8 Trans. Philips £7.00 G11 Spirt Diode £12.00	pots, tuner pots, 6 pb switch+lead £5. Pve 6 button switch portable £1.	n 34300	40p 20p	HT300 Multimeter £7.75 HT500 Multimeter £9.00
9000 Sound output panel £1	CVC820 Split Diode ITT £10.00 Thorn B/W AD5308F + Stik +	GEC V/cap VHF/UHF tuner and IF+ sound O/P PC 706B3 (Export) £12.1	4/350	5p 8p	FFT700 £15.00 HD 1000 Digital £20.00
3500 Mains Trans £4	Lead £1.50 GEC 2040 £3.00	GEC Line O/P PC 659B3 £6.0 2110 GEC Power Panel £8.0	0 4.7M/350v	10p 20p	HD1200 Low Cost Digital £13.00 HD2500 £18.00 HD3000 Digital £25.00
3500 Cut outs 10 for £4 (GEC 2110 £7.00 Mullard AT 2036 £1.50	CVC 20 Front panel with sliders +	220/350 4 300/350	30p	HD5500 Digital £29.00 HD6000 Digital £32.00
3500 Frame panel 23 [] 3500 A1 Diode 20p []	Pye 169 Line Trans £3.00 Pye mono £3.00		400/350	40p 50p	HD8000 Digital £35.00 HD9500 Digital with capacity Temp Trans Volts Ohms and Amps ranges £60
3500 A Frots 50m 1 9	Rank mono T7(4A £3.50 Split Diode Trans £7.00 GEC 20 A V Rook 7533	CVC 40 PUSH BUTTON ASSY with sliders: complete with lamp assy + pot	22/375 220/385 (ITT)	15p 75p	Trans Volts Ohms and Amps ranges £60 Infra Red
3500 Power panel with Y969 £1 [1	GEC 20 AX Rank Z522 £3.00 Rank L.O.P.T. Z970 £3.00 CVC900 Line Trans £6.00	8 button units £9.0 Universal Focus. Fits Pye, Thorn and	220/207 (21/0 020770)	60p 15p	Hanset Tester Works at 24 feet - Sound repeater.
7.5/9√/300mA	CVC800 Line Trans £6.00 CVC825 Split Diode £10.00 CVC 45 £5.00	Decca Units. T147 Rank tube base on panel £1.1	KT3 E/W .39/400	15p 20p	Works off 9 volt battery £8.00 Fits in top pocket.
4 Push button unit preh £1.00	GEC Portable G1OT2041 £3.00 GEC Portable G1OT2046 £3.00	Z718 Focus Unit £1.1 T20 Focus Unit £1.1	0 4700pf/400	10p	Handset Tester with LED £4.50
v/cap. GEC-Decca type £7.00	EHT Split Diode Leads ITT £1.00 3500 L.O.P.T. & HT Trans each £2.00	Large Type 75	9 8/400	10թ ՝ 15թ	Repaired Handsets Philips K4-K35, RC5350-RC5300, RC5370, RC5375, repaired same day £10.00
KT3 12 Push button unit £2.00 l	LOPT Rank Z763 £5.00 K35 Split Diode 3122/13835930 £10.00	Decca Small 75 KT3 Focus Unit 75	400/400	20թ 40թ	RC5370, RC5375, repaired same day £10.00
6 Push button Unit Thorn £1.00	Universal Tripler	K30 Focus Pot 75 K30 Tube base on panel £1.0	394K/400V	20p £1.00	RC4001 Full Remote KT3 K30 Teletext Handsets exchanged £15.00
6 Push button PYE 731 £6.00 ⊢	with small focus pot. Green type £7.00 Black Triplers	TX10 Focus Units £8.: CVC 32 Focus Unit 75	220/450	40p	NEW Type RC4001 9 CH not 12
Hearing aid unit £3.00 Rank Z718 4 P/B/Unit MECH £4.00	KT3 Triplers £6.00 S.T.C. Universal Tripler £6.00	Fidelity Focus Unit 14R-14S 30 3500 Thorn Focus Unit £1.0		25p 15p	GEC Full Remote Infra-red, 1983 model: £15.00
697 Push Button Unit £6.00	11 TJT £2.50 11 TGA £2.00	ITT Small for use with Split Z718 Bush Focus £2.0	0.1/1200V wire end 0.1/450 A/C wire end	20p 20p	TOSHIBA HAND SETS CT9185 £4.00
TS13AP panel 45 00 1	TTT CVC 5-8-9 £3.50 Rank T25LE Tripler £2.00	Diode 50 Remo TV12SP 50	.22/1000	20p 15p	CT9176 £4.00 CT9133 £4.00
Video Tuner	Rank 11TCP A823 £3.50 TU 25 30K Rank £3.00	1600 Thorn EHT Rec and Lead TV14 50	0.047/1000	10p	Redilfusion MK3 £5.00
