

CO/W

SEPTEMBER 1993

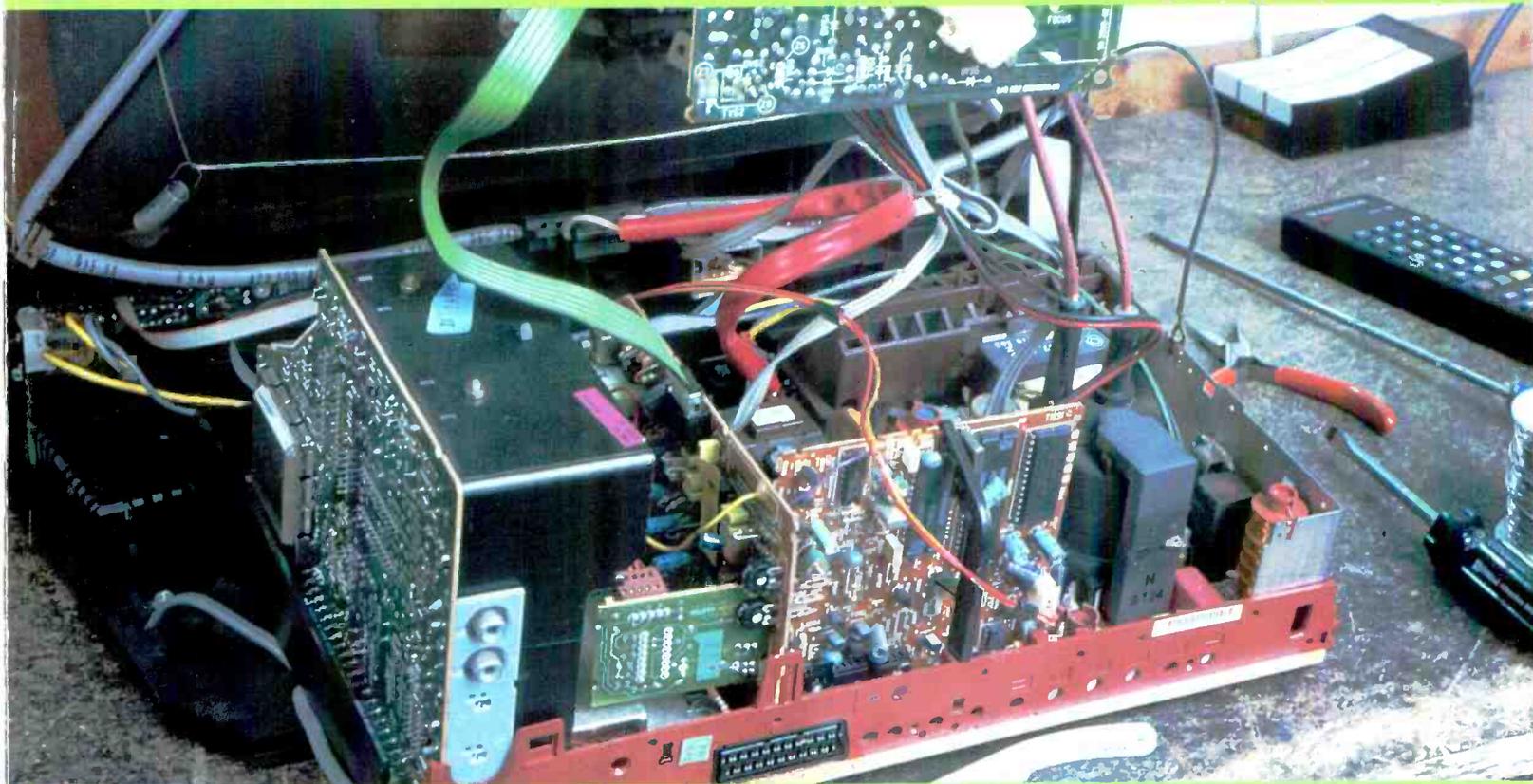
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# TELEVISION

SERVICING·VIDEO·SATELLITE·DEVELOPMENTS

**FREE 32-page CATALOGUE**



**Servicing the Ferguson ICC5 Chassis**  
**CD-i Update and the Video CD Format**  
**Simple Transformer Tester · DX-TV**  
**Panasonic's Digital TV Circuitry**  
**Liquid-crystal Display Systems**  
**TV Fault Finding · VCR Clinic**

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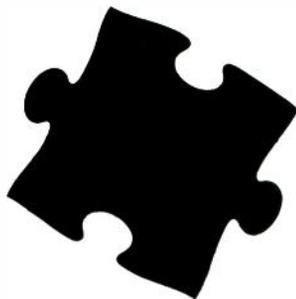
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Goldstar	Thander
Grundig	Thompson
Hameg	Toshiba
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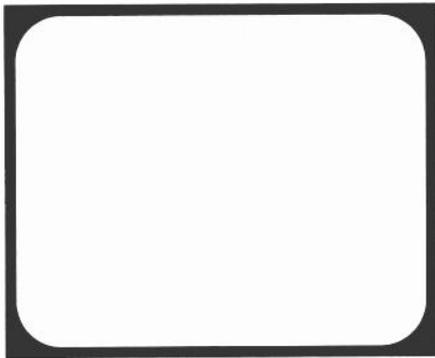
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# TELEVISION

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Reports from Michael Dranfield, Ed Rowland, Nick Beer, Chris Watton, Stephen Leatherbarrow, Mike Leach, Michael D. Maurice, Savio Da Costa and John Edwards.

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*Alex Mason*

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Operation of the power/analogue sections of the receiver.

*Ray Meadows*

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BC107	8p	BD28	50p	R2088	100p	2N6385	120p	EY86	70p	AN7145	195p	LA2000	150p	NE555	20p	STK4182H	800p	STR41090	500p	TD6238AP	200p	TD4359A	350p
BC108	8p	BD897	50p	R2108	100p	2N6403	160p	EY87	70p	AN7146	210p	LA2011	200p	NE556	40p	STK4192	800p	STR44111	650p	TD6238Z	200p	TD4360	350p
BC109	8p	BD90	50p	R2128	100p	3N143	65p	Y88	80p	AN7154	180p	LA2200	190p	NE565	110p	STK4193	800p	STR44115	650p	TD6250	200p	TD4361	200p
BC109C	8p	BD91	50p	S2800M	52p			Y89	80p	AN7156	240p	LA1180	200p	NE566	110p	STK4194	800p	STR44117	650p	TD6250A	200p	TD4362	200p
BC140	20p	BD97	50p	S2800M	52p	DIODES		Y90	80p	AN7168	260p	LA3201	80p	NE567	115p	STK4272	720p	STR50020	550p	TD6304P	200p	TD4365	150p
BC141	20p	BDX32	100p	S2800M	52p			Y91	80p	AN7178	270p	LA3210	65p	NE571	290p	STK4273	750p	STR50032	550p	TD6306P	350p	TD4365A	150p
BC142	20p	BDX33	60p	TIP23	25p	Rectifier Diodes		Y92	80p	AN7222	180p	LA3220	100p	NE592	85p	STK4301	700p	STR50108	650p	TD6306P	350p	TD4370	320p
BC143	20p	BDX65	60p	TIP23A	25p			Y93	80p	AN7254	250p	LA3230	100p	NE593	85p	STK4302	700p	STR50110	650p	TD6306P	350p	TD4370A	320p
BC147	8p	BDW23	55p	TIP29C	25p			Y94	80p	AN7356	250p	LA3301	110p	SAA566	110p	STK4332	410p	STR50115	650p	TD6306P	350p	TD4375	400p
BC148	8p	BDW24	55p	TIP30	25p			Y95	80p	AN7390	300p	LA3350	110p	SAA1006	300p	STK4352	640p	STR50115	650p	TD6306P	350p	TD4375A	400p
BC149	8p	BDW33	50p	TIP30A	30p			Y96	80p	AN7391	300p	LA3361	100p	SAA1008	450p	STK4362	600p	STR50141	650p	TD6306P	350p	TD4376	470p
BC153	8p	BDW34	50p	TIP31A	30p			Y97	80p	AN7412	350p	LA3370	100p	SAA1012	200p	STK4374	570p	STR50141	650p	TD6306P	350p	TD4377	460p
BC158	8p	BDY92	100p	TIP31C	30p			Y98	80p	AY3-1015	200p	LA4030	180p	SAA1024	200p	STK4382	650p	STR50213	650p	TD6306P	350p	TD4379	460p
BC160	30p	BF137	35p	TIP32	24p			Y99	80p	AY3-1270	800p	LA4031	140p	SAA1025	250p	STK4382	650p	STR50241	650p	TD6306P	350p	TD4380	350p
BC171	10p	BF167	30p	TIP32A	21p			Y100	80p	AY3-1350	450p	LA4032	140p	SAA1961	400p	STK4473	900p	STR50343	650p	TD6306P	350p	TD4380A	350p
BC172	10p	BF190	15p	TIP32B	21p			Y101	80p	AY3-8910	250p	LA4033	140p	SAA1075	350p	STK4793	1100p	STR50401	650p	TD6306P	350p	TD4381	300p
BC177	14p	BF181	18p	TIP33	50p			Y102	80p	AY3-8912	400p	LA4100	160p	SAA1124	200p	STK4813	720p	STR50441	650p	TD6306P	350p	TD4382	300p
BC178	14p	BF183	20p	TIP33C	50p			Y103	80p	BA301	65p	LA4101	160p	SAA1220	400p	STK4813	720p	STR50441	650p	TD6306P	350p	TD4383	300p
BC179	14p	BF195	7p	TIP34	60p			Y104	80p	BA311	60p	LA4102	160p	SAA1250	200p	STK4833	720p	STR50441	650p	TD6306P	350p	TD4384	300p
BC182	7p	BF199	8p	TIP34C	60p			Y105	80p	BA313	60p	LA4110	120p	SAA1271	380p	STK4843	810p	STR50441	650p	TD6306P	350p	TD4385	300p
BC183	7p	BF225	30p	TIP36C	65p			Y106	80p	BA320	60p	LA4112	120p	SAA1272	280p	STK4853	900p	STR50441	650p	TD6306P	350p	TD4386	300p
BC183A	7p	BF240	16p	TIP41A	20p			Y107	80p	BA320	60p	LA4120	270p	SAA1274	280p	STK4863	900p	STR50441	650p	TD6306P	350p	TD4387	300p
BC184	7p	BF254	15p	TIP42A	20p			Y108	80p	BA325	60p	LA4125	200p	SAA1304	400p	STK4873	990p	STR50441	650p	TD6306P	350p	TD4388	300p
BC212	7p	BF255	12p	TIP42C	22p			Y109	80p	BA330	60p	LA4130	240p	SAA5012	400p	STK4883	1000p	STR50441	650p	TD6306P	350p	TD4389	300p
BC212L	7p	BF256	18p	TIP47	40p			Y110	80p	BA335	60p	LA4135	280p	SAA5012	400p	STK4893	1000p	STR50441	650p	TD6306P	350p	TD4390	300p
BC213	7p	BF258	18p	TIP50	60p			Y111	80p	BA340	60p	LA4140	240p	SAA5012	400p	STK4903	1000p	STR50441	650p	TD6306P	350p	TD4391	300p
BC214	7p	BF259	18p	TIP51	120p			Y112	80p	BA345	60p	LA4145	280p	SAA5012	400p	STK4913	1000p	STR50441	650p	TD6306P	350p	TD4392	300p
BC217	7p	BF262	25p	TIP52	120p			Y113	80p	BA350	60p	LA4150	320p	SAA5012	400p	STK4923	1000p	STR50441	650p	TD6306P	350p	TD4393	300p
BC237	7p	BF267	25p	TIP53	120p			Y114	80p	BA355	60p	LA4155	360p	SAA5012	400p	STK4933	1000p	STR50441	650p	TD6306P	350p	TD4394	300p
BC238	7p	BF270	18p	TIP54	140p			Y115	80p	BA360	60p	LA4160	400p	SAA5012	400p	STK4943	1000p	STR50441	650p	TD6306P	350p	TD4395	300p
BC239	7p	BF273	15p	TIP105	65p			Y116	80p	BA365	60p	LA4165	440p	SAA5012	400p	STK4953	1000p	STR50441	650p	TD6306P	350p	TD4396	300p
BC300	20p	BF311	21p	TIP106	65p			Y117	80p	BA370	60p	LA4170	480p	SAA5012	400p	STK4963	1000p	STR50441	650p	TD6306P	350p	TD4397	300p
BC301	20p	BF312	21p	TIP107	65p			Y118	80p	BA375	60p	LA4175	520p	SAA5012	400p	STK4973	1000p	STR50441	650p	TD6306P	350p	TD4398	300p
BC302	20p	BF337	20p	TIP110	50p			Y119	80p	BA380	60p	LA4180	560p	SAA5012	400p	STK4983	1000p	STR50441	650p	TD6306P	350p	TD4399	300p
BC303	20p	BF338	20p	TIP111	50p			Y120	80p	BA385	60p	LA4185	600p	SAA5012	400p	STK4993	1000p	STR50441	650p	TD6306P	350p	TD4400	300p
BC304	25p	BF362	30p	TIP112	50p			Y121	80p	BA390	60p	LA4190	640p	SAA5012	400p	STK5003	1000p	STR50441	650p	TD6306P	350p	TD4401	300p
BC327	7p	BF345	13p	TIP113	45p			Y122	80p	BA395	60p	LA4195	680p	SAA5012	400p	STK5013	1000p	STR50441	650p	TD6306P	350p	TD4402	300p
BC328	7p	BF371	17p	TIP116	45p			Y123	80p	BA400	60p	LA4200	720p	SAA5012	400p	STK5023	1000p	STR50441	650p	TD6306P	350p	TD4403	300p
BC337	7p	BF490	25p	TIP117	50p			Y124	80p	BA405	60p	LA4205	760p	SAA5012	400p	STK5033	1000p	STR50441	650p	TD6306P	350p	TD4404	300p
BC338	7p	BF490	25p	TIP118	50p			Y125	80p	BA410	60p	LA4210	800p	SAA5012	400p	STK5043	1000p	STR50441	650p	TD6306P	350p	TD4405	300p
BC446	8p	BF443	30p	TIP122	50p			Y126	80p	BA415	60p	LA4215	840p	SAA5012	400p	STK5053	1000p	STR50441	650p	TD6306P	350p	TD4406	300p
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BC461	8p	BFX84	20p	TIP126	56p			Y128	80p	BA425	60p	LA4225	920p	SAA5012	400p	STK5073	1000p	STR50441	650p	TD6306P	350p	TD4408	300p
BC477	18p	BFX87	20p	TIP127	56p			Y129	80p	BA430	60p	LA4230	960p	SAA5012	400p	STK5083	1000p	STR50441	650p	TD6306P	350p	TD4409	300p
BC512	22p	BFX88	15p	TIP131	30p			Y130	80p	BA435	60p	LA4235	1000p	SAA5012	400p	STK5093	1000p	STR50441	650p	TD6306P	350p	TD4410	300p
BC537	25p	BFX89	60p	TIP141	90p			Y131	80p	BA440	60p	LA4240	1040p	SAA5012	400p	STK5103	1000p	STR50441	650p	TD6306P	350p	TD4411	300p
BC546	8p	BFY17	30p	TIP142	90p			Y132	80p	BA445	60p	LA4245	1080p	SAA5012	400p	STK5113	1000p	STR50441	650p	TD6306P	350p	TD4412	300p
BC547	8p	BFY18	30p	TIP143	90p			Y133	80p	BA450	60p	LA4250	1120p	SAA5012	400p	STK5123	1000p	STR50441	650p	TD6306P	350p	TD4413	300p
BC548	8p	BFY50	14p	TIP146	90p			Y134	80p	BA455	60p	LA4255	1160p	SAA5012	400p	STK5133	1000p	STR50441	650p	TD6306P	350p	TD4414	300p
BC549	8p	BFY51	14p	TIP147	100p			Y135	80p	BA460	60p	LA4260	1200p	SAA5012	400p	STK5143	1000p	STR50441	650p	TD6306P	350p	TD4415	300p
BC550	8p	BFY52	14p	TIP150	90p			Y136	80p	BA465	60p	LA4265	1240p	SAA5012	400p	STK5153	1000p	STR50441	650p	TD6306P	350p	TD4416	300p
BC556	8p	BFY53	14p	TIP151	90p			Y137	80p	BA470	60p	LA4270	1280p	SAA5012	400p	STK5163	1000p	STR50441	650p	TD6306P	350p	TD4417	300p
BC557	8p	BFY64	25p	TIP295S	42p			Y138	80p	BA475	60p	LA4275	1320p	SAA5012	400p	STK5173	1000p	STR50441	650p	TD6306P	350p	TD4418	300p
BC558	8p	BFY90	45p	TIP305S	45p			Y139	80p	BA480	60p	LA4280	1360p	SAA5012	400p	STK5183	1000p	STR50441	650p	TD6306P	350p	TD4419	300p
BC559	8p	BFY98	45p	TIP305S	42p			Y140	80p	BA485	60p	LA4285	1400p	SAA5012	400p	STK5193	1000p	STR50441	650p	TD6306P	350p	TD4420	300p
BC560	8p	BFY99	45p	TIP305S	42p			Y141	80p	BA490	60p	LA4290	1440p	SAA5012	400p	STK5203	1000p	STR50441	650p	TD6306P	350p	TD4421	300p
BC637	20p	BR103	7p	TIS61	15p			Y142	80p	BA495	60p	LA4295	1480p	SAA5012	400p	STK5213	1000p	STR50441	650p	TD630			

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UIC1365 250p	25A1186 500p	25C619 100p	25C1634 50p	25C2333 200p	25C2944 620p	25C3568 200p	25D 792 400p	25D 1407 100p	25K 240 140p	2539 200p	2539 200p
UIC1367 500p	25A1198 300p	25C647 800p	25C1635 50p	25C2334 240p	25C2958 750p	25C3583 170p	25D 794 100p	25D 1408 125p	25K 270 50p	2542 200p	2542 200p
UIC1370C 300p	25A1200 700p	25C648 500p	25C1636 50p	25C2335 150p	25C2962 800p	25C3585 200p	25D 795 100p	25D 1409 100p	25K 270 50p	2543 200p	2543 200p
UIC1373 850p	25A1208 70p	25C644 25p	25C1637 50p	25C2344 150p	25C2962 800p	25C3595 220p	25D 811 450p	25D 1412 100p	25K 310 200p	2544 200p	2544 200p
UIC1377C 200p	25A1209 100p	25C647 300p	25C1638 50p	25C2347 50p	25C2979 160p	25C3598 280p	25D 819 400p	25D 1413 175p	25K 312 750p	2545 200p	2545 200p
UIC1378 180p	25A1210 120p	25C681 340p	25C1639 120p	25C2353 120p	25C2987 325p	25C3604 650p	25D 820 450p	25D 1414 700p	25K 315 70p	2546 200p	2546 200p
UIC1382 110p	25A1211 100p	25C682 340p	25C1640 100p	25C2356 450p	25C2988 400p	25C3605 200p	25D 821 400p	25D 1415 100p	25K 316 100p	2547 200p	2547 200p
UIC1384 425p	25A1216 550p	25C708 100p	25C1641 45p	25C2362 50p	25C2995 60p	25C3606 100p	25D 822 400p	25D 1417 125p	25K 322 140p	2548 200p	2548 200p
UIC1387 250p	25A1217 100p	25C710 20p	25C1642 50p	25C2365 500p	25C3001 1400p	25C3607 150p	25D 826 100p	25D 1425 360p	25K 323 130p	2549 200p	2549 200p
UIC1394 120p	25A1220 120p	25C711 40p	25C1643 50p	25C2366 500p	25C3002 1400p	25C3608 120p	25D 836 600p	25D 1426 160p	25K 358 300p	2550 200p	2550 200p
UIC1397 350p	25A1222A 300p	25C712 300p	25C1644 50p	25C2367 100p	25C3003 1400p	25C3609 100p	25D 836A 130p	25D 1427 300p	25K 370 400p	2551 200p	2551 200p
1403CA 650p	25A1242 80p	25C732 40p	25C1645 50p	25C2371 45p	25C3005 1250p	25C3615 200p	25D 837 800p	25D 1428 360p	25K 371 400p	2552 200p	2552 200p
1420CA 450p	25A1244 120p	25C733 25p	25C1646 50p	25C2373 210p	25C3005 500p	25C3616 500p	25D 844 200p	25D 1430 280p	25K 388 850p	2553 200p	2553 200p
1421CA 650p	25A1246 80p	25C739 45p	25C1647 50p	25C2383 50p	25C3006 500p	25C3617 500p	25D 845 200p	25D 1432 400p	25K 405 450p	2554 200p	2554 200p
1422CA 550p	25A1248 100p	25C738 40p	25C1648 50p	25C2387 125p	25C3007 500p	25C3618 500p	25D 850 260p	25D 1433 750p	25K 414 500p	2555 200p	2555 200p
1423CA 550p	25A1262 160p	25C716 150p	25C1649 50p	25C2408 120p	25C3008 500p	25C3619 500p	25D 856 450p	25D 1438 140p	25K 415 500p	2556 200p	2556 200p
1424CA 550p	25A1263 280p	25C717 150p	25C1650 50p	25C2412K 50p	25C3009 500p	25C3620 500p	25D 864 200p	25D 1439 200p	25K 421 180p	2557 200p	2557 200p
1425CA 550p	25A1264 280p	25C718 105p	25C1651 50p	25C2417 200p	25C3012 600p	25C3621 500p	25D 864 200p	25D 1441 280p	25K 421 180p	2558 200p	2558 200p
1426CA 550p	25A1265 280p	25C719 80p	25C1652 50p	25C2429 900p	25C3012 600p	25C3622 500p	25D 864 200p	25D 1442 280p	25K 421 180p	2559 200p	2559 200p
1427CA 550p	25A1266 280p	25C720 80p	25C1653 50p	25C2431 900p	25C3013 600p	25C3623 500p	25D 864 200p	25D 1443 280p	25K 421 180p	2560 200p	2560 200p
1428CA 550p	25A1267 280p	25C721 80p	25C1654 50p	25C2433 900p	25C3014 600p	25C3624 500p	25D 864 200p	25D 1444 280p	25K 421 180p	2561 200p	2561 200p
1429CA 550p	25A1268 280p	25C722 80p	25C1655 50p	25C2435 900p	25C3015 600p	25C3625 500p	25D 864 200p	25D 1445 280p	25K 421 180p	2562 200p	2562 200p
1430CA 550p	25A1269 280p	25C723 80p	25C1656 50p	25C2437 900p	25C3016 600p	25C3626 500p	25D 864 200p	25D 1446 280p	25K 421 180p	2563 200p	2563 200p
1431CA 550p	25A1270 280p	25C724 80p	25C1657 50p	25C2439 900p	25C3017 600p	25C3627 500p	25D 864 200p	25D 1447 280p	25K 421 180p	2564 200p	2564 200p
1432CA 550p	25A1271 280p	25C725 80p	25C1658 50p	25C2441 900p	25C3018 600p	25C3628 500p	25D 864 200p	25D 1448 280p	25K 421 180p	2565 200p	2565 200p
1433CA 550p	25A1272 280p	25C726 80p	25C1659 50p	25C2443 900p	25C3019 600p	25C3629 500p	25D 864 200p	25D 1449 280p	25K 421 180p	2566 200p	2566 200p
1434CA 550p	25A1273 280p	25C727 80p	25C1660 50p	25C2445 900p	25C3020 600p	25C3630 500p	25D 864 200p	25D 1450 280p	25K 421 180p	2567 200p	2567 200p
1435CA 550p	25A1274 280p	25C728 80p	25C1661 50p	25C2447 900p	25C3021 600p	25C3631 500p	25D 864 200p	25D 1451 280p	25K 421 180p	2568 200p	2568 200p
1436CA 550p	25A1275 280p	25C729 80p	25C1662 50p	25C2449 900p	25C3022 600p	25C3632 500p	25D 864 200p	25D 1452 280p	25K 421 180p	2569 200p	2569 200p
1437CA 550p	25A1276 280p	25C730 80p	25C1663 50p	25C2451 900p	25C3023 600p	25C3633 500p	25D 864 200p	25D 1453 280p	25K 421 180p	2570 200p	2570 200p
1438CA 550p	25A1277 280p	25C731 80p	25C1664 50p	25C2453 900p	25C3024 600p	25C3634 500p	25D 864 200p	25D 1454 280p	25K 421 180p	2571 200p	2571 200p
1439CA 550p	25A1278 280p	25C732 80p	25C1665 50p	25C2455 900p	25C3025 600p	25C3635 500p	25D 864 200p	25D 1455 280p	25K 421 180p	2572 200p	2572 200p
1440CA 550p	25A1279 280p	25C733 80p	25C1666 50p	25C2457 900p	25C3026 600p	25C3636 500p	25D 864 200p	25D 1456 280p	25K 421 180p	2573 200p	2573 200p
1441CA 550p	25A1280 280p	25C734 80p	25C1667 50p	25C2459 900p	25C3027 600p	25C3637 500p	25D 864 200p	25D 1457 280p	25K 421 180p	2574 200p	2574 200p
1442CA 550p	25A1281 280p	25C735 80p	25C1668 50p	25C2461 900p	25C3028 600p	25C3638 500p	25D 864 200p	25D 1458 280p	25K 421 180p	2575 200p	2575 200p
1443CA 550p	25A1282 280p	25C736 80p	25C1669 50p	25C2463 900p	25C3029 600p	25C3639 500p	25D 864 200p	25D 1459 280p	25K 421 180p	2576 200p	2576 200p
1444CA 550p	25A1283 280p	25C737 80p	25C1670 50p	25C2465 900p	25C3030 600p	25C3640 500p	25D 864 200p	25D 1460 280p	25K 421 180p	2577 200p	2577 200p
1445CA 550p	25A1284 280p	25C738 80p	25C1671 50p	25C2467 900p	25C3031 600p	25C3641 500p	25D 864 200p	25D 1461 280p	25K 421 180p	2578 200p	2578 200p
1446CA 550p	25A1285 280p	25C739 80p	25C1672 50p	25C2469 900p	25C3032 600p	25C3642 500p	25D 864 200p	25D 1462 280p	25K 421 180p	2579 200p	2579 200p
1447CA 550p	25A1286 280p	25C740 80p	25C1673 50p	25C2471 900p	25C3033 600p	25C3643 500p	25D 864 200p	25D 1463 280p	25K 421 180p	2580 200p	2580 200p
1448CA 550p	25A1287 280p	25C741 80p	25C1674 50p	25C2473 900p	25C3034 600p	25C3644 500p	25D 864 200p	25D 1464 280p	25K 421 180p	2581 200p	2581 200p
1449CA 550p	25A1288 280p	25C742 80p	25C1675 50p	25C2475 900p	25C3035 600p	25C3645 500p	25D 864 200p	25D 1465 280p	25K 421 180p	2582 200p	2582 200p
1450CA 550p	25A1289 280p	25C743 80p	25C1676 50p	25C2477 900p	25C3036 600p	25C3646 500p	25D 864 200p	25D 1466 280p	25K 421 180p	2583 200p	2583 200p
1451CA 550p	25A1290 280p	25C744 80p	25C1677 50p	25C2479 900p	25C3037 600p	25C3647 500p	25D 864 200p	25D 1467 280p	25K 421 180p	2584 200p	2584 200p
1452CA 550p	25A1291 280p	25C745 80p	25C1678 50p	25C2481 900p	25C3038 600p	25C3648 500p	25D 864 200p	25D 1468 280p	25K 421 180p	2585 200p	2585 200p
1453CA 550p	25A1292 280p	25C746 80p	25C1679 50p	25C2483 900p	25C3039 600p	25C3649 500p	25D 864 200p	25D 1469 280p	25K 421 180p	2586 200p	2586 200p
1454CA 550p	25A1293 280p	25C747 80p	25C1680 50p	25C2485 900p	25C3040 600p	25C3650 500p	25D 864 200p	25D 1470 280p	25K 421 180p	2587 200p	2587 200p
1455CA 550p	25A1294 280p	25C748 80p	25C1681 50p	25C2487 900p	25C3041 600p	25C3651 500p	25D 864 200p	25D 1471 280p	25K 421 180p	2588 200p	2588 200p
1456CA 550p	25A1295 280p	25C749 80p	25C1682 50p	25C2489 900p	25C3042 600p	25C3652 500p	25D 864 200p	25D 1472 280p	25K 421 180p	2589 200p	2589 200p
1457CA 550p	25A1296 280p	25C750 80p	25C1683 50p	25C2491 900p	25C3043 600p	25C3653 500p	25D 864 200p	25D 1473 280p	25K 421 180p	2590 200p	2590 200p
1458CA 550p	25A1297 280p	25C751 80p	25C1684 50p	25C2493 900p	25C3044 600p	25C3654 500p	25D 864 200p	25D 1474 280p	25K 421 180p	2591 200p	2591 200p
1459CA 550p	25A1298 280p	25C752 80p	25C1685 50p	25C2495 900p	25C3045 600p	25C3655 500p	25D 864 200p	25D 1475 280p	25K 421 180p	2592 200p	2592 200p
1460CA 550p	25A1299 280p	25C753 80p	25C1686 50p	25C2497 900p	25C3046 600p	25C3656 500p	25D 864 200p	25D 1476 280p	25K 421 180p	2593 200p	2593 200p
1461CA 550p	25A1300 280p	25C754 80p	25C1687 50p	25C2499 900p	25C3047 600p	25C3657 500p	25D 864 200p	25D 1477 280p	25K 421 180p	2594	







## VIDEO SERVICE KITS

<b>AMSTRAD</b>			
VCR700			
<b>Contents</b>			
BELT SET PINCH ROLLER REEL IDLER VIDEO LAMP			
Order Code: SK41		£5.50	
<b>FERGUSON &amp; JVC</b>			
3V42/43			
HRD455/HRD725			
<b>Contents</b>		<b>Economy Kit Contents</b>	
BELT SET PINCH ROLLER		BELT SET PINCH ROLLER	
CLUTCH MECHANISM TENSION BAND		SUPPLY CLUTCH TAKE UP CLUTCH	
Order Code: SK37	£17.50	Order Code: SK38	£9.50
3V58/59/64/65			
HRD170/180/210/230/300/320/370/400/430/530/700/750			
HR55000			
<b>Contents</b>		<b>Economy Kit Contents</b>	
BELT SET PINCH ROLLER IDLER ARM TENSION BAND		BELT SET PINCH ROLLER REEL DRIVE UNIT TENSION BAND	
Order Code: SK44			£8.50
3V29/3V30			
HR7200/7300/7350			
<b>Contents</b>		<b>Economy Kit Contents</b>	
BELT SET PINCH ROLLER TENSION BAND IDLER TYRES		BELT SET PINCH ROLLER TENSION BAND IDLER TYRE	
Order Code: SK05			£6.00
3V35/36/38/39/49			
HRD110/111/120/225			
<b>Contents</b>		<b>Economy Kit Contents</b>	
BELT SET PINCH ROLLER TENSION BAND IDLER TYRES		BELT SET PINCH ROLLER TENSION BAND IDLER TYRE	
Order Code: SK04			£5.50
3V31/3V42			
HR7600/7610/7650/7655			
<b>Contents</b>		<b>Economy Kit Contents</b>	
BELT SET T/U REEL TABLE TYRE PINCH ROLLER REEL IDLER T/U CLUTCH T/U IDLER TENSION BAND VIDEO LAMP		BELT SET T/U REEL TABLE TYRE SUPPLY REEL TABLE TYRE PINCH ROLLER T/U CLUTCH T/U IDLER REEL IDLER TYRE	
Order Code: SK33	£12.00	Order Code: SK34	£5.50
3V35/36/38/39/49			
HRD110/111/120/121/225			
<b>Contents</b>		<b>Economy Kit Contents</b>	
BELT SET T/U REEL TABLE TYRE SUPPLY REEL TABLE TYRE PINCH ROLLER T/U CLUTCH T/U IDLER REEL IDLER TENSION BAND		BELT SET T/U REEL TABLE TYRE SUPPLY REEL TABLE TYRE PINCH ROLLER T/U CLUTCH T/U IDLER REEL IDLER TYRE	
Order Code: SK35	£10.50	Order Code: SK36	£6.50
3V29/3V30			
HR7200/7300/7350			
<b>Contents</b>		<b>Economy Kit Contents</b>	
BELT SET T/U REEL TABLE TYRE SUPPLY REEL TABLE TYRE PINCH ROLLER REEL IDLER T/U CLUTCH T/U IDLER TENSION BAND VIDEO LAMP		BELT SET T/U REEL IDLER TYRE SUPPLY REEL TABLE TYRE PINCH ROLLER REEL IDLER TYRE T/U IDLER TYRE T/U CLUTCH	
Order Code: SK31	£11.50	Order Code: SK32	£5.60
3V44/45/48/53/54/55/57			
HRP50/HRD140/150/158/160			
HRD250/257/565/566/755			
<b>Contents</b>		<b>Economy Kit Contents</b>	
BELT SET PINCH ROLLER CLUTCH MECHANISM TENSION BAND		BELT SET PINCH ROLLER	
Order Code: SK39	£15.00	Order Code: SK40	£9.50
<b>FISHER</b>			
FVHP905/906/907/908/910/911/916/918			
<b>Contents</b>		<b>Economy Kit Contents</b>	
BELT SET PINCH ROLLER IDLER GEAR IDLER UNIT TENSION BAND		BELT SET PINCH ROLLER IDLER TYRE	
Order Code: SK57	£13.00	Order Code: SK58	£5.00
FVHP615/618/620/622/710/711/715/716/720/721/722/725/730/830/840			
<b>Contents</b>		<b>Economy Kit Contents</b>	
BELT SET PINCH ROLLER IDLER GEAR IDLER UNIT TENSION BAND		BELT SET PINCH ROLLER IDLER TYRE	
Order Code: SK68	£12.50	Order Code: SK69	£3.60
<b>HITACHI</b>			
VT11/VT33			
<b>Contents</b>		<b>Economy Kit Contents</b>	
BELT SET PINCH ROLLER TENSION BAND IDLER TYRES		BELT SET PINCH ROLLER TENSION BAND IDLER TYRE	
Order Code: SK08			£6.00
VT11/VT33			
<b>Contents</b>		<b>Economy Kit Contents</b>	
BELT SET T/UP REEL TABLE TYRE SUPPLY REEL TABLE TYRE PINCH ROLLER FF/REW IDLER CLUTCH PLATE TENSION BAND		BELT SET PINCH ROLLER FF/REW IDLER TYRE T/UP REEL TABLE TYRE	
Order Code: SK45	£15.00	Order Code: SK46	£4.50

## VIDEO SERVICE KITS (Cont.)

<b>HITACHI</b>			
VT52/61/62/63/64/65/85/86/640			
<b>Contents</b>		<b>Economy Kit Contents</b>	
BELT SET PINCH ROLLER FF/REW ARM CLUTCH PLATE TENSION BAND		BELT SET PINCH ROLLER FF/REW IDLER	
Order Code: SK49	£14.00	Order Code: SK50	£3.25
VT400/405/410/13/14/15/18/20/25/26/28/430/31/35/48/450/498/510/520/25/26/530/35/36/540/545/46/48/570/75/576/580/85/88			
<b>Contents</b>		<b>Economy Kit Contents</b>	
TIMING BELT PINCH ROLLER FF/REW ARM CLUTCH BASE TENSION BAND		BELT SET PINCH ROLLER TENSION BAND	
Order Code: SK52			£11.50
VT100/110/111/113/115/118/120/125/128/130/135/138/145/150/175/220/225/250/255/258/260/NTL30			
<b>Contents</b>		<b>Economy Kit Contents</b>	
BELT SET PINCH ROLLER FF/REW ARM CLUTCH PLATE TENSION BAND		BELT SET PINCH ROLLER TENSION BAND	
Order Code: SK51			£15.00
<b>PANASONIC</b>			
NV2000/NV2010			
<b>Contents</b>		<b>Economy Kit Contents</b>	
BELT SET PINCH ROLLER TENSION BAND IDLER TYRES		BELT SET PINCH ROLLER TENSION BAND IDLER TYRES	
Order Code: SK03	£6.25	Order Code: SK02	£5.50
NV300/NV330/NV333/NV340/NV366			
<b>Contents</b>		<b>Economy Kit Contents</b>	
BELT SET PINCH ROLLER TENSION BAND IDLER TYRE		BELT SET PINCH ROLLER TENSION BAND IDLER TYRE	
Order Code: SK01			£5.50
NV2000/NV2010			
<b>Contents</b>		<b>Economy Kit Contents</b>	
BELT SET PINCH ROLLER FF IDLER PLAY IDLER TENSION BAND VIDEO LAMP		BELT SET PINCH ROLLER IDLER TYRE PULLEY TYRE	
Order Code: SK13	£9.50	Order Code: SK14	£4.50
NV7000/NV7200/NV7800			
<b>Contents</b>		<b>Economy Kit Contents</b>	
BELT SET PINCH ROLLER IDLER UNIT PLAY IDLER TENSION BAND		BELT SET PINCH ROLLER IDLER TYRE CLUTCH TYRE	
Order Code: SK11	£10.00	Order Code: SK12	£4.20
NV300/NV330/NV333/NV340/NV366			
<b>Contents</b>		<b>Economy Kit Contents</b>	
BELT SET PINCH ROLLER IDLER UNIT PLAY IDLER TENSION BAND		BELT SET PINCH ROLLER IDLER TYRE PLAY IDLER TYRE	
Order Code: SK15	£8.00	Order Code: SK16	£4.00
NVG7/NVG9/NVG10/NVG11/NVG12/NVG14/NVG15/NVG16/NVG18/NVG30/NVG120/NVG130/NVG400/NVH65 (PX/AC)/AG1810 (P/K)			
<b>Contents</b>		<b>Economy Kit Contents</b>	
LOADING BELT CAPSTAN BELT PINCH ROLLER IDLER TENSION BAND		LOADING BELT CAPSTAN BELT PINCH ROLLER IDLER TYRE	
Order Code: SK27	£9.50	Order Code: SK28	£4.50
NV332			
<b>Contents</b>		<b>Economy Kit Contents</b>	
BELT SET PINCH ROLLER PLAY IDLER FF/REW IDLER TENSION BAND FF/REW TYRE		BELT SET PINCH ROLLER PLAY IDLER TYRE FF/REW IDLER TYRE	
Order Code: SK29	£13.00	Order Code: SK30	£5.10
NV230/250/260/280/430/450/460/470/650/810/890/AG1200PK/AG1500PK			
<b>Contents</b>		<b>Economy Kit Contents</b>	
BELT SET PINCH ROLLER IDLER TENSION BAND		BELT SET PINCH ROLLER IDLER TYRE	
Order Code: SK23	£7.00	Order Code: SK24	£3.50
NV600/NV688			
<b>Contents</b>		<b>Economy Kit Contents</b>	
BELT SET PINCH ROLLER PLAY IDLER FF/REW IDLER TENSION BAND		BELT SET PINCH ROLLER PLAY IDLER TYRE FF/REW IDLER TYRE	
Order Code: SK25	£13.00	Order Code: SK26	£6.50
NV730/NV770			
<b>Contents</b>		<b>Economy Kit Contents</b>	
SLOT IN BELT LOADING BELT PINCH ROLLER IDLER UNIT TENSION BAND		SLOT IN BELT LOADING BELT PINCH ROLLER IDLER TYRE	
Order Code: SK19	£7.00	Order Code: SK20	£4.30
NV370/NV380/480/630/780/830/850/AG2100PK/AG2200PK			
<b>Contents</b>		<b>Economy Kit Contents</b>	
BELT SET PINCH ROLLER IDLER TENSION BAND		BELT SET PINCH ROLLER IDLER TYRE	
Order Code: SK21	£7.00	Order Code: SK22	£3.50
NV777/NV788			
<b>Contents</b>		<b>Economy Kit Contents</b>	
BELT SET PINCH ROLLER IDLER UNIT TENSION BAND		BELT SET PINCH ROLLER IDLER TYRE	
Order Code: SK17	£7.50	Order Code: SK18	£4.00