V.6100/05 T/V and Tel/Text unit and	11 TEZ Rank £3.00 G9 Philips £4.00	TV20 £1.1 TV45 50	0.11/1600v	10р	TOSHIBA HAND SETS
Send for data.	GEC 2110 £4,00 3500 Thorn £3.00		.47/1000v	£1.00 65p	24 Button CT938 Fuliremote 32 Button CT983 Videotext £6.00
1114 GEC TEX-DECODER	8500 Thorn	TX9 8 Button Unit £6.0	.47/250V A.C. 	10p 10p	THORN VCR Front Display Panet £7,00
PHILIPS	9500 Thorn 24.50 9600 Thorn 24.00 2040 GEC 23.50	TX90 8 Button Unit £6.0	0.00450.500	10p 10p	Large type ITT TV and V.C.R.
Decoder SAA IC 5020-5030	GEC TVM25 Tripler £2.00 Universal Tripler £5.00	TX90-TX925 8 Button £6.1	.0105/1500	10p	Handset £15.00 GEC Ultrasonic 8CH Full Remote £10.00
K40 Text Panel £8.00	G8 Tripler £5.00 CVC2(1-32 £5.00	17.90-17.92.3 8 Button 20.10	→ 2n2/1500	15p 15p	G11 Full Remote Ultrasonic £32.00
OF-425	Decca 80 100 £4.50 Grundig TVK 52 £2.50	TX100 8 Button Unit £6.0	G11.8200/2KV	15p 15p	G11 Ultrasonic Teletext Handset 8 C.H. Ultrasonic GEC Full Remote C2014H/C2219H £15.00
OF-513 correction 10m L1	11TBO Pye 731 £3.00 11THY £4.00	TX10 8 Button Unit £10.6	0.1/2KV 3n9/2KV	20p 15p	New Replacement for G11 Ultrasonic Full Remote £12.00
	D22 for Pye 18" colour portable £4.00 £4.00 £4.00	TV10/TV100 14 P	0.0015/2KV	10p 15p	Thorn 4000 insert with 7 buttons £5.00 Decca RC 11 £14.00
Bridge KBF-08 40p E	BG 100/41 £3.25 ERO Tripler print type with foacs PO7 BG2087 £5	TX10/TX100 16 Button £10.6 UHF-VHF BAND S.W.	2n2/2KV 470pf 4KV	15p	Decca RC 12 £14.00 G11 Infra-red full teletext £20.00 Dynatron-Full remote CTV 62, 63, 64
BY 127 10p 7 BY 133 10p 7	T/text ultrasonic rec'r panel £14.00 12-14V. 20 for £5.00 200 for £25.00	G11 drawer ASS 3 pots Mains switch	7500pf/2KV	10p 10p	Hitachi infra red handset £18.00
BY 134 10 C	GEC 8 touch unit assy complete with all 1.C.'s + pots £4.00	and lead £2.6	4n //2K V	10p 15p	Philips full remote KT3, 16C928/20C934; 7228/7324; K12 26C 797/1ST 66K 1826 £12.00
BY 184 25p	G11 E.W. Transformer 50p G11 E.W. coils £1.00	K30 Drawer Ass with pots cable	6n2/2KV 7n1/1500V	10p 10p	G11, Full remote top button assy. £12.00 G11, Full remote repair service (exchange
BY 187 10p S BY 190 40p S	G11 Transient Suppressors 245V 20p G11 Scan Coils £5.90	forme £1.0	9n1/2000V and 1500V	10p 20p	GEC infra red full remote 8 channel
BY 196 BY 198 10p	G11 100K tuner pots	TX10 Drawer with 8 way pots. ass.£2.5		15p	Philips infra red full remote 9 channel for
BY 204/4 BY 206 – BY 407 Eqv. 8p h	KT3/K30 infra-red receiver	TX10 Ex. port with band switch	150/3500	15p 10p	Philips infra red full remote 12 channel for 60 CP2605 £12.00
BY 208/800 BY 210/400 Sp (K30 drawer unit with IC's (home) £10	(drawer) and U.H.F. only	4.7003KV	5p 10p	K35 KT3/K30 T/Text £12.50 KT3/K30 Full remote £15.00
BY 210/800 10p k BY 223 60p 6	K30 drawer unit with IC's (export) £10	Hills Meter for the car man, volts, amp	170/8KV 180/8KV	10p 10p	KT3 Power supply £4.00 GEC infra-red 2236-2026 £4.00
BY 226 15p k	KT3 AE Sockets 50p KT3 receiver panel £8	ohm with dwell and r.p.m. £35.0		10p 10p	GEC 8 button full remote £14.00 GEC push pad handset button blobs 10p each
BY 228 1500v 20p [F	KT3 line driver transformer 50p Pye, K30, GEC, etc. Pre-mains stand-by	Hills 9 piece tool kit in case £5.0	.47/100V	80p	Pye & Philips handset KT3-K30 chassis. No RC5150-RC5176-RC5171-RC5177.