## VIDEO SERVICE KITS (Cont.)

<b>SHARP</b>			
VC381			
<b>Contents</b>		<b>Economy Kit Contents</b>	
BELT SET PINCH ROLLER REEL IDLER TENSION BAND VIDEO LAMP		BELT SET PINCH ROLLER REEL IDLER TYRE	
Order Code: SK47	£9.00	Order Code: SK48	£5.00
VC500/VC571/VC581/VC582/VC583/VC584/VC5F3			
<b>Contents</b>		<b>Economy Kit Contents</b>	
BELT SET PINCH ROLLER REEL IDLER TENSION BAND		BELT SET PINCH ROLLER REEL IDLER	
Order Code: SK60	£9.50	Order Code: SK61	£6.50
VC781/VC7810/VC7822/VC785/VC786/VC793/VC800/VC100/VC102/VC104/VC104/VC202			
<b>Contents</b>		<b>Economy Kit Contents</b>	
BELT SET PINCH ROLLER REEL DRIVE UNIT TENSION BAND		BELT SET PINCH ROLLER REEL DRIVE UNIT TYRE	
Order Code: SK64	£13.50	Order Code: SK65	£6.25
VC681/VC682/VC684/VC685/VC693/VC699/VC6F3/VC700			
<b>Contents</b>		<b>Economy Kit Contents</b>	
BELT SET PINCH ROLLER REEL DRIVE UNIT TENSION BAND		BELT SET PINCH ROLLER REEL DRIVE UNIT TYRE	
Order Code: SK62	£13.50	Order Code: SK63	£6.25

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HS306, 318, 710			
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ICPF15	ICPN10
ICPF20	ICPN15
ICPF25	ICPN20
ICPF38	ICPN25
ICPF50	ICPN38
ICPF75	ICPN50
	ICPN75

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 VSR9 1700P

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 8923/8925/8929/8935 650P  
 8931/8933 750P  
 FV43H, HRD860 3800P  
 VC141L, HRD190, HRD610 3050P  
 FV44L 2200P  
 BR1600, HRD142, HRD156, HRD152 1550P  
 BR6200 720P  
 HRD154, HRD217, HRD321, HRD350, HRD521, HRD522, HRD525, HRD527, HRD550 1700P  
 HRD580, HRD620, HRD650 2900P

**FIDELITY**  
 VR900, VR910 1600P

**FISHER**  
 FVHD140, FVHD40, FVHP1, FVHP10, FVHP20 1600P  
 FVHP40, FVHS10 1600P  
 FVHP200, FVHP210, FVHP300, FVHP310 2100P  
 FVHP500, FVHP5100, FVHP730, FVHP830 1200P  
 FVHP980 2500P

**FUNAI**  
 E1100, VIP5000 1200P  
 VCR5840, VCR8007, VIP2500A, VIP3000A, VIP6000, VIP150 2200P  
 VCR4530, VCR6000, VCR6100 1600P  
 VCR8103, VCR600, VCR6100 1600P  
 VCR8103, VCR8107 2200P  
 VIP300A MKII 1900P

**GEC**  
 V4005H 2000P

**GOLDSTAR**  
 GHV1232, 1233, 1241, 1242, 1243, 1244, 1290, 1291, 1295, 1296, 1891, VCP4130, 4300, 4301, 4305, 4306, 4310, 4311, 4315, 4316, 4320, 4321, 4326 1650P

**GRUNDIG**  
 VS456 1700P  
 SE6110, SE9100, TVR4510, TVR5510, VS500, VS510, VS5180, VS6190, VS700, VS900 1800P  
 VS790, VS930, VS940 3800P  
 MVS660, SE6160, VERONA, VS660, VS6690 3500P  
 MVS710, MVS720, MVS910, SE9120, VS800, VSB10, VS910, VS920, SE7120, VS710, VS720 1800P  
 VS160, VS740 4400P  
 VS170 4600P  
 VS680 4600P

**HINARI**  
 VCR34H, VTV200, VXL90 1850P

**HITACHI**  
 VT15, VTP10, VTP30 1100P  
 VT16B, VT260, VT498 2700P  
 VT570, VT575, VT576, VT580, VT585, VT588 3400P  
 VT5600 1200P  
 VT60 1500P  
 VT660E 2600P  
 VT6700, VT6800 1200P  
 VTL30 2100P

VT522, VTM620, VTM622, VTM720, VTM722, VTM822 2000P  
 VTM725, VTM726, VTM72B 1600P

**ITT**  
 VR3520, VR3701, VR3719, VR3720, VR3721, VR3759, VR9720 2000P  
 VR3730, VR3731, VR3749, VR3907, VR3908 2700P  
 VR3918, VR3919, VR3938 1600P  
 VR396B 7000P  
 VR3984 2300P  
 VR3958, VR4993 650P  
 VR4913, VRP3833 650P

**LUXOR**  
 9245, 9251, 9254 1225P  
 9255, 9256 2150P  
 9270, 9271, 9273 9253  
 9272, 928217 2700P  
 9252 2500P  
 928017, 928077, 928097, 929107, 929117 1700P  
 9253 2500P  
 9281 2700P  
 9284, 9295, VR3701, VR3721, VR3731, VR3761 2100P

**MATSUI**  
 VX600 1100P  
 VX750 1500P  
 VX990 1600P

**MITSUBISHI**  
 HSE12, HSE22, MX1 2400P  
 HS411EZ, HS411GZ 2900P  
 HS273 1700P  
 HSB10, HSB20, HSE10, HSE20, HSE21, HSE41 2200P  
 HSB11, HSB21 2200P  
 HSB30 2400P  
 HSE31, HSB31, HSE32 2800P  
 HSE50 3300P

**NATIONAL**  
 NV8050, NV8051 2800P  
 AG1000, AG1050, NV260 1650P  
 AG6010, AG6015 2500P  
 AG6840 2400P  
 NV200 850P  
 NVD80 5000P  
 NVF65, NVH75 3400P  
 NVF51 4200P  
 NVG19 2300P  
 NVJ33, NVL21, NVJ30 2300P  
 NVJ35 3000P  
 NVM1, NVM3, NVM5 4200P  
 AG2100, AG2200 700P  
 NVF65 3200P

**N.E.C.**  
 DX2000 3400P  
 DS6000 3500P  
 DX1000, DX1600, N9040, N9053, N9055 2000P  
 DX4000, N9610, DX3000 3200P  
 N9052, N9530 3400P  
 N9110, N9120, N914C 2700P  
 VCP1 1700P  
 PVC2300, PVC240, PVC740, PVC744, PVC760, PVC764 1600P

**SAMSUNG**  
 VM1560, VN1561 2200P

**SANYO**  
 VHR7900 3600P

**SHARP**  
 VC585, VC685 2300P  
 VC90ET 3900P  
 VFH815 2800P

**SONY**  
 SLV373UB 3000P

**TOSHIBA**  
 V660 2350P  
 V880MS 2500P  
 V700G 3700P  
 V500G, V509G 2900P  
 V9680 2550P  
 V300G, V301, V305, V309G 1700P  
 V61, V63 1700P  
 V110, V120, V130, V140, V210, V220 1800P

## LOADING MOTOR UNITS

**ITT**  
 VR3605, VR3905, VR3955, VR3985 1100P  
 VP2826, VR3906, V43926, VR3976 1250P  
 VP3946, VR3906, VR3948, VR3986, VR3995, VR6948 1500P

**JVC**  
 HRD110, HRD111, HRD120, HRD121, HRD225 1100P  
 HRD140, HRD150, HRD157M, HRD158MS, HRD160, HRD250, HRD257MS, HRD566, HRP50 1250P  
 HRD455, HRD725, N895 1500P

**SABA**  
 VR6005, VR6014, VR7004, VR7011, VR8011, VR8014 1100P  
 VR6006, VR6007, VR608, VR6009, VR6018, VR7007, VR7018, VR9006 1250P  
 VR6016, VR6038, VR7016 1500P

**TELEFUNKEN**  
 VR1925, VR1930, VR1940, VR1950, VR925, VR930, VR940, VR950 1100P  
 A920, VR2920, VR12970, VR7921, VR7926, VR7931, VR7971, VR975 1250P  
 VR1970, VR1980, VR7970, VR7980, VR970, VR980 1500P

**THOMSON**  
 V320, V321, V323, V326, V4200, V4300 1100P  
 V342, V343, V352, V353, V360, V4210, V4230, V4260 1250P  
 V364, V368, V4400, V6000 1500P

**THORN-FERGUSON**  
 3V35, 3V36, 3V38, 3V39, 3V49, 8943, 8944 1100P  
 3V44, 3V45, 3V48, 3V54, 3V55, 3V57, 8947, 8947B, 8948 1250P  
 3V43, 9845 1500P

**TOSHIBA**  
 V55, V57 1100P  
 V65, V66, V67 1250P  
 V61, V63 1500P

## CASSETTE HOUSING

**AKAI**  
 VS35, VS53, VS55, VS66, VS75 2600P

**FERGUSON**  
 FV31R 4300P

**JVC & FERGUSON**  
 HRD515, HRD520, HRD527, HRD540, HRD550, HRD580, HRD600, HRD610, HRD620, HRD660, HRD670, HRD830, HRD840, HRD850, HRD860, HRD4050, HRD6600 & FV37H 1350P

## IC TRANSISTORS

M491BB1 500P  
 SAA5243PE 800P  
 TIP112H 50P  
 UPC1488H 150P  
 STR4090A 650P

## IC AND TRANSISTORS

BU506DF 120P  
 BUZ11 200P  
 BUZ80 200P  
 M494B1 700P  
 SAA5231 300P  
 SAA1293 550P  
 S2000A3 175P  
 S2000AF 175P  
 S2055A 175P  
 S2000AF 200P  
 S2530A 100P  
 TEA201BA 200P  
 UC3844 100P  
 UPC1185H2 400P

## REMOTE CONTROLS

**AKAI**  
 RC-V10A 1000P  
 RCV37B 1000P  
 V25A 1000P

**BUSH**  
 2020T, 2114T, 2321T, 2514T 1000P  
 2020, 2114, 2321, 2514 1000P

**DECCA**  
 RC70 850P

**FISHER**  
 RC905B 1000P

**GRANADA/REDIFFUSION**  
 UNIVERSAL, 79500C, 986700 850P  
 SATELLITE 1000P  
 MK4 TEXT, 70115G, 70133G, 70357E 850P  
 MK4A TEXT, 70375C 850P  
 95288E 1000P  
 94490D 1000P

## TELEVISION ON/OFF MAINS SWITCHES

Baur, Normende, Nova, Pioneer, Quelle, Saba, Salora, TEC, Thomson & Vega 375P

## VIDEO MOTORS

**HITACHI**  
 VT11, VT14, VT15, VT16, VT17, VT19, VT35, VT39, VT57, VT88 (capstan motor) 3100P

**BANG & OLUFSEN**  
 VHS65, VHS90 (capstan motor) 3100P

## REMOTE CONTROLS

<b>GRUNDIG</b>	
TP160E	1050P
TP200, TP300	1000P
TP400	850P
TP590-600	1050P
TP390, TP610	1050P
TP621	1050P
TP630, TP650	1000P
TP660	1050P
TP661	1050P
<b>HITACHI</b>	
CLE800-CLE830	900P
A617402/655602	1000P
A512120/230	1000P
A514790	1000P
A5088470	1000P
A518612	1000P
SCL002	1000P
C2096	1000P
A511940	1000P
655602H	1000P
<b>ITT</b>	
IFB13, 14, 15	900P
FS4	850P
RG305	900P
RG306	900P
FS9/1-10/1	900P
VS5 RUK	900P
VS4-1	900P
MULTICONTROL (17C20)	1000P
<b>KORTING</b>	
18279, 18396, 18460, 18521 SE	1000P
40540 VTS	1000P
<b>LOEWE</b>	
DC11	1000P
<b>MATSUI</b>	
010270601	1000P
VX770	1000P
<b>METZ</b>	
JAVA COLOR (6890)	1000P
COLOR (7156)	1000P
JAVA (7180)	1000P
<b>MITSUBISHI</b>	
939P/03607, 939P/03609	900P
<b>NOKIA</b>	
<b>SATELLITE</b>	
1000P	
<b>NORDMENDE</b>	
TC2336	1050P
CMC1, TC3519	1050P
<b>OCEANIC</b>	
390C9500	1000P
<b>ORION</b>	
RC53	1000P
<b>PANASONIC</b>	
EUR51200	900P
TC2200	900P
VSQ0357/NV730	1050P
TNQ1621	1000P
<b>PHILCO</b>	
CARVEL, CONCORDE, MERCURY	1000P
TELESTAR	
TC10	1000P
<b>PHILIPS</b>	
RC5002, 5154	900P
KT3 NON TEXT	900P
69117032	1050P
69117194	1050P
RC5991 UNIV	850P
RC3B	900P
KT3 TEXT	900P
RC5352	900P
RC5375	900P
RC5 STANDARD	900P
RC5901	900P
RC5903	900P
<b>SABA</b>	
T6772	1000P
TC319-320	1050P
TC356	1050P
TC358	1050P
TC360	1000P
TC365	1000P
<b>SALORA</b>	
SERIES L	1000P
86173	1000P

<b>SANYO</b>	
RC218, RC222, RC228, RC238	900P
JXGE	1000P
JXDE	1000P
VHR2300	1000P
RC628	1000P
<b>SHARP</b>	
G0121CESA, 123CESA, 204, 251	900P
<b>SIEMENS</b>	
FC616	1000P
FC631	1000P
FC742	1000P
<b>SONY</b>	
RM604, RM605, RM606	900P
32 CHANNEL	900P
RM613	900P
RM632, RM636	900P
<b>TATUNG</b>	
FXA	1000P
RC70	900P
FX70 FASTTEXT	850P
<b>TELEFUNKEN</b>	
FB632	1000P
FB639	1000P
<b>THORN/FERGUSON</b>	
3V35-42	900P
3V31-32	900P
3V57-58	1050P
TX10 TEXT	850P
TX10 STEREO TEXT	850P
TX9-90-100	850P
3V55, FV11	1050P
TX100 FASTTEXT	900P
TX100 STEREO FASTTEXT	900P
PROFESSIONAL	850P
<b>TOSHIBA</b>	
CT937	1000P
CT9117	1000P
201R4B	1000P
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138-10138, 138-10313, 1.2V - 90mAh	160P	
Replaces Philips Part No's:		
138-10229, 2.4V - 90mAh	260P	
<b>REPLACEMENT FERGUSON NI-CAD BACKUP BATTERIES</b>		
Replaces Ferguson Part No: 00E6-067-001.		
1.2V		
Used on: TX10	180P	
Replaces Ferguson Part No's: 00E6-066-001.		
2.4V		
Used on: 3V35, 3V56, 3V58, 3V65	375P	

## LINE OUTPUT TRANSFORMERS

Description	Price	Order Code
HITACHI 2433752	1500P	LOT01
ORION 3714002	1500P	LOT02
FIDELITY ZX300	1500P	LOT03
FE TX100 90 DEG	1500P	LOT04
SABA 490007182	1500P	LOT05
FE TX90 WHITE	1650P	LOT06
ITT D307/37 EQ	1600P	LOT07
BLAUJUNKT 210	1600P	LOT08
GRUNDIG 2922C10	1600P	LOT09
ITT CVC800/1/3	1500P	LOT10
ITTD218/37 EQ	1600P	LOT11
NORMENDE 5255	1600P	LOT12
SABA 81000 200	1600P	LOT13
SALORA T236 EQ	1650P	LOT14
SABA 811-50-24	1600P	LOT15

SABA 770223500	1600P	LOT16
TELEFUNKEN AT1	1450P	LOT17
TELEFUNKEN EQ	1400P	LOT18
SALORA FM0218B	1600P	LOT19
NORMENDE 5255	1600P	LOT20
ITT CVC 1150/1	1500P	LOT21
ITT COMPACT 80	1500P	LOT22
FE TX100 GREEN	1450P	LOT23
HINARI CT4/5 5113	1500P	LOT24
SELECO 6320410	1600P	LOT25
BLAUJUNKT 8667	1600P	LOT26
ITT COMPACT B1	1450P	LOT27
ITT CT3326-MUL	1500P	LOT28
ITT D066/37 EQ	1600P	LOT29
ITT 3546 EQ	1500P	LOT30
LUXOR 5810110	1600P	LOT31
SABA 8493E0920	1600P	LOT32
HITACHI 2434141 CP	1450P	LOT33
FE TX100 110 D	1700P	LOT34
HANTAREX 28021	1600P	LOT35
SHARP C3700 EQ	1600P	LOT36
HITACHI 2432981 CP	1500P	LOT37

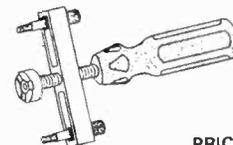
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## CASSETTE HOUSING

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<b>AIWA</b>	
G900, HVG900, HVZ10	
<b>FUNAI</b>	
IV89, VCR2100, VCR2800, VCR4530, VCR4540, VCR5653, VCR5800, VCR5840, VCR5843, VCR6000, VCR6100, VCR6800, VCR6803, VCR7000, VCR8000, VCR8002, VCR8003, VCR8007, VCR8100, VCR8103, VCR8200, VCR8500, VIP150, VR68, VR150	
<b>FINLUX</b>	
VR3009	
<b>GRANADA</b>	
VHSF63	
<b>HINARI</b>	
VCR34, VTV100, VTV200, VXL200, VXL7, VXL8, VXL9, VXL10, VXL11, VXL19, VXL34, VXL90, VXL100, VXL200	
<b>SHINTOM</b>	
VCR4540	
<b>TASHIKO</b>	
VVF933, VVF93	
<b>TATUNG</b>	
TVR6111	
<b>TENSAI</b>	
TVP1000, TVP1050, TVP2000, TVP2050, TVR130, TYR140, TVR1800, TVR1900, TVR2000, TVR2100, TVR2600, TVR2700, VR2300, VR2350, VR2450, VR2500, VR4100	
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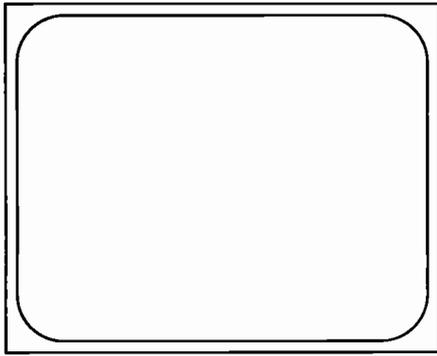


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# TELEVISION

## Who Watches What?

Is the British public beginning to lose interest in television? This is one conclusion that could be drawn from *Media Futures*, a study recently published by the Henley Centre for Forecasting. It reports that sixty per cent of a sample of viewers surveyed said they would rather be out than at home watching television. Forty two per cent of these viewers characterised TV programmes as "dull and predictable", forty one per cent saying that they had got worse during the past year. The research suggests that as a medium television has a negative image that's unlikely to improve. Sounds pretty devastating, doesn't it? But while the Henley Centre has an excellent reputation it has to be pointed out that the opinion poll on which the above figures are based consisted of only 1,500 viewers. With today's sophisticated sampling techniques even such a small poll can produce generally valid figures for the public at large, though its size does make it hard to be convinced that television is becoming a switch off. More alarming perhaps is the finding that those who are less affluent spend about a third more time watching television than those who are better off, suggesting that TV watching is to an appreciable extent something done when people have nothing better to do or can't afford other possible activities. There is nothing very new about this finding however.

Though there is no likelihood of a mass switch off, it does seem that television viewing as an activity has passed its peak. It was inevitable that this should happen at some stage. There are only so many hours in a day: just how many can be devoted to the box? The interesting point here is that the growth in the number of services, with all those extra cable and satellite channels, has not led to any increase in the amount of time spent viewing. In fact with all those hours of channel time to fill and the increased competition, which means fewer viewers and thus less revenue per channel, there does seem to have been a deterioration in the quality of the TV on offer. It's a case of the old adage "more means worse". If this really is how things are going, one wonders what will happen if continental broadcasters get their hands on UK television – many in the industry seem to want to see larger, multinational groups which would, the theory seems to go, be better able to compete with one another. The prospects here are not very inviting. A few massive organisations seeking the largest audiences is hardly a recipe for quality services and runs totally counter to the traditions of broadcasting in the UK. Yet we are assured by many that this is the way in which things will eventually go.

Cable and satellite have both been seen as ways of increasing the public's viewing and interest in TV. So far they have singularly failed in this respect. The Cable Television Association in its latest report speaks of "consistent, solid growth". Some 2.5 million homes are now passed by cable services. Of these, at June 1st 464,997 had become cable subscribers, a penetration ratio of around 21 per cent. The Henley survey claims that the future lies with cable however, forecasting 5.5 million subscribers by the year 2000 (with 4.5 million satellite TV installations). It maintains that cable has two major advantages, the ability to provide cheap telephony and local TV services. Maybe.

Satellite viewing seems to be stuck at about five-six per cent of the total. Assessments of the number of satellite TV installations are notoriously unreliable, the figures varying from 2.15 million to around four million at present. It seems clear however that sales have been disappointing in recent months and that earlier estimates – of up to eight million installations by the mid-eighties – are unlikely to be met. BSkyB's decision to encrypt most of the channels it offers from September 1st, while doubling their number to fourteen, is the joker in the pack. Will the public's well-known reluctance to pay extra for TV rebound on BSkyB? However this works out, it's unlikely to lead to any extra viewing in total.

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### COVER PHOTO

This month's cover photograph shows a Ferguson ICC5 chassis on the bench. See servicing article on pages 782-5.



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# A Simple Transformer Tester

Ian Rees

Say you've excluded all other possibilities and it's got to be the line output transformer: there can be no other explanation – can there? I recently took a large, gut-busting Grundig colour receiver (CUC720 chassis) under my wing. It had been taken to various dealers in my area and lots of work had been done in the line output stage by engineers who had replaced various diodes and capacitors. I found that the line output transistor was short-circuit collector-to-emitter, a new BU508 restoring normal operation. Much too easy! So the set was put on soak test and next morning, at switch on, there was no picture. The BU508 had failed again. After much testing and isolation of various supply lines I was left with the conclusion that the cause of the problem had to be the transformer.

A quick signal to Willow Vale via the COPS line brought one by return. I fitted it and phut, another BU508 bit the dust. I began to see why this set had been passed from workshop to workshop. To cut a long story short, the cause of the problem was eventually traced to a fault in the power supply: a small electrolytic capacitor had been fitted the wrong way round, as a result of which there was a supply surge at switch on. I had stuck with investigation of the line output stage because I couldn't see any incorrect supply voltages. Had I been able to check the transformer I wouldn't have been so quick to order a replacement and would have considered other possibilities.

In the same week a big Hitachi set arrived on the bench. It had the same symptoms and some tests brought me rapidly to the same conclusion as with the Grundig set a few days previously. But how could I be sure? – this time the transformer was five times as expensive. I decided to try to make a test circuit to check the transformer in isolation from the set. After some experiments I found that simple transformer ringing provided the best indication of performance.

A check on the Grundig transformer with my tester produced a classic ringing waveform. When the Hitachi transformer was tested it proved to be heavily damped. A replacement proved that the original one was faulty.

Resistance tests are unlikely to be able to detect a shorted

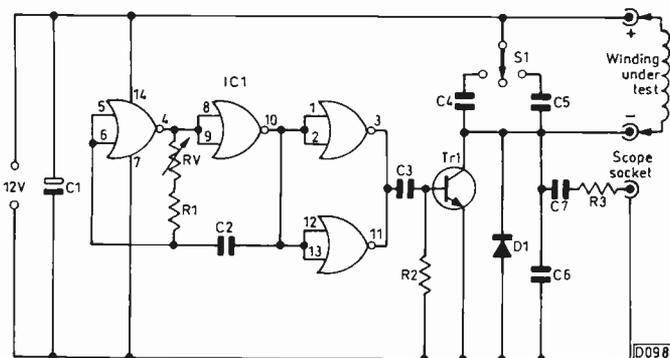


Fig. 1: Circuit diagram of the transformer tester.

turn in a transformer winding, but this tester will. A quick indication of line output transformer loading can be obtained with the transformer in circuit, but more conclusive results are obtained when the transformer is removed for test.

Fig. 1 shows the circuit of the tester, which is simple and can be made up using inexpensive components. The original prototype was built as a probe, but in use I found that it was better to have clip-on test leads, leaving the hand free to adjust the controls and keeping fingers away from the high-voltage overwinding and internal tripler arrangement: these can give you a small shock even with the reduced supply voltage used.

## Circuit Operation

A CD4001 four nand gate CMOS chip acts as a multivibrator that oscillates at around 150-250Hz – potentiometer RV sets the frequency. The oscillator's output is capacitively coupled by C3 to the BU508A switching transistor Tr1. Any winding connected across the test terminals will be subjected to a switching pulse, with the result that the winding will resonate. The ringing can be observed on a standard scope whose Y input is fed via C7 and R3.

The ability to choose the switching frequency enables a full wavetrain to be seen. Fig. 2 shows a typical example: note the characteristic decay of the waveform. This resonance or ringing is analogous to a bell being struck, the sound decaying in much the same way. The frequency of the individual cycles within the waveform envelope depend on the inductance and capacitance present in the circuit being tested.

A shorted turn, or external loading of the winding being tested, shortens the characteristic ring dramatically – this can easily be demonstrated. Switch S1 enables extra capacitance to be added, enhancing the ring when a winding has little self-capacitance. The smallest amount of external

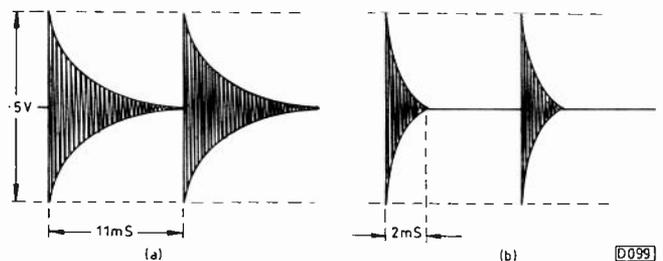


Fig. 2: Waveforms obtained with a good CUC720 chassis line output transformer. Scope settings 2msec/cm and 0.2V/cm. (a) Test on the primary winding with no load and C5 in circuit. (b) Same as (a) but with a single-turn shorting loop through the limb.

capacitance compatible with obtaining a satisfactory display should be used.

The supply voltage is limited by the CMOS device. As only a few milliamperes are required, dry cells can be used.

## Testing and Use

Connect the unit to its supply and plug its output into the Y input of an oscilloscope. Set the scope's sweep time to 2msec/cm, allowing two complete rings to be observed, and its Y input amplitude to 200mV/cm. Leave switch S1 in the off position. Connect the test clips to the primary winding of a known good line output transformer (use a transformer with open yoke construction). If only a small amplitude ring is seen, alter the setting of S1 to bring C5 into circuit.

Adjust the scope's triggering and potentiometer RV in step to obtain a stationary display. Feed a piece of wire through the transformer's yoke, then connect the ends together to form a shorted turn. The display will change in the way shown in Fig. 2. If your scope is up to it, increase the sweep time to show a single ring. By speeding up the sweep, individual cycles can be seen and counted.

Chopper transformers give similar results, but C4 may have to be switched into circuit. See Fig. 3.

Mains transformers produce short rings and generally require no extra capacitance.

The transformers used in microwave ovens can be tested at their secondary (high-voltage) side. The presence of a shorted winding will be clearly seen. Only five-six slow cycles will be obtained. When testing a microwave oven transformer be sure to disconnect the magnetron's heater supply first.

Use of the tester is not limited to transformers. Good results are obtained with all types of chokes, linearity coils, scan coils etc. I was even able to detect shorted turns on one section of a motor armature by connecting the tester to the mains input and rotating the motor shaft.

The unit has opened up an interesting new test procedure where, in the past, component substitution was required. I find that a lot of time can be saved by checking a line output transformer before, if necessary, going through the process of isolating various feeds from the transformer.

As with most tools the tester won't reveal all possible failure modes. You have to regard it as part of an arsenal of test methods when tracking down faults. In particular the tester is unlikely to be effective when the insulation within a winding or between windings breaks down only under high-voltage stress. In this case however other symptoms – heat, sound or smell – may be present.

In-circuit use of the tester gives a guide to fault conditions but requires a norm to be established for a particular model/circuit. You do this by gaining experience through use of the tester with working sets, noting the results that should be obtained. With in-circuit tests be sure to observe probe polarity so that components are biased correctly.

## Modifications

If you want to test only line output transformers, the oscillator's frequency range can be increased by reducing the value of C2 to 0.001 $\mu$ F (or lower) and R1 to 10k $\Omega$ . RV could then be increased to 1M $\Omega$  to widen its coverage.

If a stand-alone unit (no oscilloscope) is required, a neon light with a 1M $\Omega$  series resistor can be connected to the high-voltage transformer overwinding or the tripler/focus outputs. This will give an indication that the transformer is oscillating. In this mode the unit uses a greater current and a small heatsink is required for Tr1. C4 and C5 could be reduced in value or removed. The pulse voltages at the

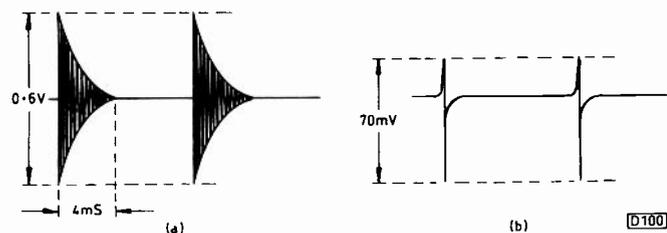


Fig. 3: Waveforms obtained with the chopper transformer in the BBC B computer. Scope settings 2msec/cm and 0.2V/cm. (a) Test on the primary winding with no load and C4 in circuit. (b) Same as (a) but with a shorted secondary winding.

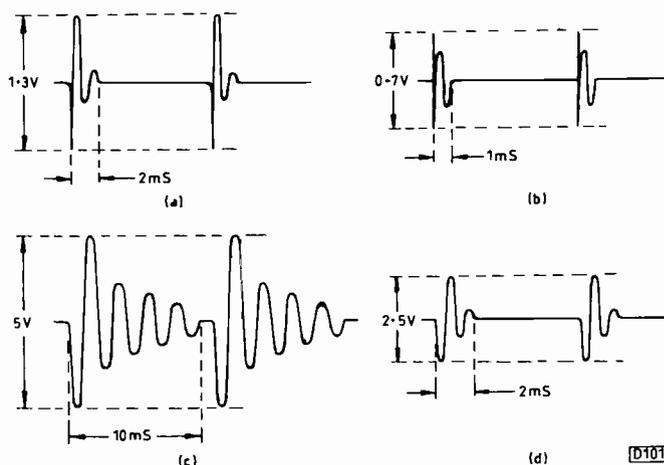


Fig. 4: Waveforms obtained with a 650W microwave oven transformer. Scope settings 2msec/cm and 0.2V/cm for (a) and (b), 2msec/cm and 1V/cm for (c) and (d). (a) Test on the primary winding with no load and neither C4 nor C5 in circuit. (b) Same as (a) but with the heater supply leads shorted together. (c) Test on the high-voltage secondary winding with no load and neither C4 nor C5 in circuit. (d) Same as (c) but with the heater supply leads shorted together.

collector of Tr1 will be higher, so scale up the working voltage of the capacitors in this area to at least 1kV. Increase the value of R3 to 10M $\Omega$ , and terminate the output with a 1M $\Omega$  resistor to protect the scope if you do want to use one. Some idea of the transformer's operation can be obtained by looking at the waveform, but because of circuit variables this is less helpful than a ringing test.

Use of a higher switching frequency will remove the ability to ring a transformer.

While D1 is not essential in the ringing version, except as a precaution, it should be retained when driving line output transformers. A BU508D with internal diode could be used instead.

I've not blown up any CMOS chips, but I found that it is possible to lock-up the BU508. This seems to happen when the value of C6 is increased or reduced. A higher than normal standing current is present, with little output from the overwinding. The BU508 oscillates at a very high frequency. Switching the supply off and on again restores more predictable results.

Some line output transformers will self-oscillate when used with this circuit and will continue to do so even with the CD4001 turned off. The cause seems to be feedback to the BU508 transistor via stray capacitance. I considered using this as a test method for a short time, but it's difficult to get predictable results with all forms of line output transformer.

## Component details

C1	220 $\mu$ F, 16V	R1	100k $\Omega$ , 0.25W
C2	0.047 $\mu$ F, 100V	R2	33 $\Omega$ , 0.25W
C3	0.1 $\mu$ F, 400V	R3	2.2M $\Omega$ , 0.25W
C4	0.47 $\mu$ F, 400V	RV	100k $\Omega$ linear
C5	0.047 $\mu$ F, 400V	D1	BY127
C6	0.001 $\mu$ F, 400V	IC1	CD4001
C7	0.02 $\mu$ F, 400V	Tr1	BU508A/BU508AF

S1 SPCO, centre off, toggle switch

See text for possible variations

# VCR Clinic

*Reports from Michael Dranfield,  
Ed Rowland, Nick Beer, Chris Watton  
Stephen Leatherbarrow, Mike Leach,  
Michael D. Maurice, Savio Da Costa  
and John Edwards*

## Ferguson FV26D

Because the brakes didn't come on in the rewind and fast forward modes there was tape spillage. A check with an identical machine showed that in the faulty machine the windmill, item 54 in the exploded view, turned both ways while in the good machine it turned only one way. The cause of the fault turned out to be a broken clutch spring, item 55 part no. PQ42002. Note that in this machine the capstan motor has to be removed before the loading block assembly can be lifted out. **M.Dr.**

## Saisho VR3300X/Matsui VX735

The customer's complaint was that there was no picture. When we carried out checks we found that the video signal entered the modulator but didn't emerge at the r.f. output socket. It was evident, when we took the modulator out, that someone had been having a go. The aerial input socket was held by solder in a manner that resembled bird droppings, and there were solder splashes on the PCB inside. We cleared the shorts, resoldered the socket and refitted the modulator. Everything worked all right – until record was selected. In this mode the E-E sound disappeared.

After spending a lot of time searching and checking along signal paths we eventually found that the fault cleared when the supply to the bias/erase oscillator was disconnected. The cause of the fault was that the bias level potentiometer VR5002 had been set at maximum. Somehow this excessive level of bias current swamped the audio. We have had this fault since in another machine that had been got at by the customer. **M.Dr.**

## Aiwa HVG71K

Should there be no capstan motor rotation, check R266 (3.3 $\Omega$ ) before, if necessary, replacing the motor drive chip IC206. **M.Dr.**

## Amstrad VCR4500

This machine wouldn't accept a cassette and the function LED was permanently alight. Voltage checks in the power supply showed that the all-time 12V line was low at just over 2V. As application of 12V d.c. from an external source restored all functions, checks were carried out around the 12V regulator Q651. Although resistance readings failed to reveal anything amiss, when Q651 and D655 were replaced normal operation was restored. **E.R.**

## Panasonic NVJ35B

The problem was no record chroma. Scope checks showed that everything was in order up to the 1.6MHz LPF section of the multi-filter package FL801 (ELB4W002). It was open-circuit. **N.B.**

## Amstrad VCR6100

A loop of tape would be left after fast-forward operation. As a result there would be chewed tape if eject was then selected. The cause of the problem was inefficient braking

of the supply spool – little wonder as the brake pad had been removed! When a replacement had been fitted there was permanent supply spool braking in fast forward and rewind, as the supply brake arm wasn't being released. In these modes it should be released by the take-up arm, which is moved by the brake actuating lever, being released by the lever on its own in the play and record modes. The cause of the problem was that the take-up arm was the wrong shape. A new arm of the type used in the VCR6000 put matters right. One wonders whether the wrong arm had been fitted during production or whether it was simply incorrectly moulded, also who had removed the pad instead of dealing with the problem properly! **N.B.**

## Sharp VC780HM

This machine would intermittently go into play from cold then unlace because the capstan didn't rotate. The fault occurred about once a day. Because of the fault's unpredictable nature, and the fact that the machine would revert to stop whenever the fault occurred, it was virtually impossible to do any fault finding. A new cam switch seemed to provide a cure. **N.B.**

## Ferguson FV31R

This machine was dead but the fuse was o.k. and the characteristic squeal was heard as the power supply started up. Failure to operate was due to loss of the 5V supply to the timer microcontroller chip. Fusible resistor RK44 (1 $\Omega$ ) was open-circuit. **N.B.**

## Panasonic NV7000

Apart from the clock this old-stager was dead. Fuse F1002 (4AT) was open-circuit because one half of the full-wave encapsulated rectifier D1006 was short-circuit. Once the machine had been got going it required a bit of mechanical work, which was hardly surprising. **N.B.**

## Samsung SI1240/1260

A cassette was stuck in this full-lace machine because there was no loading motor drive. The KA8301 chip IC206 had obviously been getting hot as the solder on its legs had melted and was now crystalline and dry. A replacement chip, type BA6209K, got things going again after we'd made sure that there was no excess loading on its output (shorted motor etc.). A long soak test proved that the machine was now all right. **N.B.**

## Hitachi VT520

This machine would load. Then the drum would stop – the capstan never started – and the deck would remain still until the mains supply was switched off and on again. The deck would then unload and the machine would switch off. When the voltages at the mode control inputs (pins 11, 12 and 13) of IC901 were checked I found that 3.3V was present at pin 11 whatever the position of the deck. The cause was a leaky

mode switch. A new switch restored normal operation – note its position before you remove it. **C.W.**

### **Saisho/Matsui VCRs**

A number of these VCRs have a little plastic item to release the limiter post. It tends to break, the usual complaint being that the machine is stuck in pause. Actually the pinch roller is jammed by the limiter post. There are various sources for this item. Unfortunately the pivot hole is sometimes too large, the result being that the limiter post again jams as it doesn't move far enough from the pinch roller. **C.W.**

### **Ferguson 3V35/JVC HRD120**

No playback or record colour is not uncommon with these machines, due to faults around the crystal oscillators. On this one however the cause of the trouble turned out to be the colour/monochrome/test pattern switch at the back. It had become leaky. **C.W.**

### **Samsung VI710**

This machine had no clock display. We found that the 6.8V zener diode ZD102 in the 30V regulator circuit on the power supply panel was short-circuit. **C.W.**

### **Ferguson FV32L**

When this machine was first switched on the drum motor hunted, the picture tore and line slip developed. The picture began to stabilise as the machine warmed up, but it never became stationary. Since the fault was worse when the machine was cold I got out the freezer and hairdryer and began my attack. Any heat in the servo area lessened the effect of the fault, but no amount of freezer made it worse. So I removed the bottom cover and applied gentle heat to the drum motor PCB. The fault then disappeared. When a shot of freezer hit C6 (3.3µF) the drum almost span off the deck. After replacing this sub-miniature capacitor perfect control at all temperatures was restored. **C.W.**

### **Amstrad VCR4600**

This machine produced a corrugated picture with both its own recordings and prerecorded tapes. There was obviously something amiss around the head drum. I checked the guides and the tape path for cleanliness. All was well here, so suspicion fell on the lower drum/motor assembly. As we had one in stock it was quickly fitted. This cured the ragged picture, but the head switching point was about two inches from the top of the screen and couldn't be adjusted. Inspection of the motor then revealed that it had a different magnet assembly. So off with the one from the old motor – only a couple of screws. When this was fitted to the new unit and everything was set up the machine worked as it should. **C.W.**

### **Samsung VI710/Logik VR955**

There was no E-E picture and no playback colour. Both symptoms were caused by D102 (1N4002) in the power supply. It's the source of the always 12V supply, which was low at only about 7.5V. **C.W.**

### **Samsung VI710**

When the power switch was pressed the channel indicator in the clock display lit up but not the indicator at the

bottom. The deck was dead. The output from the power unit has a PC15 that didn't come on with the power control command, which was present. We found that the 15V section of the STK5333 power regulator chip was open-circuit. **C.W.**

### **Hinari VXL8**

This machine had virtually no capstan drive, i.e. there was no play, rewind or fast forward. Control of the capstan motor centres around the BA6219 chip IC106. Its supply at pins 7 and 8 was o.k. at about 15V, but pin 4 was at 0V. This could have been because Q105 was short-circuit or biased fully on, but what we actually found was that the 9.1V zener diode D110, which is connected to pin 4 of IC107 (another BA6219), was the cause of the fault. As IC107 is the loading motor drive chip this calls for some further explanation! D110 straddles the print run from pin 4 of IC106. It's glued down, with just the PCB varnish for insulation. Lifting the diode clear and insulating it provided a complete cure. Just to add to the fun, the fault was initially intermittent. **S.L.**

### **JVC HRD660**

The deck functions were normal but there was no front panel display. Absence of the -30V supply at pin 2 of CN1 was the cause. We found that the safety resistor R2 (47Ω) had gone open-circuit. A long soak test proved that there was no contributory cause for the failure of R2. **S.L.**

### **Samsung VI730**

There was a blank raster with no sound though playback was normal. The supply voltages were correct at the tuner and i.f. cans, but no video emerged from the latter. When pin 1 of IC404 (TA7348) was lifted the video returned on the scope's screen. IC404 had a crack down its centre. The video signal was now being weakly displayed but there was still no sound. This was because the TA7348 audio switching chip IC403 was also faulty. The video coupling capacitor C415 (10µF, 25V) was short-circuit and the video input socket's terminating resistor R416 (75Ω) was open-circuit. We feel that the customer knows more than he is prepared to reveal about the causes! **S.L.**

### **Ferguson 3V29/JVC HR7200**

Two of these machines have been in our workshop recently with audio faults. The first machine would record the sound, albeit almost inaudibly, but failed to erase the previously recorded sound. There was plenty of bias at T1, but it wasn't reaching the erase head. In the record mode the bottom end of RY1 wasn't being switched via pin 89 (audio dub line). In fact the voltage here varied between 5V and 12V. The cause of the problem was the µPA81C chip IC5 on the mechacon PCB.

The second machine also failed to erase the sound, but for more bread-and-butter reasons – the erase head plug/socket was intermittent. We cut it off and rewired directly. **S.L.**

### **Hitachi VTF770**

This machine would shut down about two or three seconds after being switched on. The display came up, but no tape functions seemed to work. The cause of the problem was no loading motor drive because the BA6209 drive chip had

failed. Unfortunately the failure of this chip had resulted in the mechanics going badly out of sync. The mode switch had to be replaced and the mechanics realigned. **M.L.**

### **Hitachi VTM710**

When this machine came in there were no functions and no display. It was kept for about a week before we got around to it. We then found that it worked, though it didn't produce a picture. The display came up, the tape loaded and play could be selected. We assumed that the machine had locked up and that the week's rest had done it a bit of good. The no picture symptom was caused by the fact that the modulator didn't produce an output – the switched 12V supply was missing. This comes from the power supply, the switching being controlled by the power control line from the main microcontroller chip. The line was high at 2.3V instead of being at 0V. When the  $\mu$ PD75516-108 microcontroller chip (IC901) had been replaced the switched 12V line was present and the machine worked perfectly. We checked the mode switch and mechanism as a precaution. **M.L.**

### **Hitachi VT120/VT220**

Intermittent loss of colour has been the fault with several of these machines we've had in for repair. In each case replacement of the HT4539B chip IC301 on the Y/chroma PCB has cured the trouble. **M.D.M.**

### **Ferguson 3V29/JVC HR7200**

We were asked to quote for fitting a new capstan motor and suggested that we should inspect the machine first. When we opened it up the cause of the problem turned out to be a loose capstan belt – it was just about ready to fall off. A set of new belts and a clean up made the customer very happy. **M.D.M.**

### **Panasonic NV430**

The rewind, stop and eject keys worked but the others didn't. All functions worked when the remote control unit was used. The cause of the fault was that R6554 (2.7k $\Omega$ ) on the operation PCB was open-circuit. **S.DaC.**

### **Panasonic NVG30**

The clock lit but the VTR switch wouldn't. If a tape was inserted the machine would switch on but wouldn't go off. There were no deck functions, with either manual or remote control. All this was caused by a faulty M50395V4AB clock chip (IC7501).

With another of these machines the squelch characteristic at switch-on was muted and the machine would remain dead. D18 was short-circuit.

A third machine that came in was dead with a blackened fuse. The STR1806E chip was short-circuit all ways. We replaced the 2.2 $\Omega$  feed resistor R1002 as well as a precaution. **S.DaC.**

### **Panasonic G Deck**

We recently had in a couple of Grundig machines, Models VS500 and VS540, that use this deck. As the tape wouldn't lace up to the capstan the pinch roller touched it with no tape in between. The P5 unit wouldn't come into position fully, failing to sit in position in the pinch cam

rift. The P5 pull-out sector gear which controls this was slightly cracked at the corner. A replacement restored normal operation. We've also had several Panasonic machines with this fault. **S.DaC.**

### **Panasonic NVL10**

This machine would load a tape to just about the stop point, then eject it. The cause of the problem was a faulty take-up sensor. **S.DaC.**

### **Panasonic NVG12**

The symptoms were as follows: there was no rewind, forward wind or play; the capstan motor was shunting; and the drum motor ran at full speed. A quick check showed that the 4.43MHz clock signal from the video pack was missing. This signal is produced by IC8001 which on inspection was cracked. A replacement restored normal operation.

We find that this fault is now quite a common one with several Panasonic models, in particular the NV830/NV870 series. **S.DaC.**

### **JVC HRD455**

This machine actually wore Saba livery. The complaint was of periodic tracking bars, the tracking knob having no effect. We found that when play was selected the machine seemed to be in fast search for two seconds, then stabilised. Replacement chips in the servo section had no effect. When an off-air recording was tried we noticed that the channel number wouldn't change and the memory couldn't be used. The drum and capstan speeds were erratic and there was slight hum, the picture flicking about. A check on the switched 12V line produced a reading of 19.5V. All these problems were being caused by Q2 in the power supply: it was leaky all ways. **S.DaC.**

### **Samsung VI710**

Every couple of days this machine would fail to produce an E-E or playback picture. As there was no r.f. output the monitor just displayed noise. When the fault finally showed up in the workshop I noticed that the deck functions worked but there was no test signal and the channels wouldn't search. As a start I checked the power supply outputs at connector CN104. They were all correct. But something seemed to be amiss in the power supply system. The 15V line feeds the 12V regulator transistor Q105. A voltage check at Q105's collector produced a reading of 0V. The cause was a dry-joint at L105. Relief all round: when this coil was prodded the machine came to life. Resoldering L105, also D114 and Q105 to be on the safe side, restored reliable operation. **J.E.**

### **Ferguson 3V36/JVC HRD225**

The playback picture and sound were in slow motion, with tracking lines. Occasionally correct pictures and sound would appear, followed by a screeching noise then a return to the fault condition. When the capstan motor was removed I found that its shaft was very tight. A new motor cured the problem. **J.E.**

### **Toshiba V71**

No reel rotation and thus chewed tapes was the complaint with this machine. The cause was the TA7267P reel drive chip IC603. **J.E.**

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# CD-i Update and Video CD

George Cole

The fourth annual CD-i conference was held in London at the end of June. There were many new products, but the biggest news was the announcement of yet another CD format – Video CD.

## Video CD

Video CD stores up to 74 minutes of full-motion MPEG-1 standard video and digital sound on a compact disc. The format has been established by Philips, Matsushita, Sony and JVC – a formidable line up! In fact it's the new name for Karaoke CD, or the White Book standard announced by JVC and Philips in March. On a Karaoke disc you get music, graphics and video. The karaoke format was launched by JVC in Japan last October: it has sold well – in the first six months JVC claims to have sold 12,000 systems and 2.5 million discs.

Video CD is designed for linear, i.e. non-interactive, video programmes such as movies and music videos. Picture quality is claimed to be "better than VHS". Philips says that it will be possible to produce Video CD discs with Dolby Surround sound and wide-screen pictures, though these features will not appear with the first batch of titles.

Like Photo CD, Video CD uses CD-ROM-XA bridge discs which are compatible with various players such as CD-i decks that have a full-motion video (FMV) cartridge, computers with a CD-ROM drive and MPEG decoder, and modified audio CD players with a digital audio output socket and MPEG decoder. This last point caused some confusion because it wasn't made clear what modifications would be required. Philips now says that Video CD discs will be incompatible with around seventy per cent of ordinary CD players – because when Video CD discs are played via these machines they read the XA header and mute the digital output socket. According to Philips future CD players may be switchable for audio CD or Video CD operation. To maintain compatibility with existing CD players it has been suggested that the White Book standard could be modified, with the XA flag removed during the mastering stage. There's some uncertainty about whether this option is feasible however. Philips hadn't cleared up the issue when we went to press.

Video CD will offer a number of benefits in comparison with VHS tapes, such as fast track access, added durability and an end to PAL/NTSC compatibility problems. CDs are also cheaper than video tapes to produce. The shorter

playing time however means that most films will have to be on two or more discs: so we are likely to see the launch of multi-disc Video CD players.

Another problem is the confusion that Video CD will bring to a market that's already overcrowded with CD formats. For example, Video CD discs will play on a CD-i deck with an MPEG decoder, but not all CD-i discs will play via a Video CD machine. According to Philips, ordinary CD-i titles and CD-i discs that mix full-motion video (FMV) with interactive programmes (for example CD-i games with video footage) will not play on Video CD machines. Retailers are going to have their work cut out trying to explain all this to their customers.

The Video CD announcement was also controversial because Nimbus Technology and Engineering has developed a system for storing up to 79 minutes of FMV on a CD. What's more, Nimbus calls its system Video CD! Although Nimbus demonstrated the system last January, it was unable to register Video CD as a trade mark because this is a generic title.

Video CD uses an MPEG decoder unit that plugs into a CD player's digital output socket and a domestic TV set: the decoder is expected to sell for under £150.

Nimbus claims that its system is better because it is compatible with ordinary CD players, so that users won't have to buy a new player to watch CD movies, and plans to press ahead with the system. But it's difficult to be optimistic about the prospects for it when you consider the opposition. What's more, JVC, Sony, Philips and Matsushita have large interests in music, film and video software and are unlikely to release material for the Nimbus system.

Other Video CD supporters include Commodore, Gold-Star and Samsung. Commodore is to launch its Amiga CD32 system (see Teletopics), which can also play Video CD discs, this autumn while Samsung will launch a Video CD player in the Far East next spring at under \$650 (£430). When these appear, Video CD players are expected to be available in the UK at around £350.

## Full-motion Video

This autumn will see the launch of the first CD-i titles with full-motion video (FMV). Philips clearly attaches great importance to this new feature, and lots of FMV clips were shown at the conference. The sound and picture quality are impressive, especially when you consider the degree of signal compression required to fit over an hour of video and sound on to a CD. A data rate of 165Mbits/sec is required to handle CCIR 601 standard pictures, but CD's transfer rate is just 1.4Mbits/sec. The MPEG-1 standard compresses the video by a factor of around 150 to produce a data rate of 1.2Mbits/sec: the audio data rate is 0.2Mbits/sec.

The MPEG standard makes it possible to display full-screen video pictures or multiple video windows – in one demonstration the screen was split into four to show different camera angles. It's also possible to decode multiple audio tracks, such as multi-lingual sound tracks. Existing CD-i players will need to use an FMV extension module, Model 22ER9141, which contains an MPEG

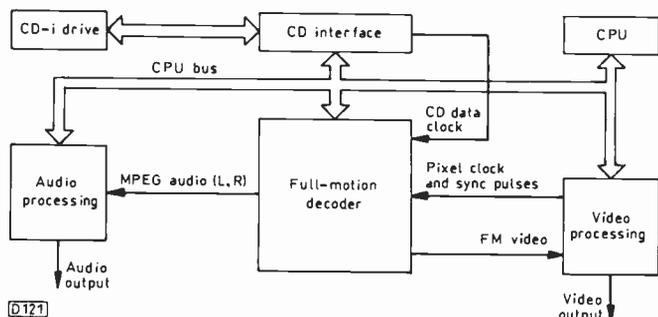


Fig. 1: Overall block diagram of the FMV system.

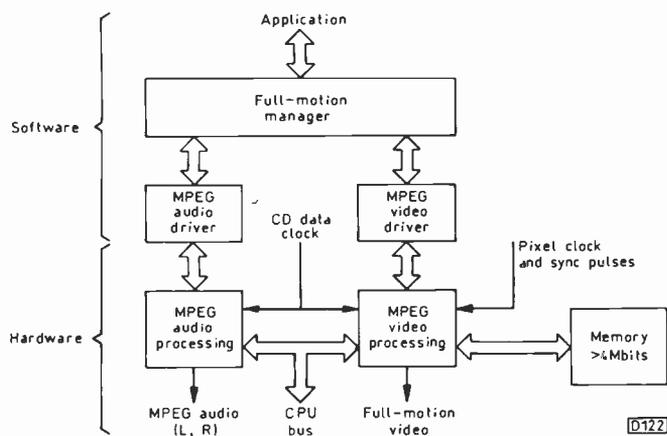


Fig. 2: Relationship between FMV software and hardware.

decoder and at least 512K of RAM – this extra memory capacity can also be used to obtain improved graphics, faster animation and other visual effects. The extension module slots into back of a table-top CD-i player: with a portable machine it sits on top. The CD-i FMV data is passed via the CD interface and the CPU bus to the audio and video processors (see Fig. 1). Fig. 2 shows the relationship between FMV software and hardware. The FMV module automatically sets the correct 50Hz or 60Hz field rate for PAL and NTSC players.

CD-i players will offer play, still frame, multiple slow-motion effects and picture search in both directions. Other features include seamless jumps, which enable users to switch instantly to another scene, 360° panoramic viewing and video loop or repeat play. The FMV extension module is to go on sale this autumn at a price of around £150-£200.

### CD-i Hardware

Philips showed a portable player, Model CD-i350, which is designed for the business market. It has a small, flip-up colour LCD screen and weighs 1.8kg without battery. No price or UK launch details were released.

GoldStar showed its first CD-i player, Model GDI-11. It has a microphone input for karaoke, which is very popular in Korea where CD-i is apparently selling well – parents are buying the machines to help their children to learn languages and to read and count. The player sells for \$830 (£530) in Korea: no European launch details were announced.

Sony had on show its IVO-V11 CD-i portable, which is on sale in the Japanese business market at around ¥178k (£1,240), and a prototype CD-i reader that plugs into a TV set. The reader is a portable machine without an LCD screen – the latter accounts for 40 per cent of the IVO-V11's price.

Kyocera's compact CD-i player weighs less than 1kg and has an RS232 port. Technics showed a prototype (or mock-up – it had 'do not touch' signs plastered all over it) mini CD-i system. Maspro demonstrated its CD-i car navigation system, which uses a geo-positional satellite system and discs to guide drivers around Japan: the discs contain maps and photographs of Japan's major cities and resorts, a voice-guidance system giving directions. There were no price details.

### CD-i and Computers

International Interactive Media (I2M) showed some interesting products that link CD-i with the computer world. Its MediaDesktop playback cards enable IBM-

compatible and Apple Mac computers to use their CD-ROM drives to play CD-i discs. If the drive is multi-session compatible it will also play Photo CD discs. A computer mouse is used to control the disc, the results being displayed on a TV set connected to the computer – I2M plans to develop a system that will enable the results to be displayed on a computer monitor. The MediaBridge is a CD-i220 consumer market player with the addition of built-in software and an SCSI interface to enable it to play CD-ROM, CD-i, CD audio and Photo CD discs. I2M said that these products will be launched in the autumn. No price details were available.

### CD-i Software

There were lots of FMV titles, and Philips plans to launch around 35 films and music videos this autumn. Many will come from Paramount films, though at the time of writing this Philips and Paramount are still negotiating on the European distribution rights. Philips says that it will concentrate on four types of titles: games, children's, reference and adult entertainment. The latter includes the Playboy Relaxation Disc and Voyeur, an erotic interactive movie that doesn't have FMV.

Also on show were the New Joy of Sex, which includes half an hour of video, and A Child is Born by Electronic Sound and Pictures, a reference title that looks at conception, birth and development. There were lots of shoot 'em up, arcade titles and educational discs.

The theme of this year's CD-i conference was 'claim your market'. The arrival of full-motion video and a new crop of software titles may help CD-i to do just that.

## CORRECTIONS

### VCR Clinic July

The heading to the item on a Sharp VCR, at the bottom of the left-hand column on page 651, should have read "Sharp VC9700H", not "Sharp VC7300".

### A Serviceman's Guide to PCs

Part 1, August: Cache memory was misspelt as cashe in Fig. 1 and throughout the text. Under the heading "Buying a PC" on page 706 the minimum recommendation for service department use should have read "a PC with a 25MHz 80386 CPU..." not "... 25MHz 80363 CPU..."

### Amstrad MP3 article August

The value of the fusible resistor in Fig. 1 is 10Ω, not 100Ω. Half way down the left-hand column, page 721, "often signals in channels R1 and R2 simultaneously" should have read "channels R1 and E2". Narrowing the i.f. to the extent suggested (see below) will remove the ch. R1 colour and sound as well as ch. E2. The circuit shown in Fig. 7 will reduce the bandwidth to under 2MHz if all the coils are peaked to the same frequency (this will separate chs. R1 and E2) – the author's rig is aligned for a bandwidth of about 2.8MHz however, the figure quoted.

As a postscript, Brian Williams adds that Roger Bunney's aerial phaser unit will do much to cancel out hash from baby alarms and similar sources in ch. R1.



panel) and CL48. Also check the value of RL10 (in series with the set-h.t. potentiometer) as this has a habit of wandering. Correct values for different tubes/models are as follows:

CRT	RL10	HT (V2)	A1 V
45AX	115kΩ	158V	130V
MP	115kΩ	158V	130V
SP	100kΩ	145V	150V
90°	76.8kΩ	115V	150V
78M5	118kΩ	164V	150V
59/68M5	110kΩ	147V	200V

The line output transformer LL53 is another possible cause.

If the meter shows a very small voltage at the cathode of DP37 it would be fair to suspect DP37 itself or its reservoir capacitor CP37.

Monitor the 23V rail (V5) as well. If the voltage here is low because of a fault you may find that RP42 has failed as a result of excessive current demand via the line driver transistor TL29 – DP43 and RP42 provide a start-up supply for TL29. With RP42 open-circuit the main h.t. supply (V2) will be present but the line-output stage derived supplies will all be missing. You may also find that the receiver doesn't trip as there's no line output stage current demand, rendering TL17 ineffective because the chopper drive mark-space ratio is too short (see below).

Once the power supply has tripped, always allow over ten seconds between switching off and switching back on again.

### The Trip Circuit

The trip circuit is shown in Fig. 3. DL38 and CL36 provide the collector supply for TL17 by rectifying the chopper drive waveform at pin 7 of IL14. TL17 is normally held fully conductive because of the positive base bias via DL25 and RL18. As a result the voltage at IL14's trip input, pin 28, is almost zero. DL25 is fed from the line-output stage derived 13V supply (V4). Should this supply be missing, TL17 will switch off, the voltage at pin 28 of IL14 will rise and the receiver will trip. That's the basic idea, but it doesn't always work like that. If the 13V supply is missing because the line output stage is not working, the chopper drive waveform at pin 7 of IL14 will have a very short high period and a much extended low period. Thus TL17 will have insufficient collector voltage to operate.

There are two other inputs to the base of TL17. CL33 is connected to the collector of TP48 (see Fig. 2) which provides the switched 12V supply. As the 13V supply (V4) rises, CL33 charges (via TP48). If a short-circuit occurs in any area supplied from this source CL33's positive plate will be earthed and the discharge current will switch TL17 off, producing the trip action at pin 28 of IL14. This removes the line, field and chopper drives. As there's no output at pin 7 of IL14, TL17's collector supply is removed. IL14 then senses that the trip voltage at pin 28 has decayed and the set tries to start up again. If the fault remains there will be no 13V supply to switch TL17 on and pin 28 of IL14 will go high again. An internal counter within IL14 allows the shutdown-restart cycle to occur three times after which the drives are not restored. Thus the line output stage is protected against overloading.

TL17's other base input comes from the current sensing resistor RP37 on the earthy side of the chopper-circuit

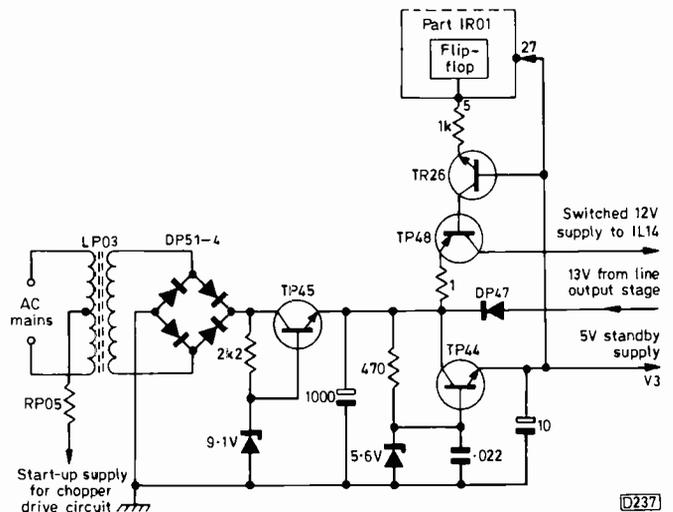


Fig. 2: The standby power supply system.

derived 8V supply (V1). A short across the 8V supply will produce a sufficiently high negative voltage across RP37 to switch DP38 and DP36 on and TL17 off, producing the trip action.

Pin 28 of IL14 is also linked to the line-output stage derived 23V line (V5) via RL20, DL19 and DL18. The 23V supply is used by the field output and line driver stages. Because of the design of the field deflection circuit (see Fig. 4), absence of drive pulses to the output thyristor DL21 could result in the V5 supply rising to 200V. DL18 prevents the rise exceeding about 40V by conducting, as a result of which a positive voltage appears at pin 28 of IL14, producing the trip action. The condition that could cause this type of tripping is discussed later, in the section on the field output stage.

### Change from Tripping to No Operation

If the receiver on which you are working starts out with a tripping fault then, during your probings, becomes totally inoperative it's likely that the fault condition is in the 23V supply (V5), pulling it low. Under these conditions the line driver transistor TL29 tries to run from its start-up supply with the result that RP42 burns out.

### Other Forms of Tripping

A short-circuit across the line-output stage derived 200V supply (V7) used by the RGB output stages and the field oscillator will result in the receiver tripping once only. This is called a 'hard' trip as a loud pop is heard from the loud-speaker.

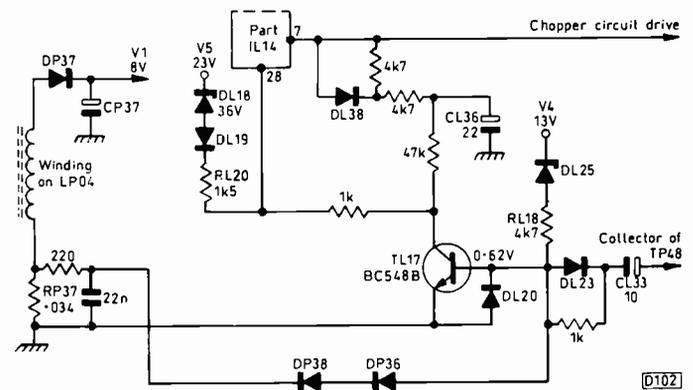


Fig. 3: The trip circuit.

If the set trips only occasionally there could be a problem with the 7.5V line on the live side of the chopper circuit. This supply is produced by DP26 and CP26 and is used by the chopper driver stage. A good indication of this will be the fact that the main h.t. supply V2 and the 13V supply V4 will be low. When the 13V supply falls below 11V TL17 switches off and shutdown is activated.

### The Ultimate Nightmare

Now to the ultimate nightmare, a short-circuited chopper transistor (TP24). A replacement will almost certainly be destroyed when the set is switched on again unless some further work is carried out in the chopper circuit (Fig. 1). For a start I suggest that the chopper transistor's emitter resistors RP21 and RP25 are replaced, as they will have been stressed by the short-circuit. Fit a new transistor of the same type that was removed, and don't forget the mains fuse FP05 – it's a 1.6A anti-surge type. Don't switch on yet!

Before you attempt to power the set again, examine the chassis print around the chopper and line output transformers and along the side and rear edges in this area. Look for dry-joints on LP04, TL31, DL46, RP21, RP25, DP23, CP23, TP19, CL48, LL53 and TL29. This done you can get a bit more technical, produce the multimeter to impress the boss, and check for shorts across the V2 and VS supplies. Check whether DP23, DP32, DP41 or TL31 is short-circuit, or CL21 or RP42 is open-circuit. Finally, don't forget RL10 – when in doubt, check it out.

A 9V battery can be used to supply the chopper driver circuit. To do so, desolder DP06 and DP07 and disable TL17 by bridging across its collector and emitter. Hold your breath and switch the set on. Check the voltage at the cathode of the h.t. rectifier DP41. It should be quite low at about 28V. If there is no voltage here, disconnect the battery and check RP05, DP32, DP37 and DP43 for shorts. If these items are o.k., reconnect the battery and scope the drive waveform at pin 7 of IL14. Trace the drive through to the base of TP24. If all is well, check for a 12V peak-to-peak signal at the collector of TP24. If this is not present, look at the circuitry around TP24 and suspect the chopper transformer LP04.

When you first connect the battery and switch on, the h.t. line should as mentioned above be at around 28V. See if you get 7.5V at the anode of DP23 in the snubber network. If you don't, check DP23 and its associated components RP23, RP28 and CP23. If the 7.5V is present, go on to check the soft-start circuit. When the set is switched on and off there should be a pulse in excess of 1V at pin 15 of IL14. Suspect CL21 (1 $\mu$ F) and of course IL14 if the pulse isn't there. If the pulse is present go on to pin 13 of IL14 and look for 1.4V. Check CL16 (3.3nF) and IL14 if this voltage is absent.

If the voltage at pin 13 of IL14 is o.k., check IL14's regulation system by connecting a 5.6k $\Omega$  resistor between the cathode of DP41 and pin 9 of IL14. The voltage at the cathode of DP41 should drop to about 8V. If it doesn't, IL14 is obviously suspect. If all is well, keep the meter connected to DP41's cathode and remove the bridge from across TL17. The circuit should trip three times then shut down. If it doesn't, either TL17 and its associated components require investigation or IL14 is unwell.

If the trip works, switch off at the mains, disconnect the 9V battery, remove the 5.6k $\Omega$  resistor between DP41 and IL14, and remember to check RL10. Disable the line drive by disconnecting RP42, reconnect DP06 and DP07, then

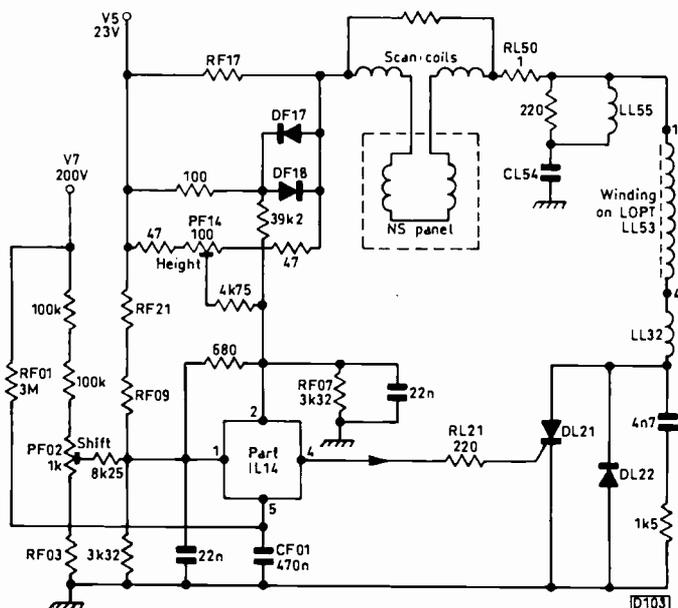


Fig. 4: The field timebase circuit. Component values not shown vary with tube size.

switch on again at the mains.

If the power supply fails, go back over the checking procedure. You may have missed something. If it works, switch off and reconnect RP42. Before you switch on again, check that the line output transistor TL31 isn't short-circuit and carry out resistance checks on the V4 and V5 supplies and at pin 8 or 10 of the line output transformer. If the conditions seem to be o.k., have faith in your work and switch the set on. If failure now occurs, with the destruction of TP24, suspect the chopper transformer LP04. Its failure is very rare, but in our game anything can happen.

### Field Scan Failure

Two types of field scan failure indicate different fault conditions. Fig. 4 shows the field scan circuitry. If the customary horizontal white line is present across the centre of the screen, there's no current flowing through the scan coils. The most obvious cause is an open-circuit somewhere in the scan current path. Check RL50, the scan coil plug BL55, plug BG36 on sets with NS correction, and the coils themselves.

More commonly the result of field scan failure is a blank screen. Momentarily increase the tube's first anode voltage. You will see a pale illumination of the screen from the top. Restore the correct first anode voltage and use a scope to check for a field-frequency sawtooth waveform at pin 5 of IL14. The most likely culprit if it's absent is RF01 (3M $\Omega$ ), though CF01 (470nF) could be in trouble.

Other suspects when there's no field scan are the output thyristor DL21 and the parallel diode DL22. Also look for dry-joints at pins 4 and 11 of the line output transformer LL53 (it's also the field output transformer).

If everything appears to be working correctly but there's an offset raster, check the field shift circuitry around PF02.

If the thyristor DL21 isn't being triggered, the 23V supply can rise to an excessive level. The cause of this is that DL22 continues to rectify the line pulses, charging CL54 to about 200V. The voltage can, with DL21 off, leak away only via the scan coils, the height control network and RF07, and the line driver stage. Under these conditions

DL18 should conduct, raising the voltage at pin 28 of IL14 with the result that the set shuts down.

### Standby Operation

The ICC5 chassis remembers the state it was in when it was switched off at the mains. If you collect a customer's set, disconnecting it while it's in the standby mode, it will power up in this mode when you switch it on again in the workshop. To bring it on without the remote control handset, press channel up for about ten seconds or connect a 9V battery between chassis (negative) and pin 8 (positive) of the scart socket. The latter will bring the set on in the AV mode.

In the standby mode the standby power supply (Fig. 2) delivers 5V to pin 27 of the microcontroller chip IR01 and 8.5V to the emitter of the switching transistor TP48. An on command to IR01 will change the state at pin 5 from high to low, turning on TP48 via TR26. TR26's base is held at 5V, and this voltage must be present if the receiver is to come on. When TP48 switches on, IL14 is powered and the chopper and line output circuits come into operation. Once the line-output stage derived 13V supply is present, DP47 switches on and the standby power supply regulator transistor TP45 switches off.

### EW Correction

EW correction circuit (not all sets incorporate this) problems seem to relate mainly to transformer LG11, whose insu-

lation is a bit suspect. The TDA4950 chip IG01 usually suffers, and the main PCB in this area can go very dark brown because of the overheating. The board darkening doesn't seem to have any adverse effects, but if you get a set with this discoloration take a good look at the EW-correction circuitry. A short within the chip can cause severe EW bowing.

### Safety

Remember that with many earlier sets the mains bridge rectifier's reservoir capacitor CP03 can retain its charge for days, even weeks – more recent sets have a discharge path consisting of two 220k $\Omega$  resistors in series. To avoid any unpleasantness in this respect, connect two 27k $\Omega$ , 1W resistors in series and encase them in a suitable sleeve. Connect these resistors across CP03 whenever you are working on the power supply.

Remember that the chassis has two separate earth lines, the isolated one and the one on the live side of the chopper circuit. Don't bridge the isolation, always work with an isolation transformer, and remember that dangerous voltages are always present.

Remember that like all other chassis the c.r.t.'s heaters are fed from a winding on the line output transformer. Unless the h.t. supply (V2) is set up accurately the heater supply will be incorrect and the life of the tube will be threatened. Always check with the service information what the h.t. voltage should be.

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## HELP WANTED

Wanted: Service information, showing waveforms, for the Sanyo Model VTC5400P VCR, and any information on fault-finding in the teletext section of the Philips G11 chassis. H. Chamberlain, 68 Valley View, St. Keyne, Liskeard, Cornwall PL14 4QJ.

Wanted: Mains transformer for the Morphy Richards Model CT869 portable colour TV/radio/clock. A. Pilditch, Essex 2 BMH, Crowthorne, Berks RG11 7EG.

Wanted: Service sheets for the Philips C670/01 (G11 chassis) and the Pye 42KT3157/05W (KT3 chassis). Photocopies would do. R. Norgan, 24 Hankinson Road, Bournemouth BH9 1HJ (0202 529 181).