BY 299 Red 20p	switch £1 Decca 80/100 IF panel £5	Abbey Security Smoke Ale Ma 1-1	Tube Thermpath 167 Rank Secam Decoder F		Special Price £13.00 RC4001 KT3 and Teletex £14.00
BY 299/60p Tag 30p 1	NPN PNP 80V 6 Amp TO66 O.P. Trans. 5 button touch tuner BBC 1/2 ITV1/2	Abbey Security Smoke Alarm Model 101 £4.0	I TO OIL .91 CAT OIL	£13.00 £2.00	CVC 32 Hand Set £15.00 CVC 45 3 and 2 Pin
BY 254 10m 1 v	video with ic SAS 560T/570T £7.00 Control panel 5 sliders + mains lead£1.50	Philips Coaxial Cable Stripper SBC325	Philips K4 CAP 150M/3 Philips Coaxial Cable S		TX10 Hand Set Text £12.50 TX9 with Text £12.50
BY 298 10p C	G11 8 touch button unit replaces old 6 P.B.U. £24	£7.50	SBC325		TX9 & TX10 button print £2.00 TX10 Focus Pots £5.50
BY 406 8p c	Tube base + base unit for 820 Euro chassis £4.00	CVC 20-25-30 Mains Switches	60p Decoder Panel £30		ITT T/V & Video Processor, 1200 Type £10.00
BY 407a 10p p	GEC Line O/P Trans. & Rec Stick for Portable £3.00	Infra Red and Ultrasonic G11 Teletext RANK & ITT Mains Remote On-Off S	ritch (720R) £1.50	2	PHR IPS
BY 500/200 — 5 amp	CVC 20/25/30/35/40 decoder panel CVC 20/25/30/35/40 decoder panel	RANK & ITT Remote Switch 2800 ohn G11 Mains Switch	£1.50 50p	ř	UNIVERSAL HAND SET £12.00 RC5 KT3 - K45
BY 602 10 C	(Untested) £5 CVC 40/45 IF panel £5	4 amp Mains Switch GEC Mains Switch 4 amp	25p 30p	E	We have all parts for Philips Handsets
BYV 26C Hbn 14	40K Transchicer 50m	KT3 Mains witch G8 Mains Switch	£1.00 75p	<u> </u>	RC5353 £15.00 RC5300 £12.00 Philips RC5 £15.00
GP20G 5p L GRP80G (TX10) 30p 2 XK 3102 50p 1	PHILIPS NESTIN £1.20 LM337M Reg. 30p 20 GEC Black Spark Gaps £1.00 KT3 Front Panel Control	G11 Preh Red LED P/Button for C.H. RANK TOSHIBA Transductors TPC-2	Change 20p	N	TEXT-TYPE
BYV 28/200 20p A	Assy. £2.50 BTW 30/50 50p	Mains Switch ITT Long Type Print	75p 75p 75p 75p		Replace Hand Set for Philips KT3-K30, K4 etc £12.30
KBPC35-02 Bridge £1.50	50p	Mains Switch Philip Long Type TAG Mains Switch GEC Long Type TAG 2000 Chassis Fidelity Mains Switch (4 T	75p 75p	U	THORN HAND SETS 9000 - 9600 - TX9 - TX10 - TX100
Bridge Rec. D35B10 40p		2000 Chassis Fidelity Mains Switch (4 T 250V/4A White Lorlin Mains Switch	35p		Text and Non-Text £10.00
	BTW 92/800R £3	KT3-K30-K35 Full Remote Mains Switt Teletext Adaptor Kit TY-500 Panasonic	£12		RC517t PHILIPS £12.00