Wanted: New or good second-hand LOPT (T502) for the Oriental Mascon Taiwan Inc. Model TE5155 CGA monitor, also a circuit diagram. LOPT delivery would be to a UK address. Stephen Shaw, PO Box 1404, Randfontein, 1760, S. Africa.

Does anyone have details of a modification to replace the BZX61C120 zener diode? – I believe ITT brought one out for the CVC1175 chassis/Solavox 20S09. Circuit diagram also required for this chassis. Also circuit diagram for a Uniden 7007 satellite receiver which is reluctant to come on. R. Baker, 17 Chapel Lane, Upwey, Weymouth, Dorset DT3 5NA (0305 208 815).

Wanted: Service manual or circuit diagram for a 28in. colour TV set by the name of Best Model 70GTX92. M.

Shafiq, 4 Leighton Road, Old Trafford, Manchester M16 9NX.

Wanted: Service sheet for the Ferguson Model 3T14. John Twamley, Fingal TV and Electric, 68 Main Street, Swords, Co. Dublin, Eire (phone 840 2206).

Wanted: Following back issues of *Television*. All 1984-1990 plus January, February and March 1991. A. Baker, 5 Croft Court, Edenbridge, Kent TN8 5BZ (0732 866 990).

Wanted: LOPT for the Network Model NWC1410R and RGB PCB or NW2521S chip for Model NWC1401. Leon Electronics, 11 Woodend Close, Three Bridges, Crawley, West Sussex. 0293 20536.

Wanted: Circuit/manual for the HMV MCH12 music centre and GEC V4100 VCR (Hitachi VT11). Lynn Miles, 128 Penllyn Estate, Cwmavon, Port Talbot, W. Glamorgan SA12 9NW. 0639 885 027.

Wanted: Akai VS301 deck or complete VCR, working or not (VS601 has same deck), also remote control unit. Service data for Hitachi VIP201P video disc player and old mono reel-to-reel video recorders. T. Martini, 6 Levant House, Mile End Road, London E1 4RB. 071 790 6807. Fax 071 702 8774.

Wanted: Modules for the ITT Model TX9792 (CVC30/1 chassis). Stan Jesney, 56 Barnacle Lane, Bulkington, Nuneaton CV12 9RQ (0203 315 788).

# Long-distance Television

Roger Bunney

June brought the start of the summer weather, with very hot days, high pressure and clear skies. As a result there was a dramatic improvement in Sporadic E propagation conditions, with openings on most days. Though the quality and duration of the openings didn't match the halcyon days of the late Eighties, it was nevertheless a very busy month. Even Arabic stations have been received. The SpE log for the month is as follows:

5/6/93	TVE (Spain) ch. E2; ARD (Germany) E2.
6/6/93	DR (Denmark) E3; TVE E2, 3.
7/6/93	TVE E2, 3; DR E3; CST (Czechoslovakia) R1; RAI (Italy) 1A.
8/6/93	TVE E2-4; RAI 1A, B; DR E3; TDF (France) L2; +PTT (Switzerland) E2; ORF (Austria) E2a; ARD E2-4; MTV (Hungary) R1; PTV (Poland) R1; CIS R1; SVT (Sweden) E2-4.
9/6/93	RAI 1A, B; TVE E2-4; TDF L2, CST R1-4; JRT (Yugoslavia) E3, 4; RUV (Iceland) E3, 4; RTSH (Albania) IC; YLE (Finland) E4; JRT (Jordan) E3; suspected NTA (Nigeria) E2; unidentified 525-line signals on ch. A2.
10/6/93	CST R1; ARD E3; RAI 1A, B; JRT E3; TDF L2, 3; TVE E2-4.
11/6/93	JRT E3; RAI 1A, B; ARD E2-4; ORF E2a, 4; +PTT E2, 3; TVR (Romania) R2; CST R1, 2; TVP (Poland) R2; CIS R1-3; SVT E2; NRK (Norway) E2, 3; TVE E4.
12/6/93	ARD E2; ORF E4; RAI 1A, B; TDF L2; TVP R2; CST R1, 2; +PTT E2, 3; TVE E2-4.
13/6/93	TVE E2, 3; RAI 1A; DR E3; CST R1; CIS R1; TVP R2.
14/6/93	CST R2.
15/6/93	CST R2; CIS R1; SVT E2, 3; TVE E4; RTP (Portugal) E3.
17/6/93	RAI 1A, B; TVE E2-4; RTP E2, 3.
18/6/93	TVE E2; RAI 1A.
19/6/93	SVT E2, 3; NRK E2-4; TVE E2.
20/6/93	ARD E2; RAI 1A, B; TVE E2, 3; +PTT E3.

21/6/93	DR E3; SVT E2-3; NRK E2, 3; CIS R2; YLE E3.
22/6/93	SVT E2, 4; YLE E3; +PTT E2, 4.
24/6/93	TVE E2, 3; RAI 1A.
25/6/93	DR E3; TVE E2, 3.
26/6/93	SVT E3; RAI 1A, B.
27/6/93	TVE E2-4.
28/6/93	TVE E2-4; RAI 1A; ARD E2-3; MTV R2; JRT E3.

With the prolonged hot weather there were marginally improved tropospheric propagation conditions on the 5/6th, with Band III/u.h.f. reception from France and the Benelux countries, and on the 29/30th when Danish and German u.h.f. signals were received across central and southern England.

Ryn Muntjewerff and Simon Hamer have both received Tirana ch. IC, which was thought to have been closed down as part of the recently notified changes to the Albanian TV network. Can anyone suggest the source of the weak 36.83MHz tropospheric scatter signal mentioned last month? – Brian Williams receives it from 190° near Cardiff.

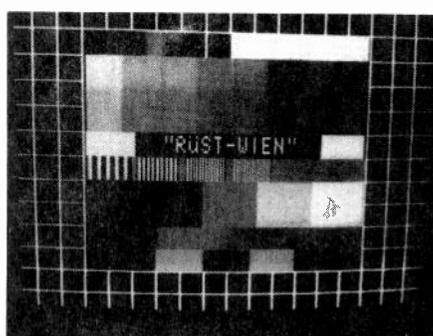
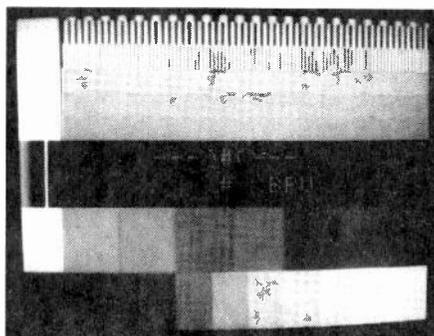
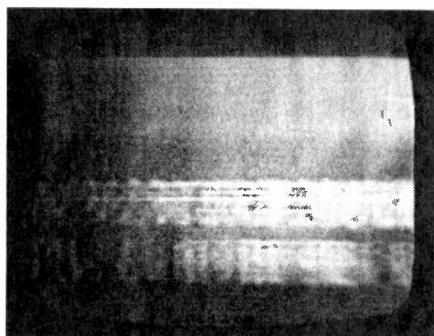
## News Items

**Sri Lanka:** Bandu Gunasekera (Colombo) reports that TNL-Telshan Network started regular broadcasting on June 21st. Transmitter details are as follows: Hantane (Colombo area) ch. E3; Nuwara Eliya and Deniyaya ch. E4; Kandy ch. E21. There are only weak ch. E3 and 4 signals in Colombo and the u.h.f. transmissions cannot be received. High-quality f.m. TV stereo sound is available at 101.7MHz. TNL is the fourth Sri Lankan TV network. East-West TV hopes to start a service broadcasting much of the AsiaSat-1 output (Star TV), including Prime Sports and BBC Asia WS. Channels E31, 32, 33 and 56 would be used.

**Australia:** Robert Copeman tells us that two new v.h.f. allocations are to be made for Channels 9A and 12. ABC-TV's ch. 2 transmitters in the main cities around the country are to move to Band III (possibly ch. 12) or u.h.f. operation.

**New Zealand:** Cellular-Vision NZ of Auckland plans to install microwave distribution systems in all the major cities, providing up to 49 channels.

**Germany:** Because of financial pressure ARD is to postpone the start of DAB (digital audio broadcasting) until 1997 at the earliest – the cost of transferring nearly three hundred ch. E12 relay stations to u.h.f. operation will be over DM30m. The first commercial, regional TV station in Berlin, Scha-  
moni-TV, is due to start operations in late August. Several channels have been allocated for commercial TV services in the eastern part of the country – RTL and SAT 1 will be two



Left: An example of F2 reception. This text display from China on ch. C1 was received by Ryn Muntjewerff in the Netherlands in February 1992. Centre: A test pattern caption being prepared in Brussels. Reception by John Locker in Liverpool via Eutelsat II F1 at 13°E (Reuters transponder). Right: Another shot from John Locker, this time of reception from Vienna via Intelsat K at 21°W.

of the broadcasters operating in Saxonia.

**Iceland:** The Stod-2 service intends to bring a microwave network into operation in Reykjavik this autumn, relaying satellite channels including Discovery, MTV, CNN, UK Gold, Sky News and BBC WS TV. Operations will be set up in other locations later.

**Turkey:** Because of delays to legislation enfranchising them, nearly a hundred commercial TV stations were closed down on April 1st.

**Czech Republic:** All ch. R4 transmitters are to move to ch. R55: the programme is to be completed by January 1st 1995. The commercial station FTV Premiera is now broadcasting in Prague on ch. R24. It relays Super Channel with the Premiera logo at the upper right-hand corner of the screen.

**Belgium:** RTBF is to use the UK instead of the Percival teletext system.

## Satellite TV

Asianet is to provide a four-channel (initially) service covering much of India/Asia from the Ekran satellites at 99°E. Transmissions will be at u.h.f. with powers from 46-56.5dBW.

Eutelsat plans to offer a new type of service, called Rainbow, for smaller broadcasting organisations unable to lease a transponder full time. It's expected to start when the new Eutelsat II F5 satellite comes into operation.

Intelsat is to increase its operations in the Asia/Pacific zone with satellites at 95, 85, 69 and 33°E. The latter is of particular interest since it will be visible from the UK – its service area will cover India, parts of Asia and much of the CIS.

A new-generation large satellite known as Dong-Fang-Hong-3 is due for launch by China this winter or next spring. It will be used for broadcasting/TV and will have 24 C band transponders with a maximum e.i.r.p. of 40.5dBW.

Filmnet is to start using digital signal compression this autumn: cable operators in Belgium and the Netherlands will be provided with decoders. Both Filmnet services will be transmitted via a single Intelsat transponder. NTL is to supply MPEG encoders while Scientific Atlanta will supply the decoders. Bear this in mind if you are thinking of buying a Filmnet decoder!

BT is to move its telecomms services from Eutelsat II F1 at 13°E to Eutelsat II F3 at 16°E. This will enable Eutelsat II F1 to be devoted solely to TV use. Late next year Eutelsat II F6 will arrive at 13°E, offering more TV channels with increased powers – sufficient to enable 90cm dishes to be used in Moscow.

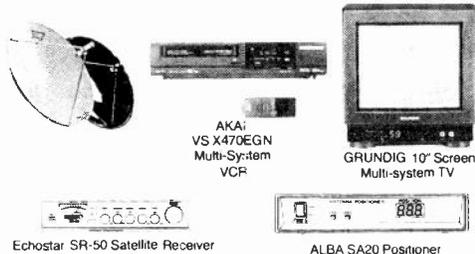
Finally, CNN1 is being transmitted terrestrially in Romania on ch. R31.

## The Way We Were

The July 1956 issue of *Practical Television* reported a major event – the closure of the BBC's TV transmitter at Alexandra Palace. Ally Pally as it was affectionately known was to close after twenty years' service, punctuated by the war years – though the transmitters were in use for radar experiments during this period. At close down the transmitters were the original Marconi-EMI ones made in 1936. The London area was to be served by new transmitters at Crystal Palace, where parallel units would be used so that a half-power service could be continued in the event of one transmitter breaking down. The report commented that they would be capable of colour transmissions "when they come".

The same magazine listed the principal exhibitors at the

## OFFERS FOR THIS MONTH!



Aerial Techniques celebrates its 14th year of successful trading with several special offers to customers, both old and new.

**GRUNDIG P27-549/12** Multisystem 10" screen tv, covers Bands 1, 2 & 3, UHF and cable channels, Systems PAL 1 (for UK), PAL B/G (for Europe), SECAM L (for France), SECAM B/G: D/K etc. NTSC 3.58 & 4.43MHz, 12-24V DC & Mains operation complete with infra-red remote control ... **£339.00**

**AKA VS X470EGN** Multisystem VCR, covers Bands 1, 3 & UHF. Systems PAL 1 (for UK), PAL B/G (for Europe), SECAM L (for France), SECAM B/G: D/K etc. NTSC 3.58 & 4.43MHz. DX 4 head. Long Play, Multi-voltage, 8 event-1 year timer ... **£499.00**

**ECHOSTAR SR-50** manually tuned Satellite receiver with built-in bandwidth filter (reduces to 12MHz) ... **£149.95**

**ALBA SA20** manual Satellite positioner with 3 digit LED display ... **£79.95**

**SATELLITE DXERS** motorised package, comprises Echostar SR-50 manually tuned receiver, 90cm spun aluminium Dish, 0.9dB LNB, feedhorn, polanser, actuator and indoor positioner (1.2m Dish option available) ... **£499.00**

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Tel: 0202 738232 Fax: 0202 716951

National Radio Show, held at Earls Court from August 22nd. The names include Invicta, Pam, Pilot, Regentone and Spencer-West. All big names in their time but today just a dusty listing in an old magazine.

There was also a report on early TV-DXing efforts – attempts in Malta to obtain some sort of service from the newly-established Radio Audizioni Italia (RAI) transmitter at Monte Lauro, some 200 miles from Valetta. The ch. E5 transmitter's location was at 3,000ft a.s.l. France was still using an obsolete 414-line system – in addition to the 819-line system. May 2nd of that year saw the opening of the first TV transmitter in the Middle East, at Baghdad. Pye of Cambridge supplied the equipment and the opening date was selected to honour the birthday of King Feisel. Pye lost out in its bid to install the first TV station in Lisbon however: the contract went to RCA which bid £398,060, considerably less than Pye's bid of £556,508!

## Multiband DX Array

We now have the answer for those who, because of planning restrictions etc., are allowed only a single DXing array: Triax has introduced a v.h.f./u.h.f. system. It incorporates a three-element array with a peak gain of 4.5dBd for Band I; an array with six directors and a large reflector, giving a peak gain of 9.5dBd, for Band III; and a high-gain (14dBd peak) X-type widebeam array for u.h.f. The boom is 3.7m long and the system weighs 6kg. It's designed for use with 75Ω unbalance coaxial cable and is intended for the Arabic markets. You can however obtain it from Aerial Techniques (0202 738 232).

# What a Life!

*Donald Bullock*

We get some strange coves here. Some of them are harder to puzzle out than the TV and video faults they bring along. Take Mr. and Mrs Bugg for example. They tottered in the other day with something wrapped in a towel in a baker's basket.

"Don't think I'm trying to be funny Mr. Er. . er. ." he said, "but are you any good at fixing transistors?"

"There never was such a fellah" I replied.

"Don't think I'm trying to be funny, but this is a telly transistor. My son tried superglue and blue tack but now he thinks it's a condenser, 'cos it stinks rotten. Then the cat suddenly had a fit last night."

"Let's see it" I said, pointing impatiently at his basket.

He untied the towel slowly to reveal a moggie. Something was beginning to build up in my chest.

"Not the bloody cat" I screamed, "the transistor." Then I pulled myself together. "Actually Mr. Bugg I'm a bit on edge. Busy, you know."

He ran out to his car and came back with a Toshiba 175T9B colour set.

I waved them out and opened the set up. An empty super-glue tube was stuck to the inside of the cabinet and the line output transformer was covered with a black, gooey mess. There was a crater of ash in the middle and a couple of nearby resistors and a capacitor were charred.

I'd a set with a similar chassis in the workshop, so I borrowed its line output transformer. The charred resistors, R440 and R441, were both 10k $\Omega$  while the capacitor (C445) was 0.056 $\mu$ F. These three items are at the earthy end of the e.h.t. system, for current monitoring purposes. I fitted the borrowed transformer, replaced the three charred components and switched on. There was an excellent picture, which pleased me. So I called Mr. Bugg on the phone to tell him of my success.

"I'll have to send for a new transformer of course" I told him. "The cost will be thirty-eight quid altogether. It's a super picture!"

"Ah now Mr. Er. . er. . , don't think I'm trying to be funny but that's a bit steep, ennit? We're old-age pensioners you know. Shall we say twenty quid? Then we'll let you do it."

It turned out to be another wasted effort. Pity.

## **Mr Chausible's VCR**

Then Mr. Chausible bumbled in, smiling and winking away as though in the know. "Ha, ha, it's good to be alive on such a nice day" he chortled. "The postman just gave me this letter for you." It turned out to be an electricity bill for over three hundred quid.

He'd brought his VCR with him, a Ferguson 3V44 (JVC HRD140). As he sloped off I pulled it on to the bench to try it. When I inserted a tape the carriage descended and the capstan motor, drum and on-off beacon pulsed for twenty seconds. Then the tape was ejected and the machine switched itself off.

"Swine" I thought as I opened it up. It was full of tape debris and dust, so I gave it a good mechanical service. The fault remained of course. Time for a bit of analytical thinking for a change. I decided to start at the beginning of the electromechanical cycle and studied the loading motor.

It was cutting off too early. But why the pulsing? That seemed to indicate an electrical problem. I moved to the power panel to check some voltages and saw that the 2A fuse F2 in the centre was open. A new one restored normal operation. The current was well within the fuse's rating, even at the peaks, but I soak tested the machine to be sure that everything was o.k.

Eventually Mr. Chausible called to collect it, grinning and winking as ever.

"Twenty-five pounds" I said.

Chausible's smile faded and his winking eye stayed shut. "Gosh, you people aren't cheap" he said. "I'd reckoned about a fiver, even a tenner if expensive parts had been required. But twenty-five pounds!" Then he looked up. "Don't think I'm trying to be funny. . . "

## **A Call from Ribby Ellis**

My next caller was Ribby Ellis, who's a keen practical joker. He's spent enough time in our workshop to know how customers carry on but said that he had a couple of genuine questions for me.

"Tell me Don, which is the best telly?"

I tried to answer this one as I always do, pointing out that most sets are much of a muchness today and that it depends on what facilities are required.

He heard me out then came back with "how long will it be before tellys get cheaper?"

"They're dirt cheap today, Ribby." I went into my usual routine about the cost of a Philips G6 and a Commer 5 cwt van back in 1968 and their respective prices now.

He then wanted to know "when tellys will work without aerials. You know, like radios do?"

So I launched into my answer to that one, as I've done so often over the years. When I'd finished he asked "whether dust in tellys makes 'em fail sooner?"

This brought us to dry dust and damp dust and folks who take the backs off sets and upset them. Time was ticking away, but there were further questions about how long a tube really lasts. does it leave the sound when it fails and how long does a telly last?

I was beginning to feel irritable again. "Tell me, Ribby, how much longer are you going to throw these questions at me?"

"Till you realise I'm taking the Mick, you silly" he grinned. "Lost some of your buttons, haven't you? Name's Ribby you know."

"I know, Ribby, but I'm afraid I'm not up to it today."

## **Next the Gas Man**

Just then there was a tap at the door. It was Rupert Quelp, the gas man.

"Hi Donald. I've just read your meter. Don't think I'm trying to be funny, but if I were you I'd leave home before the bill comes. Have a look at my portable video, will you? It can't be much because it's o.k. most of the time. It's a Fergy 3V47 and it's gone off intermittently since it was new. Snoddies never managed to find out why. Nor Gumboils, or that spotty D'Arcy kid at number 29. So I'm letting you have a go. Let me know when you've found the cause, so that I can decide whether to have it put right. They're so cheap now you see. Crubbs Foodstore have them at £99.95 and you get a hamper of goodies and a ticket in their draw for a month at Disneyland!"

"This is Disneyland" I said, "and the name's Donald Duck." I put the machine on the bench and tried it. The picture and sound were o.k. and I couldn't make it fail. So I

put it on soak test. A few hours later the vision went, leaving a snowy raster. After giving the machine a full service I looked around for dry-joints on the power and signals panels but couldn't see any. Because of the intermittent nature of the fault I spent a considerable time before finally removing the drum and discovering that the feed wires had never been soldered. When this had been attended to the machine worked perfectly, producing exceptionally good pictures.

Rupert was pleased when he called back. "Ah, a loose wire! I knew it wasn't anything much! You can't charge of course because you've not really done anything, but I'll remember the good turn. I breed reptiles you know. If you ever want to know anything about snakes or other forms of low life, just ask."

There must have been something in my expression, because he backed away and smiled weakly.

"Don't think I'm trying to be funny, Don. . ."

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# CD Player Casebook

*Reports from Mike Leach  
and Ronald Aranha*

## Laser Problems

A spate of faulty lasers has given us some problems recently. The first machine was a Samsung RCD995 portable radio/CD/cassette player. When brought into operation it would read a disc, play it for about a minute then stop. After that it would no longer read discs. If you left the machine switched off for a few minutes then switched on again it would once more perform for a minute or so. A new laser assembly cured the problem, but considerable adjustment was required to set it up. This made me wonder whether the original assembly had been faulty from new.

The second machine was a Pioneer PDM601. When the first disc was inserted the laser unit seemed to move towards the outside before slowly returning to the centre: after this it would sometimes but not always read the disc. The first clue we had was the fact that the machine would read only some discs, not others. A new laser assembly restored correct operation.

The third machine was a Goodmans GCD601 which had a tendency to skip and jump with long-play discs. A disc that had a playing time of less than about forty five minutes seemed to be all right. Again a new laser was the answer. **M.L.**

## Sony CDPS39

The customer complained that this machine got hot and that after an hour's use the sound was distorted. We ran it on test and found that the heat it generated was, when compared with another machine, normal though it was quite warm. After forty five minutes or so the distortion set in. So we checked the eye pattern waveform at the r.f. test point. There was no clear eye pattern: it was distorted, as though clipping was taking place. We first checked the power supply, whose outputs were normal. Next a few bursts of freezer were applied to the r.f. amplifier chip, which is in the laser assembly. This restored normal sound. Hot air brought back the distortion. A new laser unit, type KSS240A, cured the fault completely. **R.A.**

## Sony CDPM43

The complaint with this machine was that the display said "no disc" though there was a disc in the tray. We found that focus search took place and there was laser glow, but the disc didn't spin. So attention was turned to the spindle-motor drive circuit. The drive comes from

pins 26 and 27 of the BA6297 chip. There was a voltage across these pins when the focus o.k. signal was generated, but this voltage didn't appear across the spindle motor's terminals. The player has a double-sided PCB. As none of the tracks were open-circuit or cracked the cause of the fault had to be one of the plated-through holes. When pin 26 of the chip was wired directly to the motor's negative terminal the unit read the TOC and played normally. **R.A.**

## Telefunken CD300E

This machine was not able to read the TOC. We played a few discs but there was severe skipping. A check showed that the peak-to-peak amplitude of the eye pattern waveform was just 0.5V. After fitting a new laser unit, type KSS150A, and setting it up the machine played normally, the amplitude of the eye pattern waveform being 1.2V peak-to-peak. **R.A.**

## Sony Discman D90

There was no display, no focus search and abrupt shut down. We put the machine in the service mode but the display didn't change. The cause of the trouble was a dry-joint at the emitter of the 2SB1182 transistor Q417. Resoldering restored normal operation. It seems that the dry-joint could have been caused by the heat Q417 generates. **R.A.**

## Sony CDP17F

The customer complained about skipping. While checking the EF balance we found that the peak-to-peak amplitude of the waveform was just 0.5V. The manual said it should be 1.2V. Lens cleaning made no difference, so a new laser unit was fitted and set up. The machine then played perfectly. **R.A.**

## Sony Discman DT66

This player wouldn't read the TOC. We noticed that the spindle motor table, which holds the disc by means of three spring-loaded steel balls, was broken. Because of this there was too much wobble when a disc was loaded and rotated, hence no TOC reading. After fitting a new spindle motor, part no. A-3133-413-A, the machine worked normally. We've had this problem with a number of these players. **R.A.**

# CAMCORNER

*Reports from Savio Da Costa,  
Brian Storm, Nick Beer  
and Simon Bodgett*

## **Panasonic NVM7**

The customer's complaint was that this camcorder would fail after twenty minutes or so. In fact the battery was defective. Strange, as the battery low warning didn't show and the current consumption was o.k. **S.DaC.**

## **Panasonic NVM7**

There was no camera picture, just a blank screen. We found that the camera 16V supply was missing at pin 5 of connector P3003 though it was present at TP1001. Obviously there was a break somewhere but a jumper wire restored a good picture. **S.DaC.**

## **Telefunken 890 (VHS-C)**

This camcorder wouldn't play or record because the drum ran at full speed. When we opened the unit the screw that secures the cassette lid jumped out and we found that the three cassette deck mounting poles had broken away from the main housing – the deck was virtually falling off. We fixed the poles with superglue, securing the deck, and all was well when the unit had been reassembled. Presumably the camcorder had been subjected to shock and that screw had shorted somewhere without causing a massive fault. **S.DaC.**

## **Panasonic NVM1**

We recently had three of these camcorders with different faults. The first had no EVF picture in any mode, just a blank screen. Q3004 on the luminance PCB was open-circuit all ways.

The second machine would record but had no playback picture or sound. We found that the except Rec 5V line was at 0.86V because Q6004 on the syscon panel was open-circuit base-to-emitter.

The third one had a tape jammed inside. When we powered the machine it switched on then went off after a few seconds. The loading motor didn't operate and its driver chip IC6004 was decidedly hot. A replacement i.c. restored motor operation and the tape unloaded but didn't wind back into the cassette. There was no capstan rotation because its driver chip IC2006 was faulty. **S.DaC.**

## **Panasonic NVMS4B**

This machine was totally dead – no lights, action or anything. Voltage checks around the main systems micro-controller chip, which has a frightening number of legs, showed that the systems 5V supply was missing. The S81350HG-KD 5V regulator IC6010 and the associated 2SD1328 switching transistor Q6010 were both faulty. **B.S.**

## **Panasonic NVM10B**

There was a most surprising fault with this full-size camcorder. The electronic zoom operated slowly at switch on, going to full telephoto. After this the lens would usually work normally. Sometimes on auto-focus however it would move slowly to full telephoto: this occurred only when the picture was out of focus. I

vaguely recalled a feature of this model. If you leave the unit in macro, switched to auto-focus, at switch on it will zoom out of macro before attempting auto-focus. I immediately began to search through my box of used lenses. Digging out an old NVM10 lens, I removed the optical position sensors then fitted them to the faulty camera. Much to my relief this provided a complete cure. The defective sensors measured all right and the reflective strips were cleaned, but new sensors had to be fitted. Since my first experience I've had this fault with another NVM10B, so beware. **B.S.**

## **National VWAM7BA**

This is the power supply/charger/r.f.-av adaptor for the NVM7 camcorder. It has a switch-mode power supply with an f.e.t. as the chopper device. The unit was dead because there was no chopper drive, though the start-up voltage was present at the control chip. The cause of the fault was lack of feedback from the secondary side of the supply because rectifier D1001 was dry-jointed on all three legs. **N.B.**

## **Panasonic NVS6B**

When this camcorder powered up, the picture from the camera head flashed like mad. The iris was opening and closing at an alarming rate, with no apparent damping. A new iris assembly put matters right. **S.B.**

## **Panasonic NVM40**

In both record and playback a clicking noise could be heard coming from the mechanism. The cure consisted of removing a foreign body from the capstan motor area followed by motor rotor/stator clearance adjustment. **S.B.**

## **Fuji F610/Sony CCDF330**

This one came in with a damaged lens. I tried to fix it with sticky-backed tape but this didn't hold very well. After fitting a replacement lens deep depression set it: there was an unreported fault, intermittent loss of playback colour. We traced the cause to the colour a.f.c. filter capacitor C461. **S.B.**

## **Telefunken 4300**

The customer had two complaints with this machine: noise bars on the picture and cassette eject failure. Retiming the loading mechanism restored correct mechanical operation. The noise bars were being caused by a faulty video head preamplifier. **S.B.**

## **JVC GRAX2**

The reported faults were no camera operation and the viewfinder blank when recording. This camcorder had suffered from rough handling, as a result of which the camera PCBs had sprung apart. Reassembly was all that was required. **S.B.**

# Letters

## TRAINING

I cannot agree with your criticism of 'educationalists' in the July leader, particularly the comments on early colour TV training. I remember attending several courses that were run for college lecturers at the time on colour systems. Prior to the decision to adopt the PAL system, NTSC was used in the course structure. Once PAL had been adopted, further lectures were arranged, at various regional centres, to familiarise us with this system – and how to set up the decoder and the shadowmask tube. Since many of us had trade experience, we were able to pass this information on to our students very successfully – quite contrary to your opinion!

In any course, some of the syllabus content is 'dead wood'. But many lecturers were able to use the servicing courses as a 'diagnostic tool' with a view to transferring suitable students to higher courses, even up to degree level. I know of several cases where students ended up as being lecturers themselves and, with their practical background, very good ones.

The biggest disaster in education was the introduction of BTEC in preference to the excellent C&G technician courses 270, 271, 272, 281 etc. Now we are about to see the attempted introduction of NVQs, which will not produce anything like the high standards of the C&G 224 course.

Most of the members of advisory committees are

industry based and are responsible to C&G etc. for updating courses and introducing new ones. Why not try lobbying and hassling these people rather than college lecturers, who do a very good job considering the various pressures to which they are subjected? With a strong enough lobby and a few constructive comments to those in a position to influence committees, it may be possible to avert another impending disaster before it's too late. Now that really would be something to write an editorial about!

Ron Bravery, I.Eng., FIEEIE,  
Brighton, East Sussex.

## NIKKAI NT14 AND NT20 CHASSIS

In the July TV Fault Finding pages Chris Watton mentioned failure of R830 in the Nikkai NT20 chassis. Readers might be interested to know that Nikkai has a modification kit to avoid random failure of this safety resistor. It applies to the NT14 and NT20 chassis and consists of a replacement sub power supply transformer, a new chopper transistor (2SC3148), a replacement for R830, a 470Ω resistor and a 10μF capacitor. The last two items are connected in series across the diode combination D818/9. You may find that these components are already fitted. I've done only a few sets, but in each one T803 (the sub power supply transformer) had blue insulation while the replacement has white. This might be a guide when deciding whether a modification is required.

The kit is available from Willow Vale (part no. 85146KT). I've seen these chassis used in Dansai and Goodmans sets.

Paul Hardy,  
Reading, Berks.

## RA100 – DESOLDERING STATION – RA100

### UK's most popular desoldering station as featured in "Television" issue February 1993 page 283

The A K Electronics Desoldering Station offers extremely good value when comparing prices of other similar desoldering stations available in the market place. The design and development of this equipment was started to provide a low cost high performance machine for our own use, being dissatisfied with the performance and running costs of available (and much more expensive) machines.

The specification was based on experience of various makes and models over a number of years in the television and aerospace industries.

A K Electronics have decided to make these benefits available to other users. The cost of this machine can easily be recovered in time saved, reduction of damage to printed circuit boards and the value of components salvaged. It is more cost effective than solder braid.

The desolder iron recommended for use with this machine is a standard temperature controlled item manufactured by Weller, Model number DS3102. Spares are readily available from several sources. One of the features of this desolder station is the high powered, vane type vacuum pump, which develops some 15 inches of mercury vacuum, which is a lot of suck and cleanly removes the solder from plated through boards. Another benefit is the low cost of replacement parts i.e. replacement vacuum pump is currently £35.00.

Also no expensive filters are required.

A range of Surface Mount desoldering attachments are also available for these irons.

#### Specifications

Mains Supply 240v 50Hz AC Consumption less than 45VA idle, 180VA pump running.

Duty cycle 30%. Iron supply 24V AC, 45VA.

Vacuum 15 InHg. Vacuum pump control via low voltage foot switch.

#### Three main reasons why they are very popular

- 1 Low cost maintenance
- 2 Low cost spares
- 3 Highly efficient vacuum

Cost of machine without iron £195.65 + £12 p&p + 17.5% VAT = £243.98

Cost including DS3102 iron £259 + £12 p&p + 17.5% VAT = £318.42

Outside England, carriage will be charged accordingly

Credit cards accepted but please note a 5% surcharge will be added to the cost price.

Postage accordingly outside UK.

Manufactured by A K Electronics, Dorset, England.

#### Distributed by:

JJ Components, 63 The Chase, Edgware, Middx. HA8 5DN

Fax and Phone 081-952 4641

Hotline 081-381 1700



# A Serviceman's Guide to PCs

## Part 2

David Botto

In this concluding instalment we'll take a look at software programs that are particularly useful for service department use. Just as the digital multimeter has largely replaced the analogue type, the wordprocessor has virtually superseded the typewriter. A wordprocessor types, edits, copies and deletes text in blocks. It stores standard paragraphs and sentences once typed in, recalling them whenever needed. They can be moved around within your document (the item you're working on) and used again. This all saves brain work and makes life easier.

Thus price lists for example can be produced, and revised whenever necessary, without the need to go to a printing company and the expense that involves. Some wordprocessor programs can place your company's logo, diagrams and/or pictures within your text: this is known as a graphic feature. Finished work can be checked for typing and spelling errors. Grammar and style checking programs such as Grammatik 5, StyleWriter and Wordstar's Correct Grammar enable your text to be improved before you print it out. Personalised letters and bills sent to your customers and suppliers have a professional appearance and create a good impression.

### Shareware Programs

A shareware program is one that can, for the nominal cost of a program disc, be tried out before you buy it. If you find that you like the program and want to continue to use it you pay a registration fee. This will bring you a manual and the full version of the software.

The best shareware DOS wordprocessor programs that I've tested are Galaxy Pro Light and MindReader. Galaxy Pro Light has an excellent 100,000-word spelling checker. It's simple to use and you have the choice of text and background colours. By dividing the screen into two sections you can display two documents simultaneously: parts of one document can then be moved to the other one.

MindReader is particularly helpful for disabled people and the two-finger hunt-and-peck typist. Only the first letter(s) of a word or phrase need to be keyed in: a pop-up window then appears with a short list of words. A single keystroke selects the wanted one, the computer then automatically typing out the entire word or phrase.

But I believe that it's well worth investing in a commercial wordprocessor program. A good one will contain features and abilities that are not usually available in a shareware program, such as a preview of your finished document so that you can see exactly how it will look when printed.

### Commercial Wordprocessor Programs

The best-selling CLI (DOS-based) wordprocessor program in the world is WordPerfect 5.1 (a new version, 6.0, has just been announced). WordPerfect is particularly suitable for those who can do a bit of typing because there's no need to use anything other than the keyboard. It needs a minimum of 384Kbytes of RAM, but more will give you improved performance. The default screen text consists of sharply-focused white letters on a blue background

(assuming that you have a colour monitor, otherwise it's white on black). They are much easier to read than the fuzzy black letters on a white screen produced by some Windows wordprocessor programs. WordPerfect 5.1 comes with a tutor program and a straightforward lesson book, with easy-to-read manuals, making it easy to learn how to use the system.

With WordPerfect it's simple to create tables, print mailing labels, import spreadsheets and even print complex mathematical equations. Its many features are too numerous to list here. They include integration of text and graphics, enabling you to create professional-looking bills, letters, reports and news releases. A keystroke automatically inserts the date in your document. The WordPerfect Corporation has an efficient and friendly telephone help line and the company responds to enquiries by return of post.

The program has a 115,000-word spell checker, a 10,000-head word thesaurus (to help you find the correct word to use) and a word count. Other features are bold print, underlining, macros, merge and multiple columns. There's a WYSIWYG (what you see is what you get) print-out display that can be read on a Super VGA monitor – some WYSIWYG wordprocessor programs produce what's called a 'greeked' display, with the text layout but only black lines that can't be read.

LetterPerfect is a cut down version of WordPerfect. It's suitable for those who need only the most common and widely used features of WordPerfect. These include the spell checker, thesaurus, pull-down menus and print preview. It has full WordPerfect compatibility.

Another fine DOS wordprocessor program is TopCopy Professional. This has a built-in 115,000-word Collins dictionary and an 800,000-word thesaurus. There's an automatic 'behind-the-scenes' copy of your document so that, in the case of a power failure, your work isn't lost. You can see at a glance how your pages of text will look when printed. Five preview sizes range from fingernail, showing a tiny picture of over twenty pages at a time, to a full-sized view of each A4 page. The TopCopy help line is excellent.

If you'd like a program with GUI interface but no need to install Windows 3.1, the European StarWriter 6.0 could be for you. DOS based, it works at high speed. There are spelling-checker and thesaurus modules in English, French and German. Install a fax card/modem board in your PC and StarWriter will automatically compose and send a fax straight to the destination fax number.

The WordPerfect 5.2 Windows version program includes the Grammatik 5 style and grammar checker, also the new WordPerfect QuickFinder, an indexing and text-retrieval feature. It's claimed to be easier to use than other Windows programs.

Word for Windows 2 is a powerful windows wordprocessor program that includes a thesaurus, a spell checker and a grammar checker.

A PC with an 80386 or preferably an 80486 microprocessor chip is required to run a Windows wordprocessor program. The Windows 3.1 program has to be loaded on the hard disc. At least 4Mbytes of RAM are needed, 8Mbytes

for best results.

Other popular wordprocessor programs are WordStar 7, IBM DisplayWrite 5.0 (both DOS), WordStar 1.5 for Windows and Ami Pro 3 (Windows).

Make sure that the wordprocessor program you buy works with your printer. If it doesn't, the printer may produce gibberish or text with missing words or letters.

### **Integrated Packages**

An integrated package is a program that combines several facilities. As an inexpensive example, Microsoft Works Version 3 includes a wordprocessor program, a spreadsheet, an automatic telephone dialler, a spell checker, a thesaurus and several other features.

Geoworks Ensemble (DOS) combines a wordprocessor program, a spreadsheet and a graphic drawing program. In addition it has a planner with an appointment book, a card index file with telephone dialler, and a file and disc manager.

WordPerfect Works brings the most popular features into a single, inexpensive package. It includes LetterPerfect, a spreadsheet, a graphic editor, a database and a communication package. A small TV/video service shop should find that this program is well able to cater for its needs.

### **Desktop Publishing**

Desktop publishing programs enable documents to be laid out in a professional manner without involving the cost and time required when a printing shop is used. Advertisements and hand bills with pictures and drawings can be produced easily. Timeworks Publisher 3 is a reasonably priced program. Two other popular desktop programs are Aldus PageMaker (for Windows) and Express Publisher (DOS or Windows).

A PC version of Quark XPress is to be made available to PC users shortly. This company is a leader in electronic publishing. The program enables brochures, newsletters, books and newspapers to be produced.

### **Accounts**

Financial planning and proper book keeping are essential if a service department is to succeed. I've seen workshops where hundreds of dusty bills and receipts are impaled on a dangerous-looking spike. They await entry into an accounts book. This is usually done inaccurately and in great haste some weeks after the end of the financial year. A business that produces its accounts in this way won't show much profit and will almost certainly pay more tax than it need.

Delayed payment of employees' PAYE tax to the Inland Revenue means paying interest on the amount owed. Late payment of your VAT returns incurs heavy penalties. Accounts and spreadsheet programs prevent this, because you always know exactly where you stand. With a cash-book/accounts program it's easy to make daily entries. A VAT summary can then be printed out instantly. Yearly accounts can be printed out in the proper format quickly, ready to hand to the tax authorities.

Bank balances and charges can be displayed by your PC instantly. Banks make more mistakes with their charges than they like to admit. Your PC can check your bank's figures and could save you much money.

A spreadsheet program consists of columns of figures that show income and expenditure. Totals and balances are checked automatically, and you can see exactly how much

profit your business is making. Figures can be shown as columns, graphs or Pie charts. A spreadsheet program can calculate the profit you should be making, then compare this figure with the actual business done.

I can recommend WordPerfect Corporation's PlanPerfect spreadsheet. It interfaces with WordPerfect 5.1, is easy to use and comes with an excellent tutorial program.

Tas Books account processor is an ideal accounting program for the service engineer. It has earned good reports, is approved by the Institute of Chartered Accountants and has been inspected by the VAT office. The program is simple to use and comes with comprehensive tutorial and reference material. Tas Books shows the exact financial condition of your business. It pinpoints bad payers and helps you to get them to pay up! The program is available on a thirty-day free trial offer.

Money Manager is a particularly easy to use accounting program. It will keep your accounts and check on up to twenty different bank accounts. Full VAT reports for the week, month or year can be produced, thus keeping the VAT man happy.

### **Database Packages**

A database program will store customers' names and addresses, details of all rental contracts and sales and service records. When you keep this sort of information on your PC you may need to register with the Data Protection Registrar and pay a fee. A computerised stock control system will alert you to the spares position. You can include information on exactly equivalent parts and on those that at first seem to be interchangeable but aren't.

Two programs specially written for the TV, video and computer service departments are PC Support Group's ServiceBase and Microtest's Service Manager.

ServiceBase is a comprehensive new program that includes every function needed by the professional TV/Video service engineer. It covers all aspects of administration, keeps accurate records, issues job cards and automates stock control and parts ordering. A powerful feature is its ability to maintain a comprehensive fault data base.

Search routines enable you to check back on any repair, make, model or fault that has been previously dealt with and entered. A nice feature that's included in the package is a wordprocessor with mailmerge facility. I found it easy to learn and straightforward to use – you can simply press a key and on-screen help is immediately available. In my opinion the price is reasonable at £399 plus VAT.

Another program aimed at the TV, video and computer engineer is Microtest's Service Manager, a CLI DOS program which provides full repair logging and recall records, automatic job card production, purchase order processing, parts allocation, repair and spares costing and many other useful features.

The Service Manager program ensures that a customer is neither overcharged nor undercharged for a repair. Each user has an individual password and permission level to enter the program. Use of an incorrect password shuts the program down and records the fact that an unauthorised person tried to gain access.

The price of this program is £595 plus VAT, which is not cheap. It does however include a free training session. A free demonstration disc, containing a working model of the program, is available from Microtest.

The cost of either of these programs should be recovered quickly through more efficient costing and faster collection of outstanding money.

Alpha Four Version 2.1 is another fine database program.

It's a powerful system with all the features required to design a sophisticated custom database application without the need to pay a programmer or learn a programming language. Claims for Alpha Four are that there are over 400,000 users and that it may be the most powerful program ever developed for a PC. You can try it for thirty days on a money-back basis. At the time when this is being written Alpha Four is being offered with a free copy of SuperStor, which is claimed to double or triple the capacity of your hard disc.

### **Technical Programs**

Technical programs are useful for those involved in design or research. A carefully selected CAD (computer-aided design) package will draw circuit diagrams, produce graphics and models and simulate results.

The PADS-EVAL package from Emona Instruments is a surprisingly inexpensive CAD program from Australia. It can draw a circuit diagram of excellent quality – suitable for publishing in a book or magazine. The PADS-EVAL program also produces PCB designs. It will work with a wide range of printers (but not daisy-wheel types).

With a suitable A/D (analogue to digital) PCB, AX-SCOPE will turn your PC into an oscilloscope that emulates digital storage. It supports sixteen data acquisition and up to four display channels.

### **Buying Software**

The software you should buy depends on your needs. Shop around: prices for the same software item vary widely. Establish how much hard disc and how much RAM storage are required. Make sure that the version advertised is the latest one, and that it is in stock. Check the delivery time. Don't forget to post the registration card after you've taken delivery – it entitles you to free technical support. Table 1 lists all the programs mentioned in this article and the best prices that I could locate for them at the time of writing.

### **Viruses**

Viruses are nasty programs produced by people whose idea of fun is to infect the programs in another person's PC, rendering the PC and the programs stored on its hard disc useless. Once a virus is on your hard disc it can infect every floppy disc that's loaded into the PC. When buying a second-hand PC, take care. It's not something that I would recommend: there is always the chance that it may be infected with a virus.

If you stay with commercial software or virus-tested shareware you are not likely to be troubled. The danger comes when you receive a floppy or microfloppy disc that contains data from an infected machine.

Before I send anyone a disc I check it and my PC with an anti-virus shareware program called F-PROT. There have been no problems to date. This program is free to private users but a business user must pay a nominal fee. I then record the information to be sent on a brand-new, virus-free disc.

The Norton Antivirus version V2.0 is an alternative comprehensive virus defence program for both DOS and Windows programs. It can detect over a thousand different viruses and can repair the infection caused by most known viruses.

Never allow copied games programs that may be infected with a virus to be loaded into your workplace PC. It's a wise precaution not to allow any game program to be loaded – service engineers can all too easily succumb to spending hours playing horribly addictive, mind-bending, time-wasting games.

### **Training**

Does a service engineer need formal training to use a PC? It's a matter of opinion, but frankly I believe that the manuals and information provided with most software programs make training unnecessary for a skilled engineer. After all he or she is used to fathoming out deep mysteries whenever a previously unknown TV set, VCR or camcorder is encountered. Training may be advisable for non-technical people who do mainly clerical work.

### **Laptops and Notebooks**

A laptop or notebook PC is an expensive option unless you intend to take work home. The screen text is harder to read and the price is generally much higher than that of a desk or tower unit.

Before you buy a laptop PC as an additional computer make sure that it's fully compatible with your workshop PC. The hardware in a laptop computer is similar to that in a desktop unit but is extremely compactly arranged and is thus more difficult to service.

### **Modems**

A modem (modulator-demodulator) enables a computer to be connected to a telephone line. It converts the computer's serial digital data to a form and frequency that can be handled by the telephone system and vice versa. The modem can be in the form of a separate unit or a PCB that plugs into one of the expansion connectors on the PC's mother board. Most PCBs are now fax modem types that turn your computer into a fax machine with modem. A fax modem card can save you a lot of money that would otherwise have to be spent on postage. Your equipment must have BT approval.

## **Table 1: Software Programs**

The following is a list of sources of the programs mentioned in this article at the best prices that I can find (VAT extra unless otherwise stated). It applies at the time of writing: remember that prices and specifications can and do change, so check with suppliers when making enquiries and before placing any orders.

Action Computers, 5th Floor, Alpertown House, Bridge-water Road, Wembley, Middx HAD 1BR (Freefone 0800 333333) list the following programs:

Ami Pro release 3 (Windows) £266.  
Aldus PageMaker (Windows) £434.  
Express Publisher, DOS £99, Windows £116.  
TopCopy Professional (DOS) £87.  
WordPerfect 6.0 (DOS) £239.  
LetterPerfect (DOS) £75.  
Grammatik 5 (DOS or Windows) £78.95 (make sure that you obtain the latest, November 1992 English version).  
Norton Antivirus V2.1 (DOS) £109.  
Microsoft Works Version 3 (DOS) £95.

Timeworks Publisher 3 (DOS or Windows) £98.  
Wordstar 7 (DOS) £256.  
Wordstar 1.5 (Windows) £158.  
WordPerfect Works (DOS) £86.  
There's a new release WordPerfect for Windows 5.2 £219.

Alpha Software Corporation, Suite 113, The Computer Complex, City Business Park, Soke, Plymouth PL3 4BB (0752 606 881) lists Alpha Four Version 2.1 (DOS) at £99 (special offer).

Connect Software Ltd., 3 Flanchford Road, London W12 9ND (081 743 9792) lists Money Manager (DOS) at £49.95 including VAT.

Crown Computer Products Ltd, Plantation Road, Burscough Industrial Estate, Lancs L40 8JT can order PlanPerfect (DOS) £199.

Editor Software, Woodmancote House, 64 Woodmancote, Dursley GL11 4AQ (0453 548 409) lists StyleWriter DOS and Windows at £145.

Emona Instruments, PO Box K720, Haymarket, NSW 2000, Australia lists PADS-EVAL (DOS) at \$49.95 plus

postage (Australian dollars).

Megatech Software, 111-113 Wandsworth High Street, London SW18 4HY (081 874 6511) lists Tas Books (DOS) at £99 (special offer).

Microtest Ltd., Technology House, Normandy Bay, Bodmin PL13 1EX (0208 73171) lists Service Manager \* (DOS) at £595.

P.C. Support Group, Hamilton House, 66 Palmerston Road, Northampton, NN1 5EX (0604 604677) Fax 0604 602454 supplies ServiceBase at £399.

Star Division Ltd., 56 Halford Street, Leicester LE1 1TQ (0533 626 999) lists StarWriter 6 (DOS) at £99 (special offer).

Testware, 46 The Avenue, Harrogate, N. Yorks HG1 4QD (0423 880 471) can supply the following Shareware: Galaxy Pro Light (registered £49). Mindreader (registered £59).

Watford Electronics Ltd., Finway, off Dallow Road, Luton LU1 1TR (0582 487 777) lists Correct Grammar (DOS or Windows) at £60.

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# TEST CASE

## 369

Ray Rogers, sole proprietor of Wild West Aerials, had fallen on hard times. All the satellite dish installations in the area seemed to be in the hands of large contractors, and the storm-force winds that brought him so much business back in 1987 and 1990 were now but a distant memory. How he longed for some 80 m.p.h. gusts to bring him some work! But something had to be done to keep the wolf from the door, and the solution seemed to Ray to lie in setting up in the TV repair trade. His aerial customers had often asked him to recommend a firm, and in the past he had told them to come along to the Test Case workshop. Instead, he would do the repairs himself. He had already gathered together a rather elderly scope and a meter. With the help of a friend in the rental business and some service manuals he should be able to get along all right.

The first set to fall into the clutches of the newly-established Wild West Repairs was a Ferguson 41P3 (IKC2 chassis). Its fault was intermittent but, hopefully, not too obscure: from time to time the size of the picture would fluctuate, both the width and height being affected. The set would sometimes work for hours without any problems, then the picture would balloon and zoom, only to settle back to normal size again. Ray had a go at the PCB and various components with a screwdriver handle, but this had no effect. He could find no sign of a width control in the set or on the circuit diagram, but he did find that twiddling the set-h.t. preset control PP52 had the same effect on the picture as the fault. So far so good!

The service sheet told him that the h.t. voltage at test point BP50 should be 107V. At this level the picture size –

judged by looking at the teletext display! – was correct. Ray left his voltmeter hooked to the test point while he got on with other things. After a while the picture began to jump about and the pointer of the Avo 8 could be seen to jitter in sympathy. At one stage the picture held still in its over-sized form. During this brief interlude the voltage recorded by the meter was seen to rise well above 107V. The power supply section was responsible then. This TV servicing business is a doddle, thought Ray. Hi-ho Trigger!

He replaced the set-h.t. potentiometer and adjusted it for 107V. But twenty minutes later the picture was up to its tricks again. Following the advice he obtained from his rental-trade friend on the phone Ray replaced the two high-value resistors associated with the control, RP51 (110kΩ) and RP53 (1MΩ). You guessed it – this had no effect on the fault. Back to the phone, which was picked up by the rental company's Service Manager. Not realising this, Ray was half way through his plea for more help and components before it dawned on him to whom he was talking. Thus ended the liaison between Wild West Repairs and Rhondda Rentals. Now RR was on his own! It would obviously not be expedient to turn to the Test Case workshop, which still gave him work in the aerial and dish line.

As the bits he'd changed were associated with transistor TP53, a readily available BC558, he tried a replacement. Still the picture jittered when it had a mind to. Since the fault hadn't been cured, Ray reasoned that the BC558 he'd removed must be o.k. So he fitted it in the next position down the line, TP54, the same type of transistor being used here. But the picture still got up to its tricks spasmodically. Ray decided that both of the original BC558 transistors were all right. He had now spent four hours tinkering with this TV set and had got nowhere. Every man to his trade! He booked the repair into the Test Case workshop, where Television Ted, despite an aversion to all things French, found the cause of the fault in a matter of minutes.

# Fergy Faults

**Alex Mason**

## ICC5 Chassis

No picture: If video signals are present at pins 3, 4 and 5 of connector BV02 on the CRT base PCB, the voltage at pin 1 is 0V and at pin 6 is 12V, TV50 (BC558B) on the colour decoder PCB is either leaky or short-circuit.

## IKC2 Chassis

For field foldover check whether DF16 (BY398) is leaky.

If the set is dead with the voltage at the emitter of transistor TP18 in the power supply trip circuit low (should be about 21V) check whether DP16 (1N4148) is short-circuit.

## New TX90 Chassis

This is the chassis used in Models B39/B49F.

For field collapse check RL41 (0.22Ω, 0.5W) or JL15 (this is not shown on the circuit diagram). Both can go open-circuit.

If there are three or more flyback lines at the top or bottom

of the scan, check whether RL10 is open-circuit then DL01 (open-circuit if the lines are at the top, short-circuit if the lines are at the bottom.)

For no remote control operation check the ST639b1/kv microcontroller chip IR01.

If there's no picture after ten minutes' use check the 27MHz crystal QT01 on the text PCB.

Note that when RL41 is open-circuit the set will come straight on from power up and won't go into standby using either the handset or the front control.

## TX80 Chassis

In the event of a blow up in the combined power supply/line output stage check whether RP01 (27kΩ, 3W) has gone high in value.

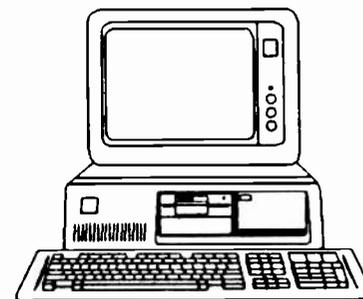
If the set is stuck in standby, check whether RP36 (75kΩ, 2W) has gone high in value.

## Notes

If you service any Model B59F/N sets note that the microcontroller chip is not the same as that used in Models A59F/N. The B series has PAL/PAL+/SECAM and 16:9 ratio switching and is marked ICC8.

The new Model B51F is fitted with the ICC7 chassis, not the IKC2 chassis.

## TELEVISION INDEX & DIRECTORY and REPRINTS SERVICE



A computerised index to *TELEVISION* magazine covering volumes 38 to 42 (1988 – 1992) is now available. It contains over 3500 references to TV/VCR fault reports and articles, with synopses. It includes a TV/VCR spares guide, an advertisers list and a directory of trade & professional organisations. The software is easy to use and very quick. It runs on any IBM or compatible PC with 512K RAM and a hard disc.

**Price: £30 (specify 5.25" or 3.5" format)**

Reprints of articles from *TELEVISION* back to 1986 are also available: ordering information is provided with the index, or can be obtained from the address below. Hard copy indexes of *TELEVISION* are available for volumes 38 to 42 at £3.50 each.

Please allow up to 28 days for delivery. All the above prices include UK postage and VAT where applicable. Cheques should be made payable to Video Interface Products.

**Video Interface Products Ltd., 1 Vineries Close, Cheltenham GL53 0NU, UK.**

# VHS VCR Servicing

John Coombes

Most of the faults experienced with VHS VCRs are mechanical rather than electrical. If a machine is properly looked after over the years, i.e. regularly cleaned and lubricated and the belts replaced periodically, it will last longer. You can do this sort of servicing in the field and arrange for it to be done during a quiet period of the year.

## Regular Maintenance

Here's a brief schedule of things to do regularly. Clean the upper drum and the audio/control and full erase heads. Check the pinch roller carefully – if it's badly worn you can get several problems, i.e. wow/flutter on sound, tape crimping or creasing, or vertical/horizontal jittering or tearing.

Check for worn parts in the fast forward/rewind/play idler. The rubber tyre may be shiny and/or cracked after prolonged use. Remember that a badly worn idler can cause intermittent operation which may result in tape damage, for example creasing and/or tangling or complete shredding. A worn idler may prevent rewind and/or fast forward operation, or there may be fast forward/rewind but not to the end of the tape (this can be because of a faulty tape however). There may also be very slow rewind/fast forward operation.

Check that the supply and take-up spools rotate correctly. They may be slow in operation, being in need of cleaning and slight lubrication. Clean or replace the clutch unit.

## Noisy Operation

Noisy operation can be caused by the flywheel spindle: clean and slightly lubricate it. Check for noise in the play idler and/or clutch assembly (be sure it's not coming from the cassette itself). If necessary check the brush on the drum spindle: a slight smear of grease on the brush and spindle will cure noisy operation.

The clutch assemblies and/or the take-up and supply spools can cause squeaking. In either case clean or lightly lubricate as necessary.

Check the belts: if worn or stretched they can cause noise.

## The Heads

One of the most common faults with a well-used VCR is a worn upper drum assembly. If the assembly is hard to remove, apply heat from a hairdryer – don't try to lever the assembly off as this may result in a rough surface and an incorrect tape transport path after reassembly.

If the drum seems to be o.k., check and clean the video head surfaces and clean the upper and lower drum assemblies both inside and outside.

## Worn Head Symptoms

Other things can cause the same symptoms as worn heads. If necessary check the tape path and the playback level and record current setting etc. Ensure that the back tension is correctly set and not too high. High back tension can cause early failure of the video heads. Insufficient tension on the other hand will produce symptoms like a faulty head. If the height of a replacement drum is incorrect the result may be noise bars.

A faulty video head drum usually has most effect in the

record mode. Symptoms can be black streaking or very low output from a known good tape.

## The Audio/control and Erase Heads

Dirt on the audio/control head assembly can result in a rolling picture or intermittent noise bars. If the assembly is clean, check whether a groove has been cut in the head. Another symptom is low playback audio. If the assembly is clean and undamaged, check for incorrect alignment. This can result in a noisy picture and jitter with prerecorded tapes, or you may just get incorrect tracking with prerecorded tapes.

If the sound from a previous recording is left on the tape, suspect a dirty or faulty erase head. Check also for dry-jointed leads where a plug/socket is used. Repair by replacing the complete lead or soldering directly to the PCB and the head.

## Front-loading Unit

The front-loading unit can cause all sorts of troubles. The problem may be as simple as stripped cogs on the loading flap. If these are all right check the internal drive cogs and, if used, the belt. Failure to load can also be caused by a duff loading motor. Check whether the cassette in/out and cassette down switches are operating correctly and that the contacts are making good connections

## Electrical Faults

Most electrical faults occur in the power supply. Check the fuses and safety resistors and if necessary for faulty regulators. The next most common cause of troubles is the servo circuitry that controls the drum and capstan motors.

With most electrical faults a service manual and an oscilloscope are required. Thus fault-finding and repairs generally have to be carried out in the workshop.

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# TV Fault Finding

*Reports from Philip Blundell, AMIEE,  
John Edwards, Michael Dranfield,  
Nick Beer, Ronald Aranha,  
Richard Newman and Chris Watton*

## Philips CP110 Chassis

This set came from another dealer, the complaint being that it tripped. Once the chassis had been withdrawn it was obvious that someone had had a long and meaningful relationship with the set. The power supply had been rebuilt, with a new i.c., chopper transistor, driver transistor and optocoupler. Most of the rectifier diodes and small electrolytics were also new. But the power supply wouldn't run cleanly: it hiccupped continuously. As the conditions in the primary side of the power supply seemed to be o.k., attention was turned to the secondary side.

Fuse F1653 had blown, but a replacement lasted only a couple of minutes. This fuse protects the 15V and 12V supplies. The voltages were correct, but the current increased the longer the set was left in operation. Many components had been replaced in this area, including C2671 (1,500 $\mu$ F) which had been fitted the wrong way round. It was fitted as the printing shows, but these are positive supplies and the positive side of the capacitor was shown connected to chassis! Fitting a new capacitor solved the problem, but when I tried it the set wouldn't go into standby. This time C2735 was found to be the wrong way round, though the printing here is correct. **P.B.**

## Toshiba 2500TB

If you find that the ON4408 chopper transistor Q802 has failed, check whether the 330k $\Omega$  (1W) resistor R810 is open-circuit before fitting a replacement. **P.B.**

## Philips 3A Chassis

This set had no picture. We found that the sandcastle pulses were missing, though they returned when the PAL decoder board was removed. The cause of the trouble was a short from pin 10 of the TDA4580 chip to chassis – a new chip was required. **P.B.**

## GoldStar CI9902F

If you get one of these sets that's stuck in standby, check whether R761 (2.7k $\Omega$ ) has gone high in value. It has to change only to 3.5k $\Omega$  for the fault to occur. **P.B.**

## Philips GR1-AX (Version 2)

There was a dim picture with Hanover bars visible on the colour. The sandcastle pulses were missing because D6326 (BZX79C12) was short-circuit – the type of diode varies with the set's date of production and country of origin. The serial numbers of version two sets start with SV04. **P.B.**

## Sony KV2062

There was sound but the screen remained blank although e.h.t. was present. Checks at the cathodes of the c.r.t. showed that it was cut off. We traced back to the CX109 colour decoder chip where the voltages at the colour-difference signal output pins were all low. We next found that the

pulse input at pin 22 was missing. It comes from pin 20 of the  $\mu$ PC1377 line oscillator chip, where the voltage was at almost 0V instead of 2V. A new chip brought the picture back. **R.A.**

## Sony CKV2760

Other than the power switch, the front panel function switches becoming jammed and failure of the line output transformer we've not previously had any problems with this TV set/monitor. Recently however two came in with other faults.

The first one showed '18' in the programme window when switched on. It didn't respond when the programme advance/decrease buttons were pressed. There was no sound and the screen was blank, though e.h.t. was present. The function switches – there are thirteen microswitches – were jammed, but replacing them made no difference. Power could be turned off by using the remote control unit, but the display window didn't give the standby indication. So attention was turned to board M, where the system control circuitry resides. Abnormal voltage readings were found around the CX761A 16-channel memory chip IC6. When a new CX761A was fitted the set worked normally.

The problem with the second set was pincushion distortion. No difficulty about fault finding this time: diodes D816 and D818 in the pincushion correction circuit had burst open. Replacements (type ERD28-06S) restored the correct raster shape. **R.A.**

## Sanyo CBP2145 (E2 Chassis)

The following fault is becoming quite common with this model. When the set is first switched on there's no picture, just snow. A normal-quality picture may appear after a while, but when the set is switched off and on again the fault symptoms are repeated. The cause of the problem is the two 10 $\mu$ F, 16V electrolytics C397 and C364. They are near a stand-off resistor that gets quite warm and dries them out. **J.E.**

## Alba CTV55

This set was dead. A check across the line output transistor produced a short-circuit reading. The cause however was the FR155 efficiency diode D404 in the series chopper circuit – it's connected between pin 11 and chassis.

The customer had wired across the mains fuse, which was o.k. I do despair of the blank look one gets when you explain to a customer what bad practice it is to link across fuses. **J.E.**

## Sharp C1421H

This set was stuck in standby because relay RY701 had an open-circuit winding. A new relay cured the fault. Don't get caught out like I did, trying to figure out why the set

wouldn't come out of standby with the circuit board removed from the cabinet (even with the new relay fitted). The on/off button is part of the cabinet front moulding: it doesn't just push the on/off switch in and out, it also pushes a separate little leaf switch just to the front and side of the main switch. So remember to short this out when activating the on/off switch. **J.E.**

### **Sony KVDX21TU (AE1 Chassis)**

The 2SD1548 chopper transistor Q602 was short-circuit because R614 (220Ω, 10W) in the snubber network had burnt out. After repairing the burnt circuit board where the resistor had once lived and replacing the transistor there was still nothing when the set was switched on. A new TEA2164 chopper control chip (IC601) brought life back to the set. **J.E.**

### **Ferguson ICC5 Chassis**

This set was tripping. Raising the PCB to the vertical position to view the underside proved to be worthwhile – a semi-carbonised dry-joint could be seen on one leg of the flyback tuning capacitor CL48. We cleaned the joint and resoldered it, then dealt with the pins of the line output transformer. The line output transistor was then checked and we weren't surprised to find that it was short-circuit all ways. A replacement brought the set back to life. **J.E.**

### **Sony KV21XRTU**

This was dead and a quick check showed that the 135V h.t. supply was missing. When pin 5 of the line output transformer was disconnected the power supply returned to life. A new transformer cured the fault. **J.E.**

### **Sharp CV2133H**

If the problem is complete loss of line and field sync check transistor Q1603 on the scart panel. A 2SA950 is fitted in this position: we use a 2SA966 for greater reliability. **M.Dr.**

### **Amstrad CTV1401/Matsui 1410/Saisho CT1400**

We've had two of these sets recently with buzz on sound and caption buzz. The first one responded to a slight tweak of the i.f. output coil in the tuner. We had to fit a new tuner in the second one. **M.Dr.**

### **Hitachi C2524T**

This set would come on for a few seconds with an excessively bright raster then trip out into standby. Checks at the cathodes of the c.r.t. produced readings of only 40V, while the load resistors in the RGB output stages got very hot. After consulting the circuit diagram we homed in on the BC558B transistor Q801 which clamps the emitters of the RGB output transistors. It's mounted on the main PCB and was leaky between its collector and emitter. The same fault could be caused by the 9.1V zener diode ZD804 being defective. **M.Dr.**

### **Sony KVM14U**

Here's a fault that is becoming as common as the defective first anode rectifier in these portable sets. The symptom is intermittently going off tune. A slight tap on the side of the i.f.

can will produce the fault, which is caused by dry-joints on either T01 or T02 – the vision detector and a.f.c. coils. **M.Dr.**

### **Ferguson ICC7 Chassis**

To prevent repeated failure of the BUH515 chopper transistor TP29, change the value of CP29 from 2.2nF to 3.3nF. An alternative chopper transistor, type S2000AF3, can be used if necessary.

If the S2000AF line output transistor TL19 has failed, change the value of RV01 from 4.7kΩ to 5.6kΩ and add a 560Ω resistor (RV03) in series with the anode of DV01. **N.B.**

### **Sharp C1410**

There was no line lock. Resoldering various dry-joints and resetting R611 (short TF601/2 to do this) provided a cure but we then found that there was another problem – the picture had shifted to the left by a significant amount. The 300Ω line shift potentiometer R647 had no effect. Rather unexpectedly, its value had risen to about 4.7kΩ. A new volume control completed the job. **N.B.**

### **Ferguson 51P7 (TX98 Chassis)**

A problem that's becoming quite common is failure of the line output transformer – usually the grey Philips type. The set pumps and doesn't work. You can usually confirm that the power supply is working all right by disconnecting the feed to the line output transformer's primary winding. When ordering a replacement the correct type must be specified: a number of different types have been used, and a list of modifications/checks comes with the replacement and must be carried out. **N.B.**

### **Ferguson ICC5 (IMC) Chassis**

A thing to note with these sets is that VCR switching is active only with channel numbers that end in zero, i.e. 10, 20 etc. Use of other numbers may cause problems with prerecorded tapes. Earlier ICC5 chassis sets used channel 9 for VCR operation. **N.B.**

### **Philips FL1.1 Chassis**

This set came from another dealer with the complaint that it was dead. When switched on it went into the protection mode. You override this by shorting pins S24 and S25 together momentarily so that fault-finding can start. When we did this the h.t. came up and there was line drive. Scope checks showed that the line protection circuit was operating, and after a few minutes we observed line collapse on the screen. A check across the line scan coil plug produced an open-circuit reading. Oh dear! If the scan coils were faulty a new tube would be required as well – the two come as an assembly. There's a PCB with a socket on the scan coils: investigation here with a meter proved that the coils were o.k., and when the PCB was unclipped a hairline fracture was seen. Bridging this with tinned copper wire cured the problem. **R.N.**

### **ITT TX3326 (Monoprint B Chassis)**

The symptom was no teletext though the green 'text on' indicator was alight all the time. If text was selected via the remote control handset the channels wouldn't change. The cause of the trouble was the DPU2541 chip on the text panel. **C.W.**

# ECONOMIC DEVICES 32 TEMPLE STREET, WOLVERHAMPTON, WV2 4AN

15/80H	3.83	2SC1573	0.26	2SD637	0.12	BC119	0.00	BD175	0.29	BF960	0.27	CD4001	0.14	M5015AP	3.24	SKF4F104	0.97	TA7205P	0.00	TDA1200	0.91	TDA8180	5.35
15/85R	3.84	2SC15730	0.26	2SD667	0.26	BC139	0.33	BD179	0.34	BF966	0.61	CD4011	0.21	M51102L	1.77	SKF4F210	0.87	TA7207P	1.58	TDA1270	1.79	TDA8190	3.30
17052	3.20	2SC1675	0.09	2SD669	0.55	BC140	0.21	BD189	0.41	BF970	0.30	CD4013	0.34	M51231P	2.03	SKF5F310	0.68	TA7210P	1.60	TDA1412	0.77	TDA9503	2.13
17053	2.38	2SC1685	0.17	2SD669A	0.63	BC141	0.34	BD190	0.31	BF979	0.35	CD4016	0.14	M51393AP	4.64	SL1430	1.41	TA7214P	3.74	TDA1470	0.00	TEA1002	4.98
17088	2.38	2SC1740	0.12	2SD716	1.11	BC147A	0.06	BD201	0.40	BF841	0.44	CD4021	0.43	M51515L	2.01	SL1431	1.70	TA7217AP	1.27	TDA1470P	0.00	TEA1009	1.24
17089	3.39	2SC1741	0.17	2SD718	1.45	BC148	0.12	BD203	0.46	BF879	0.50	CD4052	0.22	M51521L	0.54	SL1432	1.90	TA7222P	1.24	TDA1506	4.59	TEA1014	1.87
17127	1.77	2SC1815	0.14	2SD734	0.24	BC148A	0.06	BD232	0.28	BF890	0.61	CD4053	0.20	M52128L	0.48	SL471	0.70	TA7222P	1.27	TDA1510	3.23	TEA1039	2.15
1N4001	0.04	2SC1826	0.72	2SD762	1.51	BC148B	0.04	BD234	0.25	BF890A	0.77	CD4066	0.30	M5231L	0.55	SL490	2.31	TA7227P	2.02	TDA1512	3.17	TEA2018A	1.49
1N4002	0.07	2SC1827	1.00	2SD774	0.43	BC149	0.04	BD237	0.30	BF891	0.43	CD4069	0.17	M53216P	1.48	SN29764AN	1.99	TA7230P	1.75	TDA1515A	2.54	TEA216A	2.96
1N4003	0.05	2SC1845	0.20	2SD787E	0.26	BC149C	0.04	BD238	0.11	BF896	0.53	CD4070	0.14	M54532	0.00	SN7474N	0.38	TA7233P	1.95	TDA15160	3.56	TEA2165	5.23
1N4004	0.07	2SC1846	0.51	2SD837	0.90	BC157	0.13	BD239	0.29	BF929A	0.48	CN62A	0.94	M54543L	1.32	SN76013ND	7.99	TA7240AP	0.00	TDA15180	3.32	TI1060	0.55
1N4005	0.06	2SC1923	0.14	2SD841	1.61	BC159	0.06	BD241	0.41	BF885	0.55	CR3CM	2.62	M54544L	1.87	SN76227N	1.07	TA7240P	2.46	TDA1670A	2.81	TI1065M	0.75
1N4006	0.06	2SC1942	3.33	2SD856	0.94	BC160	0.00	BD243	0.39	BFY50	0.34	CR02AM	2.17	M54548L	3.29	SN76666N	1.26	TA7241	2.30	TDA1701	4.86	TI1065M	0.59
1N4007	0.06	2SC1959	0.11	2SD869	3.28	BC161	0.27	BD243A	0.43	BFY51	0.34	CV12E	2.70	M54648L	3.30	SN76705AN	1.70	TA7243P	0.00	TDA1770	0.00	TI1100	0.52
1N4148	0.04	2SC1969	2.46	2SD870	2.96	BC162	0.42	BD243C	0.55	BR100	0.17	CK109	7.05	M54648L	6.31	SR2M	2.00	TA7245P	4.03	TDA1870	3.37	TI1110	0.36
1N4448	0.06	2SC1983	0.87	2SD871	5.08	BC171B	0.14	BD244A	0.34	BR101	0.98	DTA124EF	0.13	M54889AP	9.47	ST43A1M	2.30	TA7267P	2.02	TDA1904	1.21	TI1121	0.00
1N5061	0.38	2SC2001	0.14	2SD880	4.08	BC177	0.14	BD244C	0.42	BR103	0.39	DTA144EF	0.17	M54889AP	5.95	ST4401	2.38	TA7270	1.68	TDA1905	0.94	TI112H	0.58
1N5402	0.12	2SC2029	0.00	2SD882	0.43	BC178	0.11	BD245C	0.72	BR303	0.12	ER1400	2.15	MB3730	2.38	ST441C	2.80	TA7270P	1.95	TDA1908A	1.14	TI1210	0.57
1N5404	0.13	2SC2073	0.51	2SD898B	2.97	BC182	0.06	BD246C	0.71	BRX44	1.02	HA11235	1.68	MB3731	2.20	STK0029	5.88	TA7271P	1.95	TDA1940	1.76	TI121	0.42
1N5406	0.12	2SC2078	0.77	2SD904	5.95	BC182A	0.00	BD278A	0.56	BRYS6	0.43	HA11244	3.83	MB3732	2.47	STK0039	7.11	TA7273	3.21	TDA1950	1.87	TI126	0.48
1N5408	0.12	2SC2141	1.48	2SD973	3.38	BC182L	0.06	BD317	0.87	BS338	0.23	HA1124A	1.21	MC13002	0.00	STK0040	7.40	TA7274P	2.32	TDA2002	0.85	TI132	0.46
1N914	0.04	2SC2166	1.27	74LS00	0.21	BC182BL	0.06	BD318	1.10	BT120	1.28	HA11423	2.92	MC13002P	0.74	STK0059	9.75	TA7280	2.11	TDA2003V	0.00	TI137	0.48
1S1555	0.22	2SC2168	0.85	7805	0.28	BC183	0.06	BD380	1.34	BT129	3.26	HA11440	2.02	MC1310P	0.55	STK025	9.61	TA7281	0.00	TDA2004	1.27	TI2955	0.83
1S2076	0.29	2SC2236	0.25	7805T022	0.00	BC184	0.09	BD433	0.39	BT139600	1.14	HA1166X	3.43	MC1327AP	1.62	STK043	6.90	TA7299	2.00	TDA2005	1.36	TI299	0.30
2N219A	0.27	2SC2271	0.22	7808	0.30	BC184L	0.04	BD434	0.24	BT151500R	3.40	HA11713	1.24	MC1330AP	1.26	STK3042	6.00	TA7313AP	0.82	TDA2006	1.06	TI299	0.30
2N2222	0.22	2SC2274	0.22	7812	0.30	BC184CL	0.10	BD435	0.38	BT151800	1.15	HA11741	6.77	MC1350P	1.82	STK3062	8.88	TA7317P	0.93	TDA2009	2.29	TI3055	0.77
2N2905	0.21	2SC2274K	0.22	7815	0.30	BC204	0.37	BD436	0.32	BU205	1.07	HA11745	5.10	MC1352P	1.45	STK4131	7.79	TA7325P	0.45	TDA2020	3.72	TI30C	0.35
2N2926G	0.37	2SC2314	0.33	7818	0.41	BC207B	0.23	BD437	0.32	BU208A	1.16	HA13001	1.58	MC1358P	1.59	STK4142	8.21	TA7335P	0.72	TDA2030	0.00	TI31	0.00
2N3053	0.36	2SC2335	1.43	7905	0.34	BC212	0.06	BD438	0.31	BU208D	1.53	HA13108	3.66	MC14493P	0.00	STK4142	8.21	TA7335P	0.78	TDA2030V	0.61	TI31A	0.32
2N3054	0.98	2SC2458	0.12	7912	0.43	BC212B	0.06	BD441	0.34	BU325A	1.36	HA13118	0.87	MC14528BCP	1.70	STK4162M	9.51	TA7358P	0.68	TDA2030V	1.05	TI31B	0.30
2N3055	0.77	2SC2482	0.34	AA119	0.36	BC212L	0.06	BD442	0.29	BU406	0.68	HA13119	2.03	MC14528BCP	1.70	STK4162M	9.51	TA7358P	0.68	TDA2040	0.00	TI32C	0.44
2N3442	1.00	2SC2547E	6.20	AA143	0.13	BC213	0.11	BD510	1.34	BU406D	1.02	HA13403	4.66	MDA2062	2.21	STK4171	10.50	TA7670AP	1.95	TDA2170	2.55	TI32A	0.39
2N3702	0.11	2SC2565	0.40	AC127	0.11	BC214	0.00	BD529	0.97	BU407	0.53	HA1374A	4.00	MDJ02	2.29	STK4181A	12.46	TA7630	0.00	TDA2270	1.68	TI32C	0.38
2N3704	1.14	2SC2570A	0.29	AC141K	0.46	BC214L	0.09	BD530	1.10	BU407D	0.97	HA1377	2.42	MDJ13005	0.82	STK4332	5.54	TA7630P	1.87	TDA2525	0.00	TI33	0.00
2N3713	0.02	2SC2577	1.46	AC176K	0.30	BC237	0.10	BD535	1.43	BU426A	0.96	HA1388	2.63	MDJ2955	0.68	STK4352	7.10	TA7640AP	0.98	TDA2530	3.76	TI33A	0.82
2N3819	0.34	2SC2581	0.43	AC187	0.16	BC237A	0.00	BD536	0.48	BU426E	2.13	HA1389	2.52	MDJ3055	0.51	STK437	8.30	TA7676P	4.25	TDA2540	0.88	TI33C	0.90
2N3904	0.11	2SC2632	0.43	AC187K	0.33	BC237B	0.05	BD675	0.30	BU500	1.09	HA1392	1.61	MDJ340	0.50	STK4392	5.92	TA7680AP	3.81	TDA2541	0.72	TI34	0.00
2N4444	3.22	2SC2655	0.25	AC188	0.36	BC238	0.11	BD677	0.32	BU508A	0.95	HA1397	2.63	MDJ378	0.00	STK441	11.54	TA7698AP	5.93	TDA2560	2.55	TI34C	0.89
2N6292	0.62	2SC2671	0.68	AC188K	0.82	BC238B	0.05	BD707	0.51	BU508AF	1.27	HA1398	2.33	MDJ393	4.26	STK459	10.27	TA7705P	1.68	TDA2576A	5.95	TI41A	0.38
2SA1015	0.10	2SC2688	0.30	D149	0.52	BC239	0.04	BD839	0.57	BU508D	1.27	HA1452	4.86	MDJ405VWF	11.08	STK461	10.49	TA7769P	1.43	TDA2577	0.00	TI41B	0.31
2SA1016	0.17	2SC2758	0.12	AD161	1.02	BC252B	0.07	BD901	0.51	BU508F	1.49	HM6232	10.36	MDJ435VB	14.35	STK4843	11.10	TA8205	3.89	TDA2577A	4.25	TI42C	0.34
2SA1020	0.43	2SC2791	5.44	AD162	0.96	BC300	0.48	BD902	0.51	BU508F	1.32	HM6251	9.52	MDJ435VB	10.66	STK5211	15.78	TA8210H	4.74	TDA2578A	2.55	TI42A	0.37
2SA1020Y	0.43	2SC3150	1.44	AF124	0.77	BC301	0.28	BD911	0.83	BU526	1.41	HM7103	14.07	MDJ650	2.50	STK5322	6.35	TA8215	4.57	TDA2579	0.00	TI42C	0.37
2SA1095	7.44	2SC3153	2.37	AF127	0.59	BC302	0.36	BD912	0.63	BU536	1.60	IMH281	0.26	MDJ654	0.23	STK5325	5.92	TA8691N	6.57	TDA2581	5.75	TI47	0.51
2SA1102	2.54	2SC3156	6.28	AF139	0.29	BC303	0.28	BD956B	1.16	BU608	1.44	KA2101	0.60	MDJ656	0.12	STK5326	6.20	TA8550	0.00	TDA2581Q	10.15	TI47A	1.11
2SA1143	0.17	2SC3182	3.25	AF239	0.43	BC307	0.06	BDW84C	1.28	BU705	1.61	KB108	0.47	MDJ659	0.09	STK5331	3.02	TA8626	1.05	TDA2582	1.95	TI48	0.66