	25A473 PNP C/P 10p	Philips Battery Tester All Types and ch Philips K4 Mains Switch with standby	rger vis £6 80p	-	K35-K4 HAND SET Repaired for £5.00

Txx00-TX100 Tuners with Æ socket £5,00 Thorn TX Tuner V/Cap eqv. to EL.C1043 Min, UHF, Tuner 40dB gain 2×11/2×1/2 VHF-UHF with Data Tuner MECL+S1 £3 400 Family with Data Moset Thorn TX10 Export V/Cap UHF, VHF23 V/Cap Rank UHF Z773T/Unit V/Cap Rank UHF Z773T/Unit 15 STEW GR Tuner V/Cap T20 6 Push Button Unit EL.C2000 on Panel EL.C2000 on Panel EL.C2000 NEW £5,00 EL.C2001 NEW £5,00 EL.C2004 NEW £5,00 EL.C2005 NEW £5,00 EL.C2006 NEW £5,00 EL.C2006 NEW £5,00 EL.C2006 NEW £5,00 EL.C2007 NEW £5,00 EL.C2008 NEW £5,00 EL.C2009 NEW £5,00 EL.C2009 NEW £5,00 EL.C2009 NEW £5,00 EL.C2001 NEW £5,00 EL.C2001 NEW £5,00 EL.C2003 NEW £5,00 EL.C2004 NEW £5,00 EL.C2005 NEW £5,00 EL.C2006 NEW £5,00 EL.C2007 NEW £5,00 EL.C2008 NEW £5,00 EL.C2008 NEW £5,00 EL.C2009 NEW £5,00 EL.C2009 NEW £5,00 EL.C2009 NEW £5,00 EL.C2001 S.5,00 EL.C2001 NEW £5,00 EL.C2001 NEW £5,00 EL.C2001 NEW £5,00 U341 UHF 55,00 U342 (UHF) 55,00 U342 (UHF) 55,00 U343 UHF 55,00 U344 UHF UVF10 15,00 U345 New 15,00 U346 New 15,00 U347 UNIT TUNET 55,00 U348 UHF ETS98P TUNE 55,00 U349 UVF10 15,00 U340 UVF10 15,00 UVF10 1	12"90% black and white £10 12"110" 31/510 Post £2.50 £5	Inton, EX Into Into	Them ML920 MAB8400B-C £2.00 MAB8440 P-DJ770 £2.00 MAB8441 PTU01 £3.00 MAB8441 PTU01 £3.00 MAB8441 PTU01 £3.00 MAB842P-QU05 £2.00 MAB842P-QU05 £2.00 MAB842P-QU05 £2.00 MAB842P-QU05 £2.00 MAB842P-QU05 £2.00 MAB842P-QU05 £2.00 MAB8440P £3.00 MAB8440P £3.00 MAB840 £1.00 PCD8871P £3.00 MAS840 £1.00 PCD8871P £2.00 MAS840 £1.00 PCD8871P £2.00 MAS840 £1.00 PCD8871P £2.00 MAS840 £1.00 PCD8871P £3.00 NE555P 66p NE555 60p NE556 50p NE564 50p NE558 50p NE564 50p NE558 50p NE586 50p N	SN76228N SN76270 SN76532N SN76545N SN76546 SN76550 SN76552	22.00 TH	DA450I 23. DA4420 42. DA4420 42. DA4420 42. DA4430 24. DA4430 25. DA4430 25. DA4430 25. DA4430 43.	000 000 000 000 000 000 000 000 000 00
BF758	300	(CB416848	\$AA\$ 33	SN75650 SN76650 SN76720 SN7672	11.00 S S S S S S S S S S S S S S S S S S	N74LS 125AN N74LS 248 5 N74LS 248 5 N16862AN N16862AN N16862AN N16862AN N16862AN N16862AN N16862AN S1. N16862AN S2. N16863AN S2. N16863	90p 090p 090p 090p 090p 090p 090p 090p