## SPECIAL OFFERS - ENDS 30/08/93 OR WHILE STOCKS LAST

BU 208A x 5	3.50	TDA 2600 x 2	3.95
BU 426A x 5	3.50	TDA 2579A x 2	5.00
BU 508A x 5	5.00	TDA 3562A x 2	3.99
BU 508AF x 5	5.00	TDA 3654 x 2	2.20
BUT 11AF x 5	3.25	TDA 4501H x 2	2.49
U 321 TUNER x 2	3.00	TDA 4601 x 2	2.50
VIDEO FAULT FINDING GUIDE	9.99	TDA 4601D x 2	2.95
SEMI CONDUCTOR DATA BOOK	9.99	TDA 4501H x 2	2.49
SATELLITE FAULT FINDING GUIDE	£14.95	STR 54041 x 2	7.50

2SA1175	0.25	2SC3225	0.50	AF279	0.34	BC307A	0.06	BDW93C	0.59	BU806	0.82	KSR1004	0.09	MPSU10	0.00	STK5332	2.74	TBA120	0.53	TDA2591	1.15	TL011CP	1.36
2SA1186	3.73	2SC3795	1.95	AL102	5.08	BC307B	0.06	BDW94C	0.46	BU806A	0.80	L200CV	1.13	MRS854	0.14	STK5333	4.28	TBA120S	0.90	TDA2593	0.75	TL017CP	0.38
2SA1208	0.34	2SC3800	0.12	AN245	0.00	BC308	0.06	BDX32	1.70	BU807	0.51	LA1201	0.96	MSM5840H	15.36	STK5372	3.40	TBA120S	0.89	TDA2594	2.16	TL494	1.16
2SA1265	1.95	2SC388A	0.59	AN3821K	7.23																		

TV  
SUPPLEMENT

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*Throw away your collection of  
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**THIS ONE OPERATES UP TO FOUR RECEIVERS**

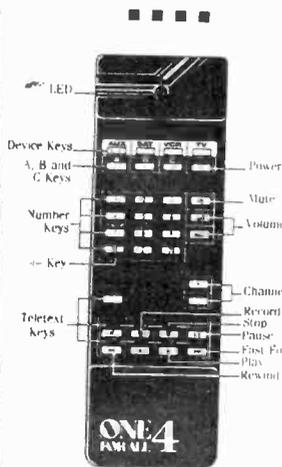
(ie 1 x VCR, 2 x TV, 1 x Satellite/Cable or 2 x VCR, 1 x TV, 1 x Satellite/Cable or any combination to suit including Teletext etc.)

The remote comes complete with FREE TELEPHONE 0800 HELP-LINE and the manufacturer guarantees that if the remote will not operate any of your VCR's, TV or Satellite receivers they will **REFUND YOU DOUBLE** what you paid for the remote!

*Full comprehensive instruction book - we have tried these units, they are incredibly easy to set up.*

**SPECIAL INTRODUCTORY PRICE £27.50 (including VAT)**

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# Aerials and Accessories

POSTAGE  
£3.00

**Double Flush Mounted Outlet Plate** for TV and Radio. Designed to separate UHF and FM signals from masthead mixer and from a single cable download. Standard wall mounting centres. Supplied complete with fixing screws.

Order Code: AER/EU284

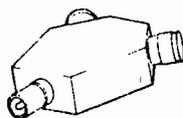
1+	10+	100+
£1.75	£1.55	85p

**Co-Axial 'Y' Splitter** giving two standard changeover outlets from one input. \* Loss: 3.5dB.

Male plug to 2x females.

Order Code: AER/CAX/ILS

1+	10+	100+
85p	75p	50p



**Switched Co-axial 'Y' Splitter.** Giving two standard changeover outlets from one input. Incorporates ferrite cores for lower loss. Loss: 3.5dB.

Male plug to 2x female sockets.

Order Code: AER/CAX/ILSB

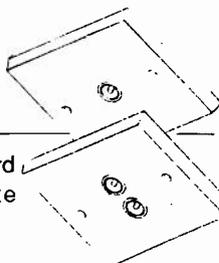
1+	10+	100+
£1.40	£1.25	70p



**Single Flush Mounted Outlet.** Standard wall mounting centres. Supplied complete with fixing screws. White plastic.

Order Code: AER/CAX/FMO

1+	10+	100+
£1.25	£1.00	49p



**Double flush mounting outlet.** Standard wall mounting centres. Supplied complete with fixing screws. White plastic.

Order Code: AER/CAX/DFMO

1+	10+	100+
£1.50	£1.25	70p

**Aerial Socket - Single.** Single surface mounting socket. Aerial lead enters through hole in rear and is screw fixed internally. TV aerial lead is then simply plugged into the outlet. Supplied with fixing screws. Colour: White.

Order Code: AER/CAX/SMS

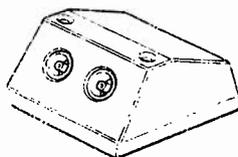
1+	100+
80p	45p



**Aerial Socket - Double.** Surface mounting splitter allowing two connectors to one aerial. Supplied with fixing screws. Colour: White.

Order Code: AER/CAX/SSC

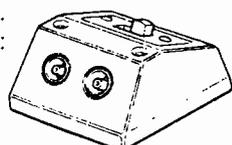
1+	100+
£1.20	70p



**Aerial Socket - Switched.** Same as above but this unit is switched. Supplied with fixing screws. Colour: White.

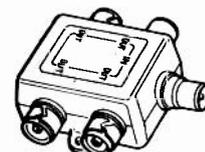
Order Code: AER/CAX/SSCS

1+	100+
£1.50	88p



**Low Loss Splitters.** Giving standard co-axial socket outlets from one standard co-axial plug input. Low loss ferrite cored splitter circuits. Loss 7dB.

Type	Order Code	1+	25+
1 in 3 out	AER/SP3	£1.65	85p
1 in 4 out	AER/SP4	£2.60	£1.30
1 in 5 out	AER/SP5	£2.99	£1.45
1 in 6 out	AER/SP6	£4.25	£2.15



**A range of all metal In-line Attenuators.** Male co-axial plug one end to female co-axial socket on the other end. Input impedance: 75ohm.

Type	Order Code	1+	30+
3dB	AER/ATT3	£1.95	£1.15
6dB	AER/ATT6	£2.00	£1.20
9dB	AER/ATT9	£2.10	£1.25
12dB	AER/ATT12	£2.15	£1.30



**Standard Co-Axial Metal Plug.**

Order Code: C357

1+	10+	100+	1000+	2000+
25p	22p	20p	17.5p	15p



**Standard Co-Axial Metal Line Socket.**

Order Code: C359

1+	10+	100+	1000+
44p	40p	35p	28p



**Co-Axial Line Socket.** To connect two co-axial plugs. Back to back coupler, co-axial socket at each end. Grey plastic.

Order Code: C360

1+	10+	100+	1000+
20p	18p	15p	12.5p



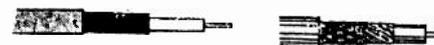
**Co-Axial Chassis Mounting Socket.** Plastic body.

Order Code: C358

1+	10+	100+	500+	1000+
20p	18p	15p	13.5p	12.5p



## JUST ARRIVED!



### 75ohm CO-AXIAL CABLE

TV aerial download cable, 1 x 1.0mm solid copper conductor. Copper braided screening. Polythene insulated. Impedance: 75ohms. Dia: 6.5mm. Colour: Black.

Order Code: CBL/1/50

Price: £12.99 per 100 metre reel!!!

### 75ohm CO-AXIAL CABLE

A special double screened cable, suitable for satellite application. Copper braiding and extra foil screen. Impedance: 75ohms. Dia: 6.65mm. Centre conductor 1/1.0mm. Colour: White.

Order Code: CBL/2/50

Price: £15.50 per 100 metre reel!!!

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# Aerials & Accessories

POSTAGE  
£3.00

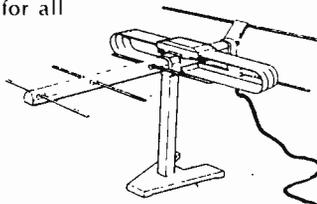
## T.V. AERIAL - INDOOR

Low cost set top aerial suitable for all channels. Complete with 5ft. cable.

Order Code: AER/1968

### SALE PRICE

£ 3.99



## TELEVERTA U.H.F. TO V.H.F.

Made in U.K., 240V low noise frequency changing device which block converts V.H.F input signals to U.H.F. Ideal if taking your U.H.F. TV abroad with you and need to use it on V.H.F. systems.

Input Band: 40 - 240 MHz; Output Band: 590 - 770MHz.

Order Code: AER/CM7122/RA

Price: 1+ £59.50 5+ £53.50



## ONE-WAY AMPLIFIER

1 in 1 out antenna amplifier for colour and black/white TV. White plastic case with on/off switch. LED indicator and 1m lead.

Band width 40 - 890 MHz; Gain 7dB ± 1dB ; Impedance 75Ω; Power 220/240Vac 50Hz; Dimensions 125 x 79 x 50mm.

Order Code: AER/AMP/E1

Price: 1+ £10.50 10+ £9.40



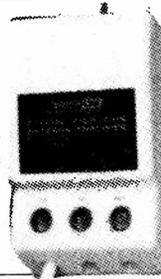
## TWO-WAY AMPLIFIER

1 in 2 out High gain antenna amplifier for colour and black/white TV. White plastic case with on/off switch. LED indicator and 1m lead.

Band width 40 - 890 MHz; Gain 14dB ± 1dB ; Impedance 75Ω; Power 220/240Vac 50Hz; Dimensions 125 x 79 x 50mm.

Order Code: AER/AMP/12HG

Price: 1+ £12.50 10+ £11.20

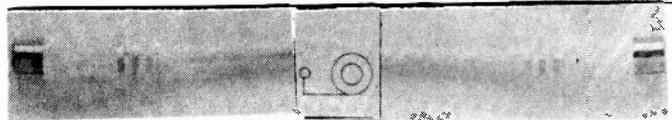


## AERIAL EXTENSION LEAD

Compact extension lead on a wind-on reel. Reel contains a built-in TV/Radio splitter. Length: 10 metres.

Order Code: AER/REEL

Price: 1+ £5.95 10+ £3.95



## CO-AXIAL LEADS

### Plug-to-Plug

TV aerial downloads with co-ax plug on each end. Available in two lengths.

Colour: White.

Length	Order Code	1+	10+
2m	AER/2TVF	80p	72p
10m	AER/10TVF	£1.99	£1.80

### Plug to Socket

A TV aerial download, available in two lengths.

Colour: White.

Length	Order Code	1+	10+
2m	AER/ETV2	85p	75p
10m	AER/ETV10	£2.50	£2.25

## EIGHT TV

Ideal for small hotels, residential homes, etc. Runs 8 TV sets from one aerial. The unit has 9 co-ax sockets, the aerial plugs into one and the TVs into the other eight.

Specification: Band

width 40MHz - 860MHz; Gain 3dB per channel - total 21dB; Impedance 75ohms; Max. output 80mV (38dBmV) (signal cross modulation - 46dB); Noise 6dB; Isolation between outputs 40dB min; Power 240V a.c. 50Hz; Dimension 250 x 100 x 60mm.

Order Code: AER/AMP/E8

Price: 1+ £27.50 4+ £73.50



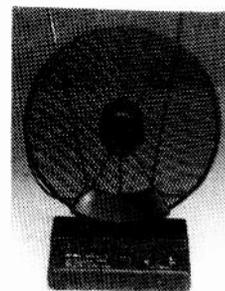
## UHF/VHF/FM AERIAL WITH AMP

The T143D is a large mesh dish antenna designed for dual purpose for the home using 220/240Vac or mobile whilst caravanning, picnicking, boating etc. using 12Vdc. The antenna dish can be rotated left to right to pick up the best signal, which can then be boosted using the built-in amplifier. The amplifier may also be used to boost the signal from an external (roof top) aerial, with integral LEDs indicating which aerial in use.

Gain 20dBVHF, 30dB UHF; Gain control 0-30dB; Max. output level 100dBu, Power 12Vdc or 240Vac; Dimensions 330 x 290 x 1100.

Order Code: AER/EU673A

Price: 1+ £19.99 4+ £17.99

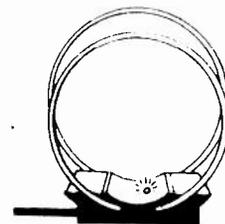


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## SUPERLOOP MICROCHIP TV AERIAL

SUPERLOOP is the very latest innovation in TV Aerial technology. This remarkable state-of-the-art design incorporates advanced microchip circuitry, an integral signal amplifier and a unique multi-function LED indicator. Introduced as "the aerial that thinks for itself", SUPERLOOP requires no mains supply. Instead, it is powered by two small batteries (not included) neatly housed in the base. SUPERLOOP sensor circuits detect whether the TV set is 'on' or 'off' and activate the signal booster only when the TV is in use, so extending the long life of the batteries even further.

An override facility is provided for unattended video recording. Designed to BS 5373. BEAB approval pending.



Order Code: ALO/1

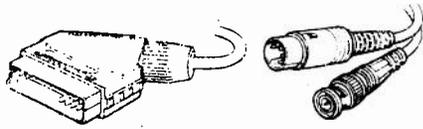
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# Aerials and Accessories

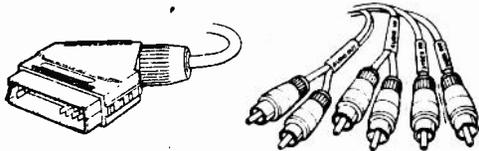
POSTAGE  
£3.00

## SCART LEADS



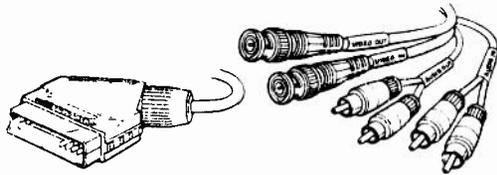
Scart plug to BNC plug and 5-pin 180 DIN plug.  
Length: 1.5m

Order Code: AER/001 Price 1+ £3.99 10+£3.50



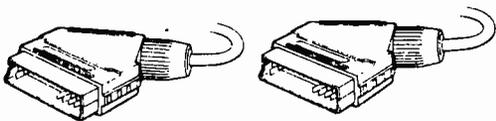
Scart plug to 4 phono plugs (audio) and 2 phono plugs (video).  
Length: 1.5m

Order Code: AER/003 Price 1+ £4.75 10+£4.25



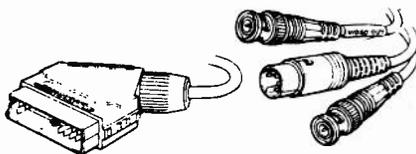
Scart plug to 2 BNC plugs (video) and 4 phono plugs (audio).  
Length: 1.5m

Order Code: AER/004 Price 1+ £4.75 10+£4.25



Scart plug to scart plug. Video and audio circuits connected.  
Length: 1.5m

Order Code: AER/005 Price 1+ £2.75 10+£2.45



Scart plug to 5-pin DIN plug and two BNC plugs.  
Length: 2m

Order Code: AER/007 Price 1+ £3.99 10+£3.65

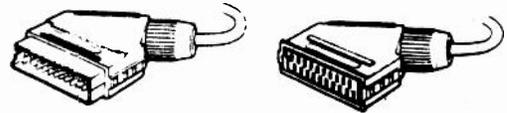


Scart plug to scart plug. All circuits connected..  
Length: 1.5m

Order Code: AER/008 Price 1+ £3.50 10+£3.05

Scart plug to scart plug. All circuits connected.  
Length: 5m

Order Code: AER/009 Price 1+ £5.50 10+£4.95



Scart plug to scart socket. All circuits connected.

Length: 1.5m

Order Code: AER/011

Price 1+ £3.50 10+£3.10

Scart plug to scart socket. All circuits connected.

Length: 5m

Order Code: AER/012

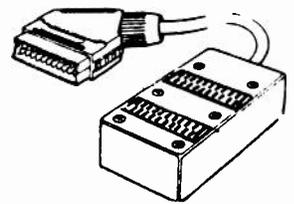
Price 1+ £6.50 10+£5.85

## SCART ADAPTOR

Scart plug to two scart sockets.  
For coupling together three  
pieces of audio/video equip-  
ment with scart sockets.

Order Code: AER/015

Price 1+ £5.99 10+£5.40

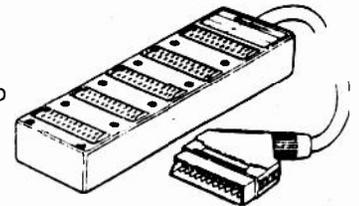


## SCART ADAPTOR

Scart plug to 5 scart sockets.  
For coupling together three or  
more pieces of audio and video  
equipment with scart sockets.

Order Code: AER/016

Price 1+ £13.50 10+£12.25

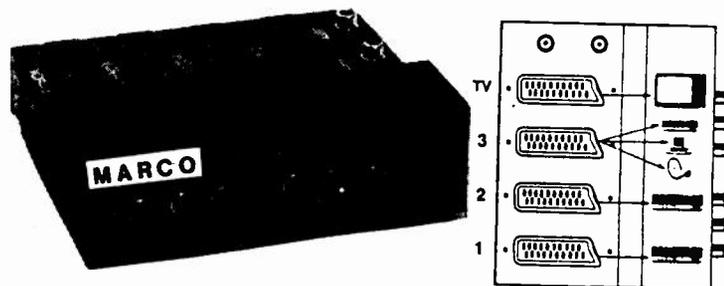


## AUDIO BREAK-OUT BOX

A scart adaptor to tap off the  
audio signal from TV or video  
system and feed it into hi-fi  
systems. Scart plug to scart  
socket adaptor with audio out  
via 2 x phono sockets with  
audio/video sound changeover  
switch.

Order Code: AER/017

Price 1+ £8.25 10+£7.35



## THREE-WAY SCART VIDEO CONTROL

Connects up to 3 video recorders (VCRs), 1 satellite + 2 VCRs,  
1 computer + 2 VCRs. Push button switch to select viewing.

Record from satellite or another VCR whilst watching TV.

Phono output sockets for TV sound through your Hi-Fi system.

Order Code: AER/BT21

Price £29.99

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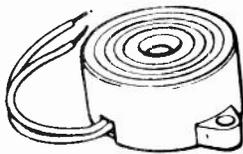
## Audio - Buzzers

POSTAGE  
£3.00

### PIEZO BUZZER (Extra High Sound)

A Piezo Buzzer with extra high sound output for use in alarms, etc. Internal circuitry

Input voltage 12V DC; Input current 20mA; Sound output 100dB (A) @ 1m typ; Dimensions 39mm dia x 26mm; Fixing centres 50mm.



Order Code: AUD/BUZ/P2

Price: 1+ £1.65 10+ £1.40

### PIEZO BUZZER (Musical)

A Musical Buzzer that plays a total of seven tunes including 'Yellow Rose of Texas', 'Land of Dixie' and 'When the Saints Go marching In'.

Frequency 3.5kHz; Power 9V DC 50mA; Dimensions 27mm dia x 22mm; Fixing centres 34mm.



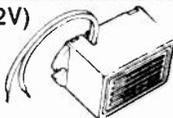
Order Code: AUD/BUZ/MUS

Price: 1+ £2.75 10+ £2.50

### MINIATURE BUZZERS (6V, 9V, 12V)

Miniature Solid State Buzzers with long life, low current drain, no moving contacts, no R.F. noise and high reliability, giving a clear, penetrating sound.

Frequency approx. 500 Hz; Output 82dB (A) @ 1m typ; Dimensions 22mm x 16mm x 15mm; Fixing centres 26mm; Current 25mA; Lead length 150mm..



Order Codes: AUD/BUZ/6V - AUD/BUZ/9V - AUD/BUZ/12V

Prices All : 1+ 94p 10+ 88p

### PIEZO BUZZER (Standard)

A Miniature Buzzer encased in a durable white plastic casing. This Buzzer comes complete with 90mm leads.

Frequency approx. 5kHz; Output 95dB (A) 1m typ; Dimensions 30mm dia. x 14mm; Power 12V DC (24V DC) 100mA; Fixing centres 37mm; Lead length 90mm.



Order Code: AUD/BUZ/P1

Price: 1+ £1.20 10+ £1.08

### PIEZO BUZZER (Super Thin)

A super thin Piezo Buzzer operating on a broad voltage range from 3 to 24 V DC and incorporating a simple two hole fixing.

Frequency approx. 3.5kHz; Output @ 12 vDC - 75dB (A) 0.3m typ; Operating voltage 3 - 24V dc; Current @ 12 V DC - 5mA; Fixing centres 29mm; Dimensions 23.4 (dia) x 7mm.



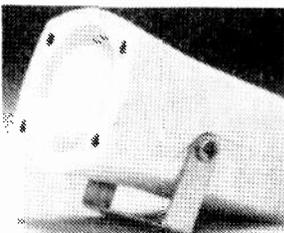
Order Code: AUD/WPM

Price: 1+ £1.40 10+ £1.20

### PIEZO ELECTRIC SIREN

A high powered electric Piezo Siren which emits an ear piercing warbling sound. Ideal for Alarms, Annunciators etc. White plastic body with mounting bracket.

Frequency Approx. 2.5kHz; Output 100dB (A) @ 1m typ; Power 12V DC 150mA; Dimensions 57mm x 42mm x 37mm; Fixing centres 22mm; Leads 300mm



Order Code: AUD/SIR/SP12

Price: 1+ £6.90 5+ £6.75

### ELECTRONIC SIREN

A gold coloured metal horn with its own circular fixing plate. The siren emits a high powered 160 cycle per minute wailing note.

Output 115dB (A) @ 3m Typ; Power 12v DC 1.5A; Dimensions 130 dia x 160mm; Sonics 160 cycles minute.

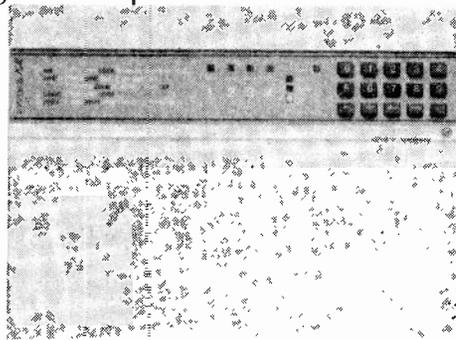


Order Code: AUD/SIR/ELT

Price: 1+ £9.90 4+ £9.50

## HOME ALARM PACKAGE SPECIALS

We have sold hundreds of these Home Alarm Security Packages. They are excellent value for money offering a substantial saving on list prices. OK so what do you get?

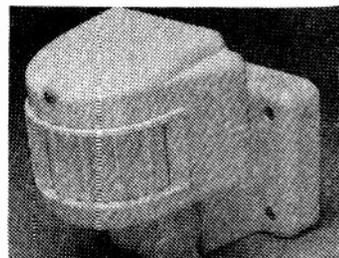


- OPTIMA XM ALARM CONTROL PANEL
- 2 x INTERNAL PIRS
- EXTERNAL RED BELL BOX
- 2 SETS OF DOOR CONTACTS
- SIREN FOR BELL BOX
- 100m CABLE AND CLIPS
- FULL FITTING INSTRUCTIONS

Order Code: SEC/PACK/OPT

Price: £130.00

### PASSIVE INFRA-RED (PIR) DETECTOR - EXTERNAL



Simply connect to existing external lighting. Swivel mounted passive infra red sensor for the detection of body heat. The mounting arrangement allows horizontal and vertical swivel of 180°, allowing difficult to reach areas to be covered by the beams. A built-in adjustable photo detector prevents daylight operation. Adjustable timed on period. Provided with a walk test LED.

Detection range 200°, (fan shaped) 15m; Auto reset time 9 secs. to 10 minutes; Lighting load 2kW incandescent, 1kW fluorescent; Power 220/240Vac 50Hz.

Order Code: SEC/SN2002

Price: 1+ £26.50 4+ £22.50

ALL PRICES  
INCLUDE VAT

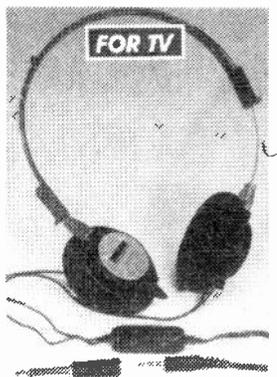
# Audio - Head/Earphones

POSTAGE  
£3.00

## STEREO HEADPHONES AO83F (TV 800)

A set of headphones for use with audio or video. Complete with left and right hand volume controls, adjustable headband and stereo/mono adaptor.

Impedance 32ohms;  
Response 20 - 18,000 Hz;  
Power 100mW; Sensitivity  
104dB @ 1kHz; Lead 2.8m  
screened; Plug 3.5mm  
stereo.

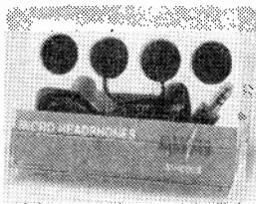


Order Code: AUD/AO83F  
Price: 1+ £4.05 10+ £3.60

## ULTRA MINIATURE STEREO EARPHONES

Ultra miniature stereo earphones (fit inside ear) packed in a cassette library case. Spare ear pads are included.

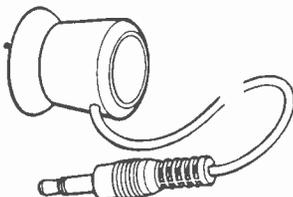
Impedance 32ohms; Response 20 - 20,000 Hz; Power 50mW; Lead 1.2mm screened; Plug 3.5mm stereo; Weight 13grams.



Order Code: AUD/HP/MH8  
Price: 1+ £1.35 10+ £1.05

## TELEPHONE PICK-UP COIL

One end has a 3.5mm plug which fits into the socket of a tape recorder, the other end attaches by suction to a telephone enabling the conversation to be recorded. This unit does not require wiring. Pick-up coil 3.5mm; Dimensions 20mm x 17mm.

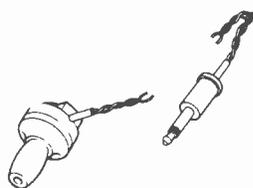


Order Code: AUD/TCP  
Price: 1+ £1.15 10+ £1.00

## MAGNETIC AND CRYSTAL EAR PIECES

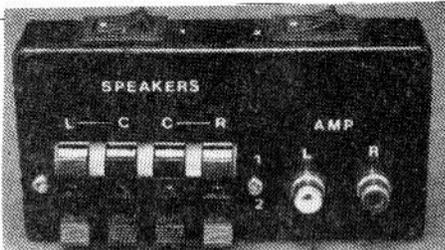
A very useful range of magnetic and crystal earpieces. There are two choices of magnetic earpiece, each having a different plug fitting. All come with approx. 1 metre of lead.

Type	Plug	Code	1+	10+
Magnetic	3.5mm	AUD/EAR/35	26p	24p
Crystal	3.5MM	AUD/EAR/CRY	£1.20	£1.00



## 2-WAY

## SPEAKER SWITCH



Designed for mounting on the rear of the amp. Allows two pairs of speakers to be used where the amp only allows one pair. Inputs are via Spring terminals. Parallel resistive protection. Includes double sided adhesive fixing pads. Dimensions 110mm x 58mm x 30mm.

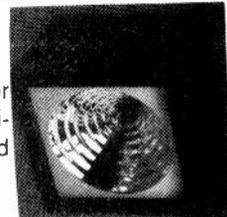
Order Code: LSP/SSW2  
Price: £7.75 each

## STROBE UNIT

This Strobe light unit with circular reflector comes housed in a veneered wooden cabinet and incorporates a variable speed control.

Power 240V AC, 50 Hz.

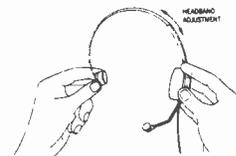
Order Code: AUD/STROBE  
SPECIAL PRICE: £19.99



## RACAL FREEDOM HEADSET

### TYPE RA130/1C05

Highest quality, Racal need no introduction. Complete with headband, earpiece and boom mic. fitted with lead and plug. Brand new, even supplied with neat cloth storage bag. Only one catch, yes, limited quantity. FIRST COME, FIRST SERVED. These monaural headsets allow the operator to listen to other people in the office at the same time.



NORMAL PRICE OVER £130 EACH  
ORDER CODE: SO/357

MARCO PRICE: £45.00

## AUDIO CASSETTES



Used once and bulk erased. All fully guaranteed. Over the last 12 months we have sold over 50,000 of these tapes and demand is growing. Order now and save money.

### ALL. REPEAT ALL ARE FULLY GUARANTEED!

Maxell UDI 90 (Complete with inlay cards)  
Length: 90 minutes.

ORDER CODE: SO/MAX

Price: 1 + 85p 10+ 75p 100+ 60p

### BASF-C90

Sorry no inlay cards, hence super low price.

ORDER CODE: SO/BSF

Price: 1+ 60p 10+ 50p 100+ 35p

## PLUG-IN FLASHING LED

A flashing LED built into a car cigar plug to act as a visual warning/deterrent that an alarm may be fitted. Simply plug the device into your cigar socket. Won't flatten the battery and may stop your vehicle being stolen!

ALL FOR £1.99

Order Code: Car/B200Z



ALL PRICES  
INCLUDE VAT

# Audio and Video

POSTAGE  
£3.00

## VIDEO BELTS

Comprehensive range of replacement video drive belt kits for most popular videos. Each kit contains all the belts required to give a full overhaul. High quality precision formed rubber.

Diameter (mm)	Order Code	Model	Brand Name	No. of Belts	Prices	
					1+	5+
40, 45, 60.5, 70, 89, 95, 113	VBK001	VT5000E	Hitachi	7	£3.00	£2.20
23, 32.5, 48, 59.5, 78.5, 95.5, 104	VBK002	HR3330	JVC	7	£4.50	£3.50
47.5, 86	VBK003	HR7700	JVC	2	£1.10	.95p
28, 45.5, 87	VBK004	HR7650	JVC	3	£1.30	£1.00
32, 47, 57, 75.5, 76, 93, 97	VBK005	HR3360	JVC	7	£4.45	£3.85
36, 40.5, 50.5, 97, 100, 107	VBK006	NV3000	Nat. Pan.	6	£3.15	£2.60
34, 36, 51, 71.5, 107	VBK007	NV7200	Nat. Pan.	5	£1.68	£1.35
26, 36, 70.5, 100, 107	VBK008	NV2000	Nat. Pan.	5	£2.50	£2.00
36, 55.5, 60.5, 100, 107	VBK009	NV300	Nat. Pan.	5	£3.00	£2.48
18, 27	VBK010	VTC5000	Sanyo	2	£5.25	£4.10
28.5, 30, 41, 56, 68.5, 78, 80, 88, 100, 102, 113	VBK011	SHARP11	Sharp	11	£4.65	£3.85
(VC7700), 29, 70.5, 75, 88, 112	VBK012	VC7300	Sharp	5	75p	60p
22, 26, 42, 44, 75	VBK013	VC9300	Sharp	5	65p	55p
50, 81.5, 107, 109, 127, 151	VBK014	SONY8000	Sony	6	£2.99	£2.75
36, 46, 88, 100, 107	VBK015	V7540	Toshiba	5	75p	55p



## CASSETTE PLAYER DRIVE BELTS - SQUARE SECTION

A range of top quality square-section rubber cassette drive belts.

Diameter (mm)	Order Code	Price	
		1+	10+
19	VID/AB19	50p	45p
21	VID/AB21	50p	45p
25	VID/AB25	50p	45p
27	VID/AB27	50p	45p
30	VID/AB30	50p	45p
32	VID/AB32	50p	45p
35	VID/AB35	50p	45p
40	VID/AB40	50p	45p
43	VID/AB43	50p	45p
46	VID/AB46	50p	45p
51	VID/AB51	50p	45p
54	VID/AB54	50p	45p
57	VID/AB57	50p	45p
60	VID/AB60	50p	45p
63	VID/AB63	50p	45p
66	VID/AB66	50p	45p
70	VID/AB70	50p	45p
75.5	VID/AB755	50p	45p
78	VID/AB78	50p	45p
83	VID/AB83	50p	45p
86	VID/AB86	50p	45p
90	VID/AB90	50p	45p
94	VID/AB94	50p	45p
100	VID/AB100	50p	45p
110	VID/AB110	50p	45p

## TURNTABLE DRIVE BELTS

A range of high quality turntable drive belts covering most popular models. All 5mm wide by 0.7 mm thick.

Diameter (mm)	Model	Order Code	Price	
			1+	10+
121		VID/TTB/121	£1.75	£1.50
125		VID/TTB/125	£1.75	£1.50
138		VID/TTB/138	£1.75	£1.50
147		VID/TTB/147	£1.75	£1.50
158		VID/TTB/158	£1.75	£1.50
166.5		VID/TTB/1665	£1.75	£1.50
170	Phillips, Sanyo	VID/TTB/170	£1.75	£1.50
172	BSF	VID/TTB/172	£1.75	£1.50
175	BSF	VID/TTB/175	£1.75	£1.50
178	BSF	VID/TTB/178	£1.75	£1.50
185	Phillips	VID/TTB/185	£1.75	£1.50
187	JVC	VID/TTB/187	£1.75	£1.50
189	JVC, Sony	VID/TTB/189	£1.75	£1.50
195		VID/TTB/195	£1.75	£1.50
201	Sony	VID/TTB/201	£1.75	£1.50
205	Pioneer	VID/TTB/205	£1.75	£1.50
210		VID/TTB/210	£1.75	£1.50

## VIDEO BULBS -

12V 60 MA Extra Long 28cm leads. Suitable for VHS Videos and general purposes.

**Price: 75p Each - Buy 10 at 60p each**

## VIDEO SENDER

A superb video sender that simply transmits your video/audio signals around the home - up to approx 100ft. So if you want to watch a video on a second or third television in the house and don't want to move your VCR - you need a video sender. Simple to use, simply connect sender to VCR using leads supplied.

(Sender may also be connected to most camcorders for broadcasting live pictures)

Power: 12 Vdc (adaptor supplied)

ILLEGAL FOR USE IN U.K.

Order Code: SO/SENDER

Price: 1+ £17.50 4+ £15.00

## VIDEO SPARES CLEARANCE

SEND SAE FOR A LIST OF BRAND NEW,  
MAINLY KONIG VIDEO SPARES

We are clearing our stocks at once only prices.  
Many at less than original cost

*Some items only small quantities.*

**DON'T BE DISAPPOINTED**

**FIRST COME, FIRST SERVED!**

ALL PRICES  
INCLUDE VAT

# Batteries and Accessories

POSTAGE  
£3.00

## RECHARGEABLE BATTERIES -NI-CADS\*

A range of Nickel Cadmium batteries that will replace dry cell batteries. Capable of being recharged some 1000 times they are very economical in all applications.

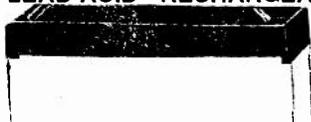
\* When possible Hitachi brand will be supplied

(We offer a suitable charger for these Ni-Cads at the end of this section).



Type	Volt	Ah	Order Code	Price		
				1+	10+	100+
AAA	1.2V	180mAh	BAT/AAA	£1.50	£1.30	£1.05
AA	1.2V	500mAh	BAT/AA	95p	85p	65p
AA	1.2V	650mAh	BAT/A700	£1.75	£1.60	
C	1.2V	1.2Ah	BAT/C	£2.10	£1.90	£1.40
C	1.2V	2.0Ah	BAT/C1	£4.20	£3.75	£2.50
D	1.2V	1.2Ah	BAT/D	£2.20	£1.98	£1.42
D	1.2V	4.0Ah	BAT/D1	£5.50	£4.75	£3.95
PP3	9V	110mAh	BATPP3	£3.95	£3.75	£3.55

## SEALED LEAD ACID - RECHARGEABLE BATTERIES



			1+	10+
12V	1.2Ah	95 x 45 x 50mm	£15.27	£13.50
12V	1.9Ah	175 x 30 x 60mm	£16.75	£15.00
12V	3.0Ah	130 x 65 x 55mm	£17.25	£15.50
12V	6.5Ah	150 x 60 x 90mm	£22.50	£19.99

## NI-CAD BATTERY CHARGER

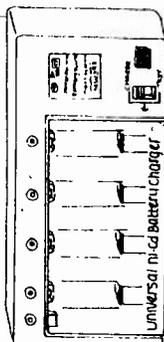
Capable of charger 4 x AAA, AA, C or D sizes, 2 x PP3.

White in colour, free-standing unit with LED 'Charging' indicators. A built-in tester is provided for 1.5V batteries.

Power 240 Vac. Dimensions: 180 x 85 x 50mm.

Order Code: BAT/CHARGE/UNI/B

Price: 1+ £4.99 10+ £4.75



## CORDLESS TELEPHONE RECHARGEABLE BATTERIES

Two different packs of replacement batteries suitable for cordless telephoneS.

Pack 'A' contains 3 x AA solder tag batteries (3.6V). Total @ 500mAh.

Pack 'B' contains 3 x Button cells with connector. (3.6V. Total @280mAh.

Order Code (Pack A): 02-3814 H/A

Price £7.50

Order Code (Pack B): 02-3854 H/B

Price £8.50

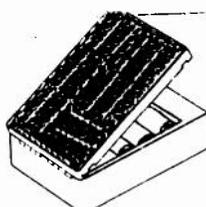


## SOLAR POWERED BATTERY CHARGER

Model 2806 charger. Takes up to 4 x AA (HP7) size Ni-cad batteries and will charge two batteries in 4 to 6 hours. Four batteries in 10 to 14 hours, depending on the strength of available sunlight. The solar cell is housed in the hinged lid, which can be angled towards the sun for optimum effect.

Order Code: BAT/CHARGE/50L

PRICE: £8.50



## SOLAR MODULES

A range of encapsulated solar cell modules mounted in sturdy and attractive black poly-carbonate cases. The faceplate consists of tiny bubble magnifiers which maximises performance by enhancing light as it

strikes the cell. Output current ranges from 100mA to 700mA. All modules have an output 0.45V and are fitted with threaded stud terminals. A miniature copper busbar is also fitted to enable simple parallel connection to produce the required voltage or current.

Order Code	Output Current	Dimensions (mm)	Price	
			1+	25+
SOL/G100	100mA	45 x 26 x 7.5	£1.25	95p
SOL/G200	200mA	52 x 36 x 7.5	£1.55	£1.20
SOL/G400	400mA	75 x 45 x 7.5	£2.15	£1.75
SOL/G800	800mA	95 x 65 x 7.5	£3.95	£3.10
SOL/G1000	1000mA	95 x 65 x 7.5	£4.90	£3.95

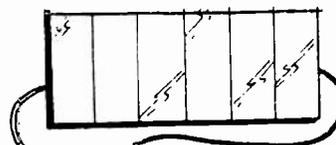
## 3V SOLAR PANELS



Produces an output of 3V 100mA maximum. Can be used as a power source for low current current circuits or for triple charging AAA or AA ni-cad batteries. Dimensions: 95 x 65 x 7.5mm

Order Code: SOLA/715 Price: 1+ £4.95 10+ £4.45

## AMORPHOUS SILICON PHOTO VOLTAIC PANEL



A high efficiency solar panel. Supplied on an aluminium frame and supplied with tilting brackets. Pre-wired lead supplied has croc clips, 2.5 and 3.5mm jack plugs and 2.1mm and 2.5mm power plugs.

Output	Order Code	1+	10+
6V 2 Watt (333mA)	SOLA/720	£28.00	£26.00
12V 2 Watt (166mA)	SOLA/725	£28.00	£26.00

## BATTERY CLIPS

Order Code: BAT/BOX/PP3S  
Price: 1+ 8p 10+ 6p 100+ 4p



P3 CLIP - HEAVY DUTY  
Order Code: BAT/CLIP/PP3H  
Price: 1+ 18p 10+ 12p 100+ 8p



PP9 CLIP - STANDARD  
Order Code: BAT/CLIP/PP9  
Price: 1+ 15p 10+ 12p 100+ 8p



THERE ARE  
**18 DIFFERENT BATTERY HOLDERS**  
IN THE MAIN CATALOGUE

Quantity prices can be quoted

ALL PRICES  
INCLUDE VAT

## Special Offers

POSTAGE  
£3.00

### BNC - 75ohm SOCKET

Very high quality bulkhead 75ohm BNC Socket manufactured by Suhner

This socket conforms to MTL, IEVC and DEF Standards. The centre contacts are gold-plated brass or beryllium copper and the body made of brass silver or chrome plated. Working voltage: 500Vdc or AC peak, Temperature range: -55°C to +155°C. Socket comes complete with locking washer and fixing nut. Mounting nut: 9mm. Quantity available 120.



ORDER CODE: SO/002

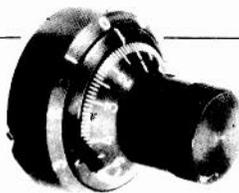
Price: 1+ 80p 10+ 70p

### DIAL MECHANISM

High quality dial with engraved black numerals. Quantity available: 240.

ORDER CODE: SO/061

Price: £3.75



## TUNGSTEN HALOGEN LAMPS

### EXTRA SPECIAL OFFER!

Standard halogen lamps offering a choice to suit every pocket!

Choice of 3 wattages: 200W, 300W and 500W.

LIMITED PERIOD ONLY

(Catalogue Price: £3.75)

SALE PRICE: £3.00

Any four for £10.00

### IEC MAINS LEADS - BELDEN

IEC MAINS LEADS - 10Amp  
IEC LEAD 250V Right Angle.

Made by Belden

This may be the highest quality lead available. FULLY screened cable, moulded IEC socket one end with USA plug on the other. To use in UK, simply cut off the USA plug and wire up to a standard 13A plug.

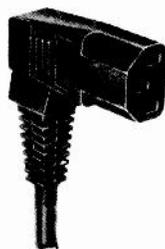
Makings on cable: 18-3. Type SJT E-3462. LL-7874 Shielded GE. Length: 2 metres.

OVER 10,000 IN STOCK!!!

QUANTITY PRICES AVAILABLE

ORDER CODE: SO/307

Price: 1+ £1.00 10+ 85p 100+ 60p



### INSULATED CRIMP PACKS

#### SUPER OFFER

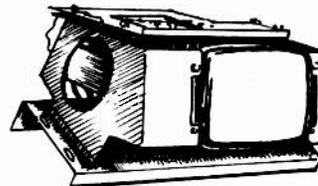
Highest quality crimps, random mix of Red, Yellow and Blue. Plugs and sockets. Each pack contains approx. 100 mixed crimps.

ORDER CODE: SO/353

Price: £3.75



### Hi-RES MONITOR



#### (MADE IN UK GREEN SCREEN) USED

Very high quality monitor, complete apart from the case. Resolution at centre is 900 lines therefore ideal for computer applications. Simply input 12V @ 1.2A.

#### COMPOSITE VIDEO

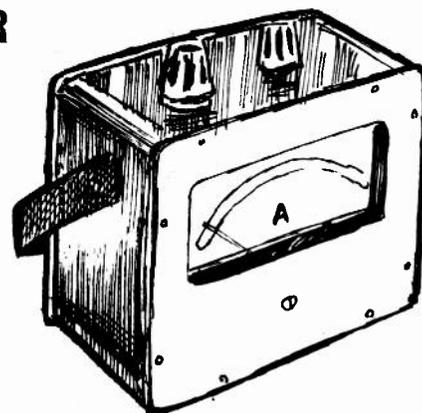
Supplied complete with full handbook and circuit diagram and full parts list. (Manual available separately £2.00 each)

Spec: CRT Size 7in. (178mm), Power 12V/1A, Line Frequency 15-19KHZ, Vertical Frequency 50-60HZ, Resolution at centre 900 lines, Linearity <2%, EHT Typical 12.0Kv, Line Blanking 12-7.5us, Vertical Blanking 750us, Video Input unterminated 12K, terminated 75R, Video response 22MHz, Video Rise/Fall 17nS, Video in for 35V output 1Vp-p.

ORDER CODE: SO/MONITOR

Price: £19.99 Two for £35.00

## METER SPECIAL WEIR



7in. x 7in. with 5in scale.

A selection of secondhand, very high quality meters.

First come, first served!

Scale	Code	Price
0-0.8A	SO/W1	£10.50
0-0.15DC	SO/W2	£11.50
0-300V	SO/W3	£12.50
0-2.5VA	SO/W4	£10.00
0-1.5, 3, 7.5DC	SO/W5	£11.50
0-100V	SO/W6	£10.00

ALL PRICES  
INCLUDE VAT

# Special Offers

POSTAGE  
£3.00

## TOROIDAL TRANSFORMER

Made in UK

Manufactured to a very high standard by St. Ives Windings.

Primary: 0-120 0-120 Secondary: 9ve 4A. 15-0-15ve @0.5A. Dimensions: Dia. 75mm, Thickness: 38mm.

Subject to availability we will supply fixing hardware. (Only while stocks last)



List price in tens; £24.00 each!

ORDER COSE: SO/268

Price: £10.00

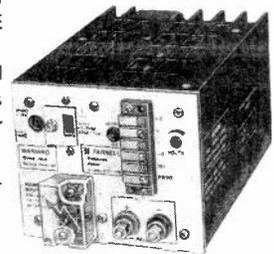
## FARNELL SWITCH MODE POWER SUPPLY

G-SERIES SWITCH MODE POWER SUPPLY. 240WATTS. FARNELL TYPE G12 SS: 2011

Mostly still in sealed boxes. Unused and complete with full manual. This unit is still in production. Catalogue price over £400.

Input: 240Vac. Output: 8-12.6V. 20Amps.

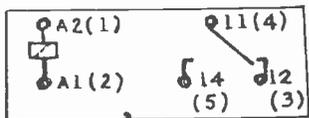
Dimensions: 88 x 160 x 194mm.



ORDER CODE: SO/431

Price: £160

## SCHRACK RELAY TYPE:



Internationally approved heavy duty PCB mounting relay

In industry standard dimensions with 1 form C contact rated at 8Amps. Mounted on 1-0" grid.

Switching voltage: 380Vac max. 8A 250Vac Dims: 28 x 25 x 11mm

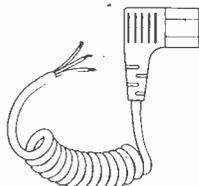
Nominal V DC:12V 270 ohms.

ORDER CODE: SO/602

£1.00 10+ 90p 100+ 65p 1000+ 55p

## IEC LEAD - CURLY

6A 240Vac Right Angle IEC plug fitted to 3-core 0.75mm black curly cable. Stretches to approx. 2.5 metres.

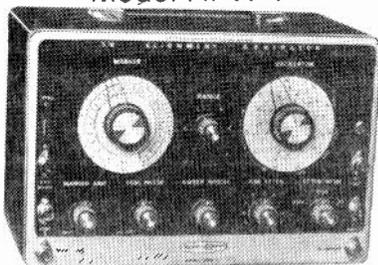


ORDER CODE: SO/604

Price: 1 + £1.00 10+ 90p

## HEATHKIT GENERATOR

Model HFW-1



SPECIFICATION:

Frequency Range and Output:

Band A: 3.6 Mc/s to 10 Mc/s, output .23 volts RMS ± 1/2dB.

Band B: 10 Mc/s to 26 Mc/s, output .22 volts RMS ± 1/4 dB.

Band C: 30 Mc/s to 80 Mc/s, output .11 volts RMS ± 1/2 dB.

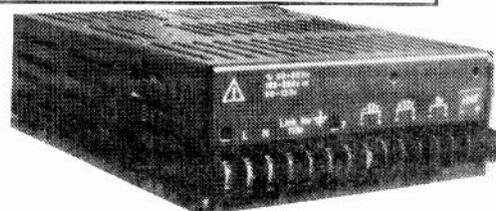
BAND D: 80 MC/S to 220Mc/s, output .08 volts RMS 3/4 dB.

Output Impedance:

80Ω, terminated at both ends from 0-4 Mc/S lowest maximum sweep.

Price: £50

## WEIR SWITCH MODE POWER SUPPLY



50 WATTS MODEL SMM 50/12 a24

Again, no promises but all these units seem unused. Still in original packaging. Complete with full spec. sheet and circuit diagram. (Available separately - send £1 plus SAE).

Input: 98 -132V, 196-264V. Output: OP1: 5V, OP2: +12V, OP3: -12V, OP4: +24V.

(Fully cased). These units have just arrived and we regret that we have no current ratings yet.

Dimensions: 200 x 150 x 60mm.

ORDER CODE: SO/WEIR/SMM

Price: £17.50

## ZX SPECTRUM +2A/+3/+3A



ALL BRAND NEW

Those of you who service/repair Sinclair computers will know what a real bargain these are. However, only limited stocks so hurry! These keyboards are made by Amstrad. Marked as follows: 40060/B ESU2456A.

At time of printing, the Trade Price for this keyboard is £26.06 + VAT!!

ORDER CODE: SO/668

Price: £6.50 Two for £11.50

## ORIGINAL SPCO MINIATURE RELAY

Contact material. Silver cadmium oxide, Contact Rating 7A/120Vdc 5A/240ac, Max. Switching Voltid 240ac, Max Carry Current 7A, Contact Res <50M ohms, Temp Range -25°C to +55°C. Operate Time <7.0mS, Release Time: <1.0mS, Electrical Life: >1 x 10<sup>7</sup>, Mechanical Life: >1 x 10<sup>7</sup>, Approvals UL and CSA, L19.8, 1 x H20.5mm Pin dia. 1.3mm, Coil Volts, SRUDHSS 112D 12V, Coil Res: 400, (Vevo Code: 25641016) Q/300.

12 volt 7amp



Order Code: R/7

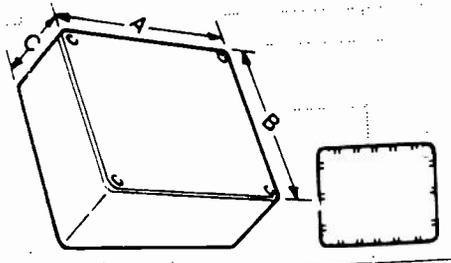
Price: 1+ £1.75 10+ £1.50

ALL PRICES  
INCLUDE VAT

# Boxes

POSTAGE  
£3.00

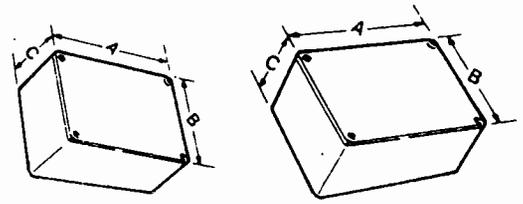
## ABS MULTI-PURPOSE BOX - STANDARD



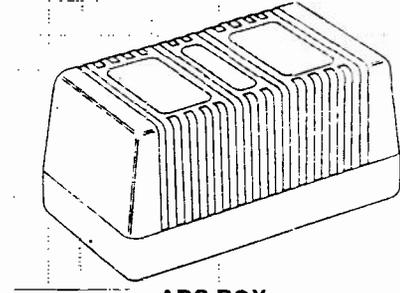
A range of professional quality boxes, offering a high quality finish at a very realistic price. Moulded in high impact ABS to give maximum strength, they are easily punched or drilled to produce a professional looking end product. Printed circuit board slots are provided on this range except for MB6. All the lids are retained by four or 6 BA countersunk posidrive screws into brass inserts. Colour: Black.

Internal Dim. mm			Order Code	1+	10+
A	B	C			
76	58	35	BOX/MB1	£1.38	£1.24
95	71	35	BOX/MB2	£1.50	£1.35
115	95	37	BOX/MB3	£1.70	£1.53
145	95	55	BOX/MB4	£2.45	£2.20
207	122	77	BOX/MB5	£5.25	£4.75
213	142	57	BOX/MB6	£4.00	£3.60
174	117	80	BOX/MB7	£3.40	£3.05
147	77	47	BOX/MB8	£2.20	£2.00

## ABS MULTIPURPOSE BOXES - MINIATURE



5 Internal Dim. mm			Wall Thickness	Order Code	1+	10+
A	B	C				
72	46	22	1.5	BOX/T3	75p	68p
107	53	18	2.0	BOX/T4	90p	81p



ABS BOX

Two part housing, ideal for mains to low voltage power supplies. Mains input cable will be securely clamped when fitted through the slot in the base, the latter being held in place by four self-tapping screws. An internal divider is provided for transformer electronics isolation. The external appearance is enhanced by ribbing.

Dimensions 117 x 63 x 62mm.

Colour: Black

Order Code: BOX/PSU-2  
Price: 1+ £1.25 10+ £1.12

**OUR MAIN CATALOGUE LISTS  
MANY MORE BOXES AND  
HOUSINGS - PLEASE ENQUIRE**

ALL PRICES  
INCLUDE VAT

# Valves

POSTAGE  
£3.00

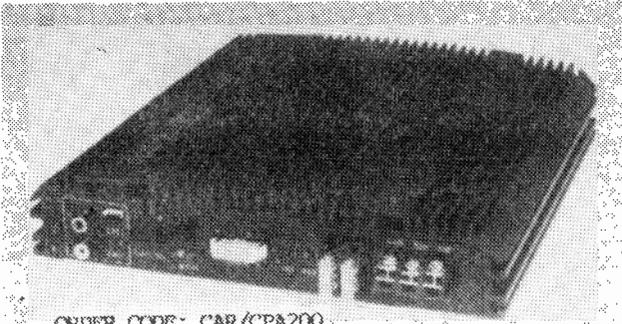
EC1184	£1.45	EL509	£10.46	EBF89	£1.32	PC92	£14.58	PD500	£6.50	UF41	£4.84
ECL80	£1.00	EL519	£10.46	EC92	£18.42	PC97	£1.82	PFL200	£2.32	UL84	£1.48
ECL82	£1.45	EM84	£1.48	ECC81	£3.46	PC900	£1.38	PF82	88p	UY41	£6.82
ECL84	£1.45	EM87	£2.58	ECC82	£3.02	PCC84	70p	PL83	88p	UY85	£1.22
ECL85	£1.45	EY86/87	82p	ECC83	£3.36	PCC85	94p	PL84	£1.44	2D21	£3.02
ECL86	£3.45	EY88	£1-10	ECC84	80p	PCC88	£1.26	PL85	£3.30	6AQ5	£3.30
EF37A	£5.08	EY500A	£3.68	ECC85	£2.03	PCC89	94p	PL504	£2.42	6AU6	£1.92
EF41	£3.92	EZ41	£4.02	ECC88	£3.96	PCC189	£1.22	PL508	£1.60	6AV6	£1.32
EF80	70p	CV850	£3.24	ECC91	£2.36	PCF80	£1.54	PL509/519	£10.40	6BA6	£2.58
EF83	£6.88	CV4015	£3.57	ECC189	£3.96	PCF82	88p	PL802	£11.62	6BE6	£2.92
EF85	70p	DAF96	£1.32	ECF80	£1.70	PCF86	£1.66	PY32/33	82p	6BJ6	£2.42
EF86	£2.76	DF96	£1.54	ECF82	£1.60	PCF87	£1.66	PY81/800	£1.66	6BW7	£2.32
EF89	£2.42	DL96	£2.09	ECH35	£4.74	PCF200	£3.42	PY88	£1.66	6C4	£3.64
EF91	£2.54	DY51	£1.32	ECH42	£1.88	PCF201	£3.42	PY500A	£3.52	6JS	£6.49
EF92	£4.18	DY86/S7	£1.10	ECH81	£1.44	PCF801	£1.66	PY801	£1.54	6K7	£3.58
EF95	£1.00	DY802	£1.44	ECH83	£2.32	PCF802	£1.38	UR6	£1.44	6FJ7	£3.14
EF183	82p	E88CC	£8.42	EZ80	£2.42	PCF805	£1.60	UAVC80	88p	6V6GT	£3.74
EF184	82p	ECC91	£5.34	EZ81	£1.98	PCF806	94p	UAF42	£2.42	6X6	£4.02
EH90	70p	EABC80	£2.54	GY501	£3.03	PCF808	£1.60	AVC41	£5.00	12AU6	£3.50
EL34 CH	£4.62	EAF42	£2.04	GZ32	£3.46	PCH200	£2.80	UVC81	£3.52	12AV6	£1.92
EL34TR	£5.00	EAF801	£1.88	GZ34	£5.00	PCL82	£1.98	UBF89	88p	39FK1/2	£2.54
EL36	£1.76	EB91-	82p	KT66	£26.62	PCL83	£4.34	UCC85	82p	30FL12	£3.14
EL81	£9.52	EBC41	£4-23	KT88G/L	£67.84	PCL84	£1.32	UCH42	£3.90		
EL84	£2.76	EBC81	£1.32	KT88	£19.08	PCL86	£1.54	UCH81	£1.00		
EL86	£1.48	EBF80	£1.00	PC86	70p	PCL88	£2.26	UCL82	£1.66		
EL95	78p	EBF83	£1.88	PC88	70p	PCL805/85	£1.56	UCL83	£3.19		

ALL PRICES  
INCLUDE VAT

## Car Accessories

POSTAGE  
£3.00

### 2 x 200W CLASS A AMPLIFIER



ORDER CODE: CAR/CPA200

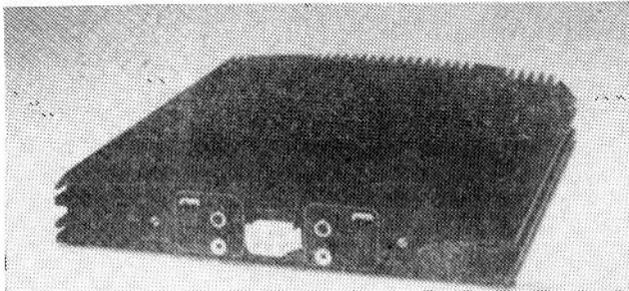
High power class A amplifier capable of delivering 2x 200W stereo or 400W mono in bridge mode. Inputs are direct from the speaker outputs of the car radio/cassette or low level phono inputs, with left and right level controls. Full thermal and overload protection.

Output power: 2x 200W stereo 0.08%THD, 400W mono 0.2%THD Signal to noise ratio: >9dB, Frequency response: 10-50000Hz, Input sensitivity: 100mV-3V adjustable, Input impedance: High level input 100Ω, Low level input 20kΩ, Output impedance: 4Ω, Damping factor >180 into 4Ω, Power: 4.4Vdc 43A nom, Dims: 240 x 180 x 50mm

Order Code: CAR/CPA200

Price: 1+ £107.95 5+ £103.75

### 4 x 120W CLASS A AMPLIFIER



ORDER CODE: CAR/CPA504

High power 4-channel class A amplifier, capable of delivering 4 x 120W or 2 x 240W in bridge mode. Inputs are direct from the speaker outputs of the car radio cassette. or low level phono inputs with left and right level controls. Full thermal overload protection.

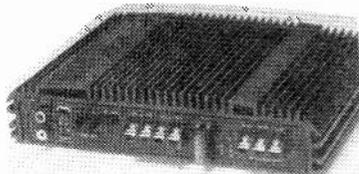
Output power: 4 x 120W or 2 x 240W (bridged), Signal to noise ratio >90dB, Frequency response: 100-50000Hz, Input sensitivity: 100mV-3V adjustable, Input Impedance: High level input 100Ω, Low level input 20Ω, Power: 14.4Vdc 60A, Dims: 400 x 240 x 50mm

Order Code: CAR/CPA504

Price: £149.50 15+ £128.50

### 2 x 60W CLASS A AMPLIFIER

Class A stereo in-car amplifier capable of delivering 2 x 60W stereo or 120W mono in bridge mode. Inputs are low level phono, with left or right level controls. Full thermal and overload protection.



Output power 2 x 60W stereo 0.1%THD; 120 mono 0.1% THD; Signal to noise ratio: ≥80dB; Frequency response 20 - 20,000Hz; Input sensitivity 100mV-3V adjustable, Input impedance - low level input 20KΩ; Output impedance 4Ω; Power 14.4Vdc 15A; Dims: 240 x 120 x 50mm.

Order Code: CAR/CPA 100

Price: 1+ £57.50 5+ £47.50

### CAR EQUALISER/BOOSTER — 60WATT



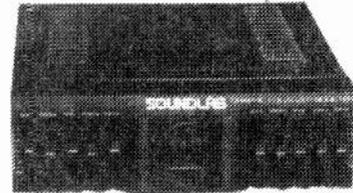
Slimline 10 channel in-car graphic equaliser/booster giving 60W of output power to four speakers. Built in 3.5mm stereo headphone socket. Front to rear fader control. Twin 5-LED power level indicators. Mounting hardware included.

Output Power: 30W per channel, Frequency response: 20-20000Hz, Input Impedance: 23ohm, Control Frequencies: 30, 60, 120, 250, 500Hz, 1, 2, 4, 8, & 16kHz, Control Range: 12dB cut or boost, Output Impedance: 4-8ohm, Power: 12-14Vdc 6A, Dims: 148x33x27mm

Order Code: CAR/EB1

Price: £27.50

### CAR EQUALISER/BOOSTER



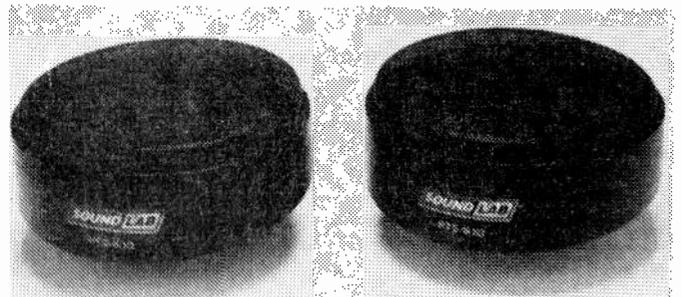
High power stereo equaliser booster. Twin 5-band graphic equaliser. Fader control for front/rear speakers and twin 10-LED power indicators. Inputs for high or low level from car stereo. Mounting hardware included.

Output Power: 15W per channel, Frequency response: 30-20000Hz, Input Level: 300mV (Low) 2.5v (high), input Impedance: 500hm. Control Frequencies: 60,250,1K,3.5K,10k,Hz, Output Impedance: 4-80hm, Power :12-14Vdc

Order Code: CAR/EB2

Price: £42.95

### 200W SHELF SPEAKERS



Co-axial 3-way shelf mounting speakers consisting of an 8" woofer with mid range and tweeter mounted on axis. These speakers feature a very broad frequency response, ideal for digital system.

Maximum power: 200W, Frequency response: 18-30000Hz, Speaker size: 8" woofer, 2.5" mid range, 1.5" tweeter, Impedance: 4Ω, Mounting depth: 82mm

Order Code: CAR/RTS830

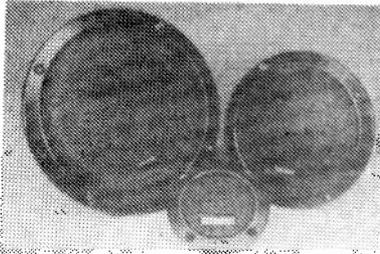
Price: £57.95

See the main 172 page catalogue for eight pages of in-car entertainment accessories and loudspeakers

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## Car Accessories

POSTAGE  
£3.00



### COMPONENT SPEAKER SYSTEM

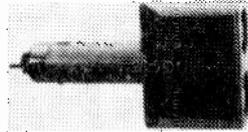
2 x 3 way component speaker system comprising: two 6.5 woofers, two 4 mid range, two 2.25 tweeters and, all leads, filters and fixing screws. Finished in black with black mesh grilles.

Max Power: 60W/side, Frequency response: 60-20000Hz, Speaker Sizes: 6.5 Woofer, 4 midrange, 2.25 Tweeter, Impedance: 4 ohm

Order Code: CAR/BO20  
Price: £33.50 Per se

### IN CAR ADAPTOR

An adaptor to provide two cigar lighter sockets from the single socket provided in the car. Internally fused at 15A.



Order Code: CAR/ADAP  
Price: + £2.50 25+ £1.75

### CAR FAN — 12Vdc

A 12Vdc oscillating car fan with a large suction cup for attaching the fan to the dashboard etc. Fully adjustable for tilt and angle. Supplied with a 1.7m lead fitted with a cigar plug.



Order Code: CAR/FAN  
Price: £5.99

### DC/DC CONVERTER

A plug in DC/DC converter with 3, 4.5, 6, 7.5, 9 & 12V @ 800mA. Plugs directly into a car cigar lighter socket. Output via a polarity reversible lead to a 'spider' plug with 1.3, 2.1, & 2.5mm DC power plugs and a 3.5mm plug.



Input Voltage: 12Vdc nom, Output voltage: as above, Output Current: 800mA max.

Order Code: CAR/PSU/1  
Price: £2.99 10 off £2.50

### AUDIO CONNECTING LEAD



High quality, for connecting in-car systems. Two gold plated phono to two gold plated phono plugs with high quality low capacitance double screened cable.

Order Code: 4.0m CAR/053  
Price: £8.95 10 off £8.50

### SPEAKER LEADS



1 pair of leads fitted with low profile 2 pin DIN plugs. Length: 0.3m

Order Code: CAR/SL  
Price: 95p 10 off 85p each

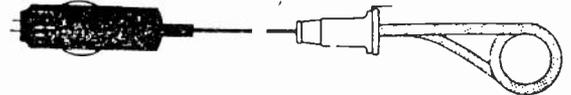
### EXTENSION LEAD



Adaptor lead to project cigar lighter-type socket to a distance of 2m. Max. current 5A. Fuses (5A) built into plug.

Order Code: CAR/PLE  
Price: £2.75

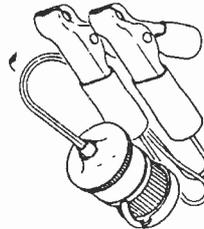
### IMMERSION HEATER



A handy mobile immersion heater for boiling water, soup, etc. Plugs into cigar lighter socket. Power: 12Vdc, 120W, Lead length 1m.

Order Code: 4.0m CAR/IH  
Price: £2.99

### CAR CIGARETTE LIGHTER SOCKET



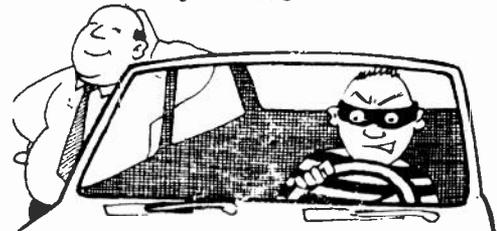
A 12V car cigarette lighter socket connected to 2 x battery crocodile clips.

Order Code: CAR/JL

Price: £2.99 10+ £2.50

## CAR, MOTORHOME, VAN IMMOBILISER

"The real thing" as reviewed by Practical Motorist June 1993!



A brand new design and indeed a very clever device which gives 100% peace of mind to the vehicle owner and causes the would be car thief 100% frustration! This unit may also be used alongside an existing car alarm. So what's so special about this device?

Most alarms require the owner to activate them when exiting the vehicle, which can be easily overlooked or simply forgotten. The AT1 circuit overcomes this by activating the moment the engine is switched on or the vehicle is 'Hot Wired', making it impossible to forget. From the moment the ignition is switched on the AT1 circuit starts timing. When the engine has started the unit MUST BE DE-ACTIVATED otherwise (this is the clever bit) the engine will cut out.

The thief is then faced with the problem of not only the engine cutting out but then failing to re-start. The thief will not hang around to 'repair' the vehicle - simple!

A red LED is supplied with the kit which may be fitted to the dashboard and will remain lit all the time acting as a visual deterrent to any would be thief.

Suitable for both Electronic and Non-Electronic Ignition cars. Full fitting instructions are supplied with the assembly instructions.

SUPPLIED READY-BUILT AND HOUSED

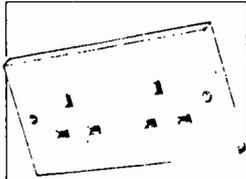
Order Code: COM/AT1

1+ £25.99 5+ £24.00

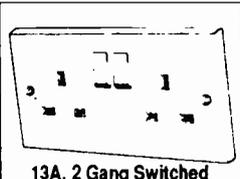
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# Electrical

POSTAGE  
£3.00



**13A, 2 Gang Flush Socket**  
To BS1363  
Order Code: ELEC/2509  
Price: 1+ £3.60 10+ £3.25

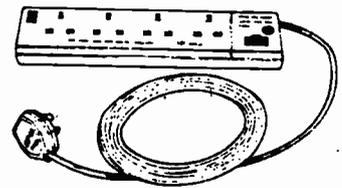


**13A, 2 Gang Switched Fluswh Socket**  
To BS1363  
Order Code: ELEC/8325  
Price: 1+ £5.25 10+ £4.75



**13A Rubber Trailing Socket**  
White to BS1363/A

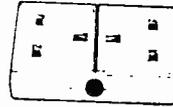
Order Code: ELEC/EXT/1W  
Price: 1+ £1.50 10+ £1.35



**13A Fused 4 Way Extension Lead 3 metres**  
Order Code: ELEC/MS/4LP  
Normally £6.99.  
SALE PRICE: £5.99 10 OFF £5.50

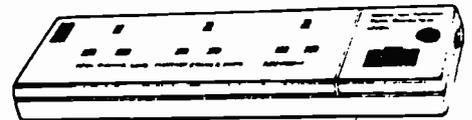


**13A 4 Way Socket with Neon Indicator. Unfused to BS 1363/A**  
Order Code: ELEC/MS/4.  
Price: 1+ £3.75. 10+ £3.45



**13A Twin Nylon Trailing Socket**  
White to BS1363/A

Order Code: ELEC/EXT/2  
Price: 1+ £2.10 10+ £1.89



**13A 4 Way Socket with Neon Indicator. Fused to BS 1363/A**  
Order Code: ELEC/MS/4F  
Price: 1+ £4.25. 10+ £3.85

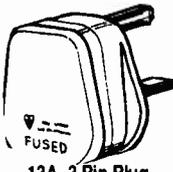


2A Connector Strip. Order Code: ELEC/TB/2  
Price: 1+ 50p 10+ 45p

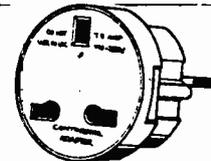
5A Connector Strip Order Code: ELEC/TB/5  
Price: 1+ 55p 10+ 50p

15A Connector Strip Order Code: ELEC/TB/15  
Price: 1+ 88p 10+ 80p

30A Connector Strip Order Code: ELEC/TB/15  
Price: 1+ £1.65 10+ £1.49

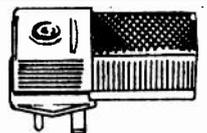


**13A, 3 Pin Plug**  
Fused 13A to BS1362  
Order Code: ELEC/188  
Price: 1+ 65p 10+ 60p 100+ 55p



**European Travel Adaptor**

Order Code: ELEC/ETA  
Price: 1+ £1.99 10+ £1.75



**Automatic Nightlight**  
Order Code: ELEC/605  
Price: 1+ £4.99

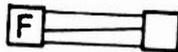
**Spare Bulb for above**  
Order Code: ELEC/765  
Price: £1.00

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# Fuses

POSTAGE  
£3.00

A full range of Quick Blow and Anti-Surge Fuses meeting all European and British standards



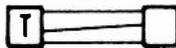
## 20mm QUICK BLOW

100mA, 125Ma, 160mA, 200mA, 250mA, 315mA, 400mA, 500mA, 600mA, 630mA, 800mA, 1A, 1.25A, 1.5A, 1.6A, 2A, 2.5A, 3A, 3.5A, 4A, 5A, 6.3A, 7.5A, 10A, 13A, 15A, 20A.

Order Code: FUSE/QB2/Value

Price: 1+ 8p 10+ 6p 100+ 4p 500+ 2.7p

ORDER 500 PIECES OF ONE VALUE AND  
PAY ONLY 2.7P EACH INCLUDING VAT



## 20mm ANTI SURGE

100mA, 125mA, 160mA, 200mA, 250mA, 315mA, 400mA, 500mA, 600mA, 630mA, 800mA, 1A, 1.25A, 1.4A, 1.5A, 1.6A, 2A, 2.5A, 3A, 3.15A, 4A, 5A, 6.3A, 7.5A, 13A.

Order Code: FUSE/AS2/Value

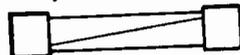
Price: 1+ 18p 10+ 15p 100+ 12p

## 32mm QUICK BLOW

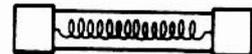
100mA, 150mA, 200mA, 250mA, 350mA, 500mA, 600mA, 630mA, 750mA, 800mA, 1A, 1.25A, 1.5A, 2A, 2.5A, 3A, 4A, 5A, 10A, 13A, 15A, 20A

Order Code: FUSE/QB4/Value

Price: 1+ 9p 10+ 7p 100+ 4.5p



## 32mm ANTI-SURGE



100mA, 150mA, 200mA, 250mA, 350mA, 500mA, 600mA, 630mA, 750mA, 800mA, 1A, 1.25A, 1.5A, 2A, 2.5A, 3A, 4A, 5A, 7.5A, 10A, 13A,

Order Code: FUSE/AS4/Value

Price: 1+ 26p 10+ 24p 100+ 18p

## 20mm PANEL MOUNTING

Finger Release 6.3A 240V.

Order Code: FUSE/PM/20

Price: 1+ 36p 10+ 33p



## 32mm CAR LINE TYPE

Bayonet action..

Order Code: FUSE/IL/B

Price: 1+ 12p 10+ 10p



In line white plastic fuseholder with heavy gauge wire tails fitted.

Order Code: FUSE/IL/C

Price: 1+ 32p 10+ 28p

ALL PRICES  
INCLUDE VAT

# SALE Component Kits SALE

POSTAGE  
£3.00

## RESISTOR KIT — 0.25W (5 off each value)

A pack containing 305 resistors. Values as listed below. Each value individually packed and each bag marked with the values enclosed.

Contents: 5 of each value:

10R, 12R, 15R, 18R, 22R, 27R, 33R, 39R, 47R, 56R, 68R, 82R, 100R, 120R, 150R, 180R, 220R, 270R, 330R, 390R, 470R, 560R, 680R, 820R, 1K, 1K2, 1K5, 1K8, 2K2, 2K7, 3K3, 3K9, 4K7, 5K6, 6K8, 8K2, 10K, 12K, 15K, 18K, 22K, 27K, 33K, 39K, 47K, 56K, 68K, 82K, 100K, 120K, 150K, 180K, 220K, 270K, 330K, 390K, 470K, 560K, 680K, 820K, 1M.

Order Code: KIT/RES/25/5

Catalogue Price: £3.95 **SALE PRICE £2.99**

## RESISTOR KIT — 0.25W (10 off each value)

A pack containing 610 resistors. Values as listed below. Each value individually packed and each bag marked with the values enclosed.

Contents: 10 of each value:

10R, 12R, 15R, 18R, 22R, 27R, 33R, 39R, 47R, 56R, 68R, 82R, 100R, 120R, 150R, 180R, 220R, 270R, 330R, 390R, 470R, 560R, 680R, 820R, 1K, 1K2, 1K5, 1K8, 2K2, 2K7, 3K3, 3K9, 4K7, 5K6, 6K8, 8K2, 10K, 12K, 15K, 18K, 22K, 27K, 33K, 39K, 47K, 56K, 68K, 82K, 100K, 120K, 150K, 180K, 220K, 270K, 330K, 390K, 470K, 560K, 680, 820, 1M.

Order Code: KIT/RES/25/10

Catalogue Price: £5.40 **SALE PRICE £4.00**

## RESISTOR KIT — 0.25W Popular

A pack containing a total of 1,000 0.25W 5% carbon film resistors ranging in value from 10R to 10M. In this pack we have included larger quantities of more popular values. Each value individually packed.

Contents

No. Value	No. Value	No. Value	No. Value
10 x 10R	10 x 390R	10 x 8K2	15 x 180K
10 x 12R	30 x 470R	30 x 10K	20 x 220K
10 x 18R	20 x 560R	15 x 12K	15 x 270K
10 x 22R	20 x 680R	15 x 15K	15 x 330K
10 x 33R	10 x 820R	15 x 18K	10 x 390K
20 x 47R	40 x 1K0	20 x 22K	20 x 470K
10 x 56R	15 x 1K2	15 x 27K	10 x 560K
10 x 68R	15 x 1K5	20 x 33K	10 x 680K
10 x 82R	10 x 1K8	10 x 39K	5 x 820K
20 x 100R	25 x 2K2	30 x 47K	20 x 1M
10 x 120R	20 x 2K7	20 x 56K	10 x 2M2
10 x 150R	20 x 3K3	15 x 68K	5 x 3M3
10 x 180R	15 x 3K9	10 x 82K	10 x 4M7
20 x 220R	25 x 4K7	30 x 100K	5 x 6M8
20 x 270R	20 x 5K6	20 x 120K	20 x 10M
20 x 330R	15 x 6K8	15 x 150K	

Order Code: KIT/RES/25/POP

Catalogue Price: £7.00 **SALE PRICE £6.00**

## METAL FILM 1% RESISTOR KIT - MR25

A pack containing a total of 1,000 0.25W 1% Metal Film premium resistors, ranging in value from 10R to 1M. We have included larger quantities of the more popular values.

10x 10R	20 x 220R	10 x 1K8	15 x 15K	40 x 100K
10 x 15R	20 x 270R	10 x 2K	10 x 16K	15 x 120K
10 x 22R	30 x 330R	20 x 2K2	10 x 18K	10 x 150K
10 x 33R	10 x 390R	10 x 2K7	10 x 20K	10 x 180K
10 x 39R	10 x 430R	15 x 3K3	20 x 22K	15 x 220K
15 x 47R	20 x 470R	10 x 3K9	15 x 27K	10 x 240K
10 x 56R	10 x 560R	25 x 4K7	15 x 33K	10 x 270K
10 x 68R	10 x 620R	10 x 5K1	10 x 39K	20 x 330K
10 x 75R	20 x 680R	15 x 5K6	10 x 43K	10 x 390K
10 x 91R	10 x 820R	15 x 6K8	20 x 47K	20 x 470K
30 x 100R	10 x 910R	10 x 7K5	15 x 56K	10 x 560K
10 x 120R	20 x 1K0	10 x 8K2	10 x 68K	15 x 680K
15 x 150R	20 x 1K2	30 x 10K	10 x 75K	10 x 820K
10 x 180R	15 x 1K5	15 x 12K	10 x 82K	30 x 1M

Order Code: KITMR/POP

Catalogue Price: £12.99 **SALE PRICE £11.00**

## RESISTOR KIT — 0.5W Popular

A pack containing a total of 1,000 of 0.5W 5% carbon film resistors ranging in value from 2R2 to 10M. In this pack we have included larger quantities of more popular values. Each value individually packed.

No. Value	No. Value	No. Value	No. Value
5 x 2R2	10 x 82R	20 x 2K7	10 x 68K
5 x 2R7	20 x 100R	20 x 3K3	10 x 82K
R5 x 3R3	10 x 120R	10 x 3K9	30 x 100K
5 x 3R9	10 x 150R	25 x 4K7	10 x 120K
10 x 4R7	10 x 180R	20 x 5K6	10 x 180K
10 x 47R	20 x 220R	10 x 8K2	20 x 220K
5 x 5R6	20 x 270R	20 x 22K	15 x 270K
5 x 6R8	20 x 330R	30 x 10K	5 x 280K
5 x 8R2	10 x 390R	15 x 12K	15 x 330K
10 x 10R	30 x 470R	15 x 15K	10 x 390K
10 x 12R	20 x 680R	30 x 18K	20 x 470K
10 x 18R	10 x 820R	20 x 22K	10 x 680K
10 x 22R	40 x 1K0	10 x 27K	20 x 1M
10 x 33R	10 x 1K2	20 x 33K	10 x 2M2
10 x 47R	10 x 1K5	10 x 39K	5 x 3M3
10 x 56R	10 x 1K8	30 x 47K	10 x 4M7
10 x 68R	25 x 2K	20 x 56K	5 x 6M8
			20 x 10M

Order Code: KIT/RES/5/POP

Catalogue Price: 1+ £9.75 **SALE PRICE £8.00**

## RESISTOR KIT — 0.5W (5 off each value)

A pack containing 365 resistors. Values as listed below. Each value individually packed and each bag marked with the value enclosed.

Contents: 5 of each value

2R2, 2R7, 3R9, 4R7, 5R6, 6R8, 10R, 12R, 15R, 18R, 22R, 27R, 33R, 39R, 47R, 56R, 68R, 82R, 100R, 120R, 150R, 180R, 220R, 270R, 330R, 390R, 470R, 560R, 680R, 1K, 1K2, 1K5, 1K8, 2K2, 2K7, 3K3, 3K9, 4K7, 5K6, 6K8, 8K2, 10K, 12K, 15K, 18K, 22K, 27K, 33K, 39K, 47K, 56K, 68K, 82K, 100K, 120K, 150K, 180K, 220K, 270K, 330K, 390K, 470K, 560K, 680K, 820K, 1M, 1M2, 1M8, 2M2.

Order Code: KIT/RES/5/5

Catalogue Price: £5.50 **SALE PRICE £4.50**

## RESISTOR KIT — 0.5W (10 off each value)

A pack containing 730 resistors. Values as listed below. Each value individually packed and each bag marked with the value enclosed.

Contents: 5 of each value

2R2, 2R7, 3R9, 4R7, 5R6, 6R8, 10R, 12R, 15R, 18R, 22R, 27R, 33R, 39R, 47R, 56R, 68R, 82R, 100R, 120R, 150R, 180R, 220R, 270R, 330R, 390R, 470R, 560R, 680R, 1K, 1K2, 1K5, 1K8, 2K2, 2K7, 3K3, 3K9, 4K7, 5K6, 6K8, 8K2, 10K, 12K, 15K, 18K, 22K, 27K, 33K, 39K, 47K, 56K, 68K, 82K, 100K, 120K, 150K, 180K, 220K, 270K, 330K, 390K, 470K, 560K, 680K, 820K, 1M, 1M2, 1M8, 2M2.

Order Code: KIT/RES/5/10

Catalogue Price: £8.95 **SALE PRICE £7.50**

## RESISTOR KIT — 1W (5 off each value)

A pack containing 305 resistors. Values as listed below. Each value individually packed and each bag marked with the values enclosed.

Contents: 5 of each value:

10R, 12R, 15R, 18R, 22R, 33R, 39R, 47R, 56R, 68R, 82R, 100R, 120R, 150R, 180R, 220R, 270R, 330R, 390R, 470R, 560R, 680R, 820R, 1K, 1K2, 1K5, 1K8, 2K2, 2K7, 3K3, 3K9, 4K7, 5K6, 6K8, 8K2, 10K, 12K, 15K, 18K, 22K, 27K, 33K, 39K, 47K, 56K, 68K, 82K, 100K, 120K, 150K, 180K, 220K, 270K, 330K, 470K, 560K, 680K, 820K, 1M.

Order Code: KIT/RES/1/5

Catalogue Price: £15.50 **SALE PRICE £14.00**

ALL PRICES  
INCLUDE VAT

# SALE Component Kits SALE

POSTAGE  
£3.00

## RESISTOR KIT — 2W (5 off each value)

A pack containing 365 resistors. Values as listed below. Each value individually packed and each bag marked with the values enclosed.

Contents: 5 of each value:

10R, 12R, 15R, 18R, 22R, 33R, 39R, 47R, 56R, 68R, 82R, 100R, 120R, 150R, 180R, 220R, 270R, 330R, 470R, 560R, 680R, 820R, 1K, 1K2, 1K5, 1K8, 2K2, 2K7, 3K3, 3K9, 4K7, 5K6, 6K8, 8K2, 10K, 12K, 15K, 18K, 22K, 27K, 33K, 39K, 47K, 56K, 68K, 82K, 100K, 120K, 150K, 180K, 220K, 270K, 330K, 470K, 560K, 680K, 820K, 1M, 1M2, 1M5, 1M8, 2M2, 2M7, 3M3, 3M9, 4M7, 5M6, 6M8, 8M2, 10M.

Order Code: KIT/RES/2

Cat. Price: £27.50 **SALE PRICE £25.00**

## CERAMIC KIT - 50V

A pack containing 125 50v disc and plate ceramics - ranging in value from 1pF to 10nF (0.01mF). Each value individually packed and each bag marked with the values enclosed.

Contents: 5 of each value.

1.8pF, 2.2pF, 3.3pF, 4.7pF, 6.8pF, 8.2pF, 10pF, 15pF, 22pF, 27pF, 47pF, 56pF, 68pF, 82pF, 100pF, 150pF, 180pF, 270pF, 470pF, 560pF, 1000pF, 2200pF, 4700pF, 10nF.

Order Code: KIT/CER/50V

Cat. Price: £3.99 **SALE PRICE £3.50**

## PRE-SET VERTICAL KIT

A pack containing a total of 120 miniature vertical mounting pre-set potentiometers. A total of 13 different values. Each value individually packed.

No. Value	No. Value	No. Value
5 x 100R	5 x 2K2	10 x 47K
5 x 220R	15 x 4K7	20 x 100K
5 x 470R	20 x 10K	5 x 220K
15 x 1K	5 x 22K	5 x 470K
		5 x 1M0

Order Code: KIT//POT/VERT

Cat. Price: £8.75 **SALE PRICE £7.00**

## PRE-SET HORIZONTAL KIT

A pack containing a total of 120 miniature horizontal mounting pre-set potentiometers. A total of 13 different values. Each value individually packed.

No. Value	No. Value	No. Value
5 x 100R	5 x 2K2	10 x 47K
5 x 220R	15 x 4K7	20 x 100K
5 x 470R	20 x 10K	5 x 220K
15 x 1K	5 x 22K	5 x 470K
		5 x 1M0

Catalogue Price £8.75)

Order Code: KIT//POT/HORIZ

Cat. Price: £8.75 **SALE PRICE £7.00**

## FUSE KIT - 20mm Quick Blow

A pack containing 80 Quick-Blow 20mm fuses. Each value individually packed.

No. Value	No. Value	No. Value
5 x 100mA	10 x 500mA	10 x 3.15A
5 x 250mA	20 x 1A	5 x 5A
5 x 315mA	5 x 1.6A	5 x 6.3A
	10 x 2A	

Catalogue Price £4.45)

Order Code: KIT/FUS/QB2

Cat. Price: £4.95 **SALE PRICE £3.75**

## FUSE KIT - 20mm Anti-surge

A pack containing 80 Anti-Surge 20mm fuses. Each value individually packed.

No. Value	Contents:	No. Value	No. Value
5 x 100mA	5 x 1.6A	5 x 5A	
5 x 250mA	5 x 2.5A	5 x 6.3A	
10 x 500mA	10 x 3.15A	20 x 1A	

Order Code: KIT/FUS/AS2

Cat. Price: £12.50 **SALE PRICE £10.75**

## ELECTROLYTIC KIT - Radial

A pack containing 100 miniature radial lead electrolytic capacitors. 12 different values. Each value individually packed.

No.	Value	Voltage	No.	Value	Voltage
10	1mF	63V	15	100mF	25V
10	2.2mF	63V	10	220mF	25V
10	4.7mF	63V	10	470mF	25V
15	10mF	16V	5	1000mF	16V
5	22mF	16V	2	1000mF	25v
5	47mf	16V	3	2200mF	16v

Order Code: KIT/ELEC/RAD

Cat. Price: £7.95 **SALE PRICE £7.25**

## ZENER DIODE KIT—400MW 5 OFF EACH VOLTAGE

A pack containing 95 zener diodes. 5 off each value from 3V0 up to 33V. Each value individually packed and the pack marked with the voltages enclosed. Voltages as follows:

3V0, 3V6, 4V7, 5V1, 5V6, 6V2, 7V5, 8V2, 9V1, 10V, 12V, 15V, 18V, 20V, 22V, 24V, 27V, 30V, 33V.

Order Code: KIT/ZEN/1

Cat. Price: £5.99 **SALE PRICE £5.00**

## ZENER DIODE KIT—1.3 W 5 OFF EACH VOLTAGE

A pack containing 95 x 1.3W Zener Diodes. Each voltage individually packed and the bag marked with the voltages enclosed. 5 off each value from 4V7, to 39V as listed below: 4V7, 5V2, 5V6, 6V2, 7V5, 8V2, 9V1, 10V, 12V, 15V, 18V, 20V, 22V, 24V, 27V, 30V, 33V, 36V, 39V.

(Catalogue Price: £9.50)

Order Code: KIT/ZEN/2

Cat. Price: £9.50 **SALE PRICE £7.00**

## LED KIT

A kit containing a good assortment of LED's and mounting clips. Kit contains: 10 x 3mm Red, 10 x 3mm Yellow, 10 x 3mm Green, 30 x 3mm Clips, 10 x 5mm Red, 10 x 5mm Yellow, 10 x 5mm Green, 30 x 5mm Clips.

Order Code: KIT/LED

Cat. Price: £7.75 **SALE PRICE £7.00**

## IC SOCKET KIT — LOW PROFILE

A kit containing a total of 90 in profile IC sockets each kit contains: 20 x 8 pin, 20 x 14 pin, 20 x 16 pin, 5 x 18 pin, 5 x 20 pin, 5 x 24 pin, 10 x 28 pin, 5 x 40 pin.

Order Code: KIT/IC/1

Cat. Price: £7.50 **SALE PRICE £6.75**

## IC SOCKET KIT—TURNED PIN

A kit containing a total of 90 turned pin IC sockets; 20 x 8 pin, 20 x 14 pin, 20 x 16 pin, 5 x 18 pin, 5 x 20 pin, 5 x 24 pin, 10 x 28 pin, 5 x 40 pin. Order Code: KIT/IC/2

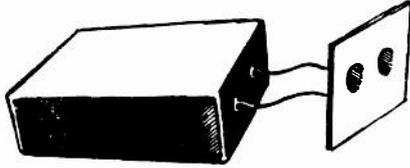
Cat. Price: £21.50 **SALE PRICE £19.50**

ALL PRICES  
INCLUDE VAT

# Comdek Hobby Kits

POSTAGE  
£3.00

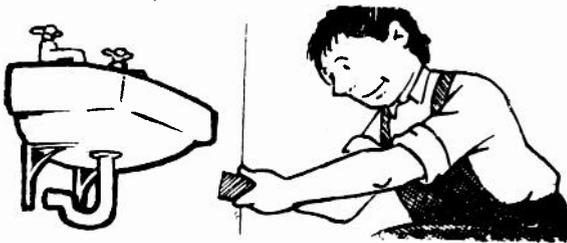
## ELECTRONIC ACUPUNCTURE



A new kit to our range, but we think you will love it. Based on the ancient practice of acupuncture but instead of using needles we use electronics! And very effective it is too. This kit operates, as they say, in accordance with the electrical acupuncture method. A fully illustrated leaflet is included for the treatment of many ailments. Come on, give it a go! Operates on between 3V and 12V.

Order Code COM/KIT/003  
Price: 1+ £8.95 4+ £8.00 10+ £6.75

## CABLE AND METAL DETECTOR (PCB size 60 x 40mm)



A super kit, using a ferrite antenna. The Detection range is up to approx. 6cm. Complete with LED for visual indication. Operates at 3V using 2 x AA batteries.

Applications include: Detecting cables in walls, under floors, detecting hidden pipes, nails in wood.

Order Code: COM/KIT/005

Price: 1+ £5.95 4+ £5.45 10+ £4.95

## TWIN ALTERNATING LED FLASHING UNIT

Two types available – either 2 x Red LEDs or 1 x Red 1 x Green which flash alternatively.  
(PCB size 45 x 30mm)

Two Red LED's which flash alternatively at a fully adjustable rate operating on a voltage from 3V up to 15V, at approx. 25mA depending on voltage it is run at. Ideal for battery use either AA, C, D or PP3 size battery.

RED ONLY Order Code COM/KIT/001

RED/GREEN Order Code COM/KIT/002

Price: 1+ £5.99 4+ £5.50 10+ £5.00

## FM MINI TRANSMITTER (PCB size 40 x 25mm)

FM MINI-TRANSMITTER  
(PCB size 40 x 25mm)



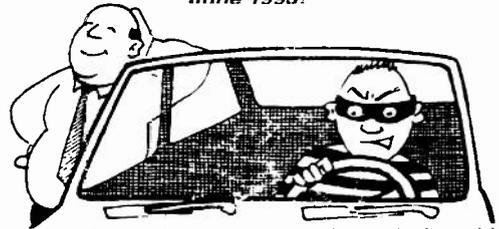
A superb quality, very small mini-bug, ideal for baby alarms etc. Simply runs off 1 x AA (1.5V) battery. Using a quality battery unit you should run for up to 1 week continuous. Whilst the range is difficult to quote, but you could achieve up to half a mile in good conditions. A well tried and tested unit, excellent value for money. Illegal for use in the UK>

Order Code COM/KIT/004

Price: 1+ £7.50 4+ £6.85 10+ £5.99

## CAR, MOTORHOME, VAN IMMOBILISER

*"The real thing" as reviewed by Practical Motorist  
June 1993!*



A brand new design and indeed a very clever device which gives 100% peace of mind to the vehicle owner and causes the would be car thief 100% frustration! This unit may also be used alongside an existing car alarm. So what's so special about this device?

Most alarms require the owner to activate them when exiting the vehicle, which can be easily overlooked or simply forgotten. The AT1 circuit overcomes this by activating the moment the engine is switched on or the vehicle is 'Hot Wired', making it impossible to forget. From the moment the ignition is switched on the AT1 circuit starts timing. When the engine has started the unit MUST BE DE-ACTIVATED otherwise (this is the clever bit) the engine will cut out.

The thief is then faced with the problem of not only the engine cutting out but then failing to re start. The thief will not hang around to 'repair' the vehicle – simple!

A red LED is supplied with the kit which may be fitted to the dashboard and will remain lit all the time acting as a visual deterrent to any would be thief.

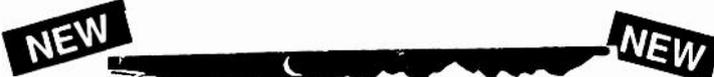
Suitable for both Electronic and Non-Electronic Ignition cars. Full fitting instructions are supplied with the assembly instructions.

## SUPPLIED READY-BUILT OR IN KIT FORM

KIT FORM Order Code: COM/KIT/AT1  
1+ £15.00 5+ £12.50

READY ASSEMBLED Order Code: COM/AT1  
1+ £25.99 5+ 24.00

## 12 VOLT TO 240 VAC INVERTER KITS



The Comdek Pulse Width Modulated (PWM) Inverter Kits employ the very latest Vmos power technology, making them extremely efficient. Two Inverter Kits are available, 100VA and 250VA. Both inverters require a supply of 11-14 volts and produce 240Vac Square Wave Output. The output voltage is continuously adjustable from 240Vac down to 90Vac should lower voltage be required ie: 110Vac equipment etc.

### 12Vdc - 240Vac, 100VA INVERTER

Order Code: COM/KIT/006

Price: 1+ £39.00 4+ £37.50 10+ £31.50

### 12Vdc - 240Vac, 250VA INVERTER

Order Code: COM/KIT/007

Price: 1+ £59.00 4+ £56.50 10+ £49.50

We are also offering these kits 'ready-assembled' and tested ready to go. See below for prices.

### 100VA Assembled and tested (uncased)

Order Code: COM/KIT/AT2

Price: 1+ £49.00 4+ £47.50 10+ £41.50

### 250VA Assembled and tested (uncased)

Order Code: COM/KIT/AT3

Price: 1+ £74.00 4+ £71.50 10+ £64.50

NOT LICENSABLE IN THE UK.

ALL PRICES  
INCLUDE VAT

## Super Saver packs

POSTAGE  
£3.00

### PRE-SET PACK

A mixed pack of various pre-sets. Miniature, standard, 0.1W, 0.25W, vertical, horizontal. Assorted values from 100R to 1 Meg.

Total Pack Qty: 100 pcs

ORDER CODE: PACK/001      **SALE PRICE: £3-40**

### POTENTIOMETER PACK

A mixed pack of pots single, dual, slider, convergence - in fact almost every kind of pot. Assorted values ranging from 10R to 1 Meg. These really are super value.

Total Pack Qty: 100 Assorted

ORDER CODE: PACK/002      **SALE PRICE: £4.75**

### VOLTAGE DEPENDENT RESISTOR PACK

A good mix of different types of V.D.R.s 50-500V Super value

Total Pack Qty: 50 Assorted

ORDER CODE: PACK 004      **PRICE £3.45**

### WIREWOUND RESISTOR KIT

A very mixed pack of assorted wirewound resistors. Mixed wattages and values, many popular values. A really good value pack.

Total Pack Qty: 100 assorted

ORDER CODE: PACK 004      **SALE PRICE £2.75**

### DIL SOCKET PACK

A good assortment of various IC sockets which may range from 8 pin to 64 pin! Generally low profile. May also include gold plated, turned pin, wirewrap etc.

Total pack Qty: 100 pcs.

ORDER CODE: PACK 009      **SALE PRICE: £8.50**

### SUPADRV SELF TAPPING PACK - HARDWARE

A super pack of a mixture of No. 4 x 3/8in. and No. 6 x 1/2in. All Panhead hardened steel type AB bright zinc.

Total Pack Qty: 100 assorted

ORDER CODE: PACK 010      **SALE PRICE: £1.25**

### MIXED SELF TAPPING SCREW PACK - HARDWARE

A good mixture of various self-tapping screws of assorted types, lengths etc. All top quality. Length's 5-10mm.

Total Pack Qty: 200 assorted

ORDER CODE: PACK 011      **SALE PRICES: £2.75**

### PRE-SET PACK 0.25W

A super selection of 0.25W Pre-sets mainly Piher enclosed. AB etc. Both vertical and horizontal and many popular values. Values may range from 100R to 10 Meg!

Total Pack Qty: 100 pcs. assorted

ORDER CODE: PACK/016      **SALE PRICE: £2.75**

### POLYESTER PACK

A good assortment of various polyester capacitors. Both Radial and Axial styles, values ranging from 0.01uF up to 2.2uF and voltages from 63V to anything up to 1000V! This pack is very good value for money.

Total Pack Qty: 100 Assorted

ORDER CODE: PACK/017      **SALE PRICE: £2.75**

### TANTALUM BEAD CAPACITOR PACK

A random selection of tantalum bead capacitors of assorted voltages and values. many popular values.

Total Pack Qty: 50 pcs.

ORDER CODE: PACK /005      **SALE PRICE: £2.75**

### TRANSISTOR PACK

A mixed pack of various transistors, many popular types including: AC169, BC107, BC125, BC147, BC148, BC158, BC182A, BC237, BC328, BC558, BCY72, 2N2907A, TIP126, TIP141, TIS90, 2N2222A, etc. etc.

Over £17-00 value at current catalogue prices!!

Total Pack Qty: 100 pcs

ORDER CODE: PACK/006      **SALE PRICE: £5.25**

### INTEGRATED CIRCUIT PACK

A super value pack containing all types of I.C.'s many popular types included. All are new and full spec.

Total Pack Qty: 100 pcs

ORDER CODE: PACK/007      **SALE PRICE: £5-75**

### CALCULATOR PACK

A mixed pack of calculators! hand held, mains, desk type, printers, non-printers, cased, uncased, damaged cases, bits missing. You name it - this pack has it! Lots of useful bits. Sold by weight.

Total pack weight 10kg.

ORDER CODE: SO/034      **SALE PRICE £5.75**

### M5 & M6 Pack

A mixed pack of steel screws, a mixture of Panhead, Supadriv and Allen type. All super quality and a real bargain!

Total Pack Qty: 50 Assorted

ORDER CODE: PACK/012      **SALE PRICE: £1.25**

### MIXED HARDWARE JUMBO PACK

A super Jumbo pack containing all types of bolts, screws, washers. All mainly small types and high quality. Also nuts etc. Length's 10-45mm This pack is really super value for money.

We are selling this pack by weight: 1Kg.. This is up to 1000 pcs depending on sizes.

Pack Size: 1Kg.

ORDER CODE: PACK/014      **SALE PRICE: £2.75**

### FUSE PACK

A super pack containing an assortment of fuses which could include 20mm 32mm 1", fast blow, slow blow, in fact any type of fuse. Many popular sizes and values.

Total Pack Qty: 100 pcs.

ORDER CODE: PACK/015      **SALE PRICE: £2-75**

# YOUR SURPLUS STOCK WANTED

THESE PACKS ARE  
OUTSTANDINGLY GOOD VALUE FOR  
MONEY

ALL PRICES  
INCLUDE VAT

## Super Saver Packs

POSTAGE  
£3.00

### TRANSFORMER PACK

A superb pack containing various small transformers, all being 220/240V primary. The secondary outputs will vary anything from 4.5V up to 12V. Mainly chassis type but maybe some PCB types included. Current ratings anything from 200mA to 1Amp.

Total Pack Qty: 20 pieces  
ORDER CODE: PACK/035 SALE PRICE: £15.00

### WATCH PACK

Another very mixed pack which may include LCD, LED, gents, boys, ladies and girls watches. Watches may or may not have straps, bracelets fitted. Having just seen a bracelet for sale for over £7-00 this pack is a winner! Sold by weight, but you should get 6-10 watches.

Total Pack Weight: 0.5Kg  
ORDER CODE: PACK/037 SALE PRICE: £5-00

### MOTOR PACK

A good mixture of mainly 3-12Vdc motors but maybe a couple of 10V or 220v/240v included for good measure.

Total Pack Qty: 10pcs  
ORDER CODE: PACK/038 SALE PRICE: £5-00

### SWITCH PACK

An assortment of switches which may include: rocker, illuminated, rotary, toggle, micro, push, slide etc.

Total Pack Qty: 20 pcs.  
ORDER CODE: PACK /039 SALE PRICE £2.25

### POWER SUPPLY PACK

An assortment of mainly 220/240V 2 pin low voltage power supplies useful for running calculators, radio's, walkman's etc. Most fit the standard UK shaver socket.

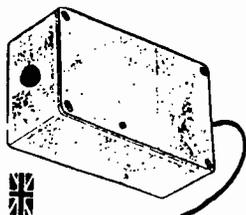
Total Pack Qty: 10pcs  
ORDER CODE: PACK/040 SALE PRICE: £5-99

### SOLDER PACK

A mixed pack of both 18swg and 22swg solder. Each pack contains 10 assorted 12in lengths of solder.

ORDER CODE: PACK/043 SALE PRICE: £1.50

## FM MINI TRANSMITTER



Very high quality Mini-Bug, ideal for baby alrms etc. These units are well tried and tested and may be the best on the market. Range is difficult to quote because it depends on conditions,

Simply remove box cover, insert AA battery (not included) and tune radio to mini-bug and you're ready to go. One battery can last five days continuous!

NOT LICENSABLE IN THE UK

Frequency range 95-110MHz. Power aa 1.5V  
Battery. Dimensions: 72 x 46 x 22mm.

Order Code: SEC/FMBI

Price 1+ £9.99 10+ £7.50

### CONNECTOR PACK

A useful pack containing a wide & varied selection of assorted connectors. Typical types may include: D type, IDC, Edge, Audio, Chassis, Line etc. In fact almost any type including popular ones.

Total Pack Quantity: 25 pcs.  
ORDER CODE: PACK/044 SALE PRICE: £5.99

### DIN CONNECTOR PACK

An assorted pack of DIN plugs, sockets chassis and line.

Total Pack Qty: 25pcs  
ORDER CODE: PACK/045 SALE PRICE: £4-50

### PVC SLEEVING PACK

Assorted diameters & colours of PVC sleeving. Diameters may range from 2mm up to 19mm. These packs are super value.

Total Pack Qty: 10 lengths each approx 12" long  
ORDER CODE: PACK/046 SALE PRICE: £1-25

### TV DROPPER PACK

This pack contains a random selection of very assorted values of TV Replacement Droppers. Pack may include droppers for Philips, Thorn, Pye, Decca etc. etc.

Total Pack Qty: 15pcs  
ORDER CODE: PACK/047 SALE PRICE: £6.50

### MULTI-SECTION ELECTROLYTIC PACK

A super mixed pack of multi-section electrolytics. Widely used in TV sets etc. The original prices of some of these capacitors was over £5-00 each!! These really are good value.

Total Pack Qty: 10pcs  
ORDER CODE: PACK/048 SALE PRICE: £5-50

### 0.25W RESISTOR PACK

Assorted values, some popular because we are overstocked, others simply values we don't stock. Either way, these really are a bargain. A minimum of 10 different values. All 0.25W carbon film, 5% tolerance.

Total Pack Qty: 1000pcs  
ORDER CODE: PACK/049 SALE PRICE: £1-99

### GOODY PACK

This pack contains a random selection of very assorted components including:

Resistors, Capacitors, Connectors, IC's, Diodes, Potentiometers and much much more. Many of the items are to a much higher spec. than those usually available to the hobby market. These packs really are a bargain. These packs are sold by eight.

Total Pack Weight: 1Kg  
ORDER CODE: PACK/050 SALE PRICE: £2-50

### MAGAZINE PACK

A random selection of Electronic Magazines! Some may be old, some may be new, but whatever you get it will be interesting reading. Ideal for those winter nights!

Total Pack Qty: 10 Magazines  
ORDER CODE: PACK/051 SALE PRICE: £4-50

## VALVE PACK

A useful pack of ten assorted valves – all shapes and sizes, some old, some may be new types. All supplied ex-equipment and used. None of the values supplied are guaranteed.

Total pack qty: 10 pieces  
Order Code: PACK/VALVE

PRICE £5.99

ALL PRICES  
INCLUDE VAT

# Power Supplies

POSTAGE  
£3.00

## NON REGULATED OUTPUT.

Plug in power supply fits directly into 13Amp socket. Internal fuse overload protection. Polarity reversing socket. Voltage selector switch. Output via lead with 4 Way 'spider' plug.

Input voltage.....240V DC 50Hz  
Output voltage.....3/4.5/6/7.5/9/12V DC  
Output current.....300mA  
Stability.....40 %  
Ripple.....1V  
Dimensions.....74 x 52 x 46mm

ORDER CODE: POW / POO7.

1+ £3.15      10+ £2.83



## REGULATED OUTPUT.

Regulated power supply with voltage selector switch.

Input voltage.....240V DC 50Hz  
Output voltage.....6/9/12V DC  
Output current.....1A continuous  
Stability.....2 %  
Ripple.....25mV  
Dimensions.....142 x 65 x 60mm

ORDER CODE: POW / POO5A.

1+ £8.10      10+ £7.30



## POWER SUPPLY / BATTERY CHARGER.

Plug in 13.8V DC 100mA power supply designed to charge 10 AA nicad batteries found in mobile CB's etc. Plugs into a 13A socket. Output via integral lead with 2.5mm DC power plug.

Tip positive. Thermal fuse overload protection.  
Input voltage.....240V DC 50Hz  
Output voltage.....13.8V DC  
Output current.....100mA  
Stability.....40 %  
Ripple.....1V  
Dimensions.....62 x 51 x 49mm

ORDER CODE: POW / POO7C

1+ £3.35      10+ £3.05



## REGULATED OUTPUT.

Regulated power supply with voltage selector and polarity reverse switches. LED on indicator. Input via 1.9m two core mains lead. Output via 1.8m lead to 4 way 'Spider' plug and PP3 battery clip. Overall thermal fuse protection.

Input voltage.....240V AC 50Hz  
Output voltage.....6/7.5/9/12V DC  
Output current.....1000mA  
Stability.....2 %  
Ripple.....10mV  
Dimensions.....122 x 67 x 55mm

ORDER CODE: POW / POO7N.

1+ £9.99      10+ £8.75



## REGULATED OUTPUT.

Plug in regulated power supply with 12V DC output. Plugs directly into a standard 13A socket. Internal thermal fuse for overload protection. Polarity reversing socket. Output via lead with 4 way 'Spider' plug and PP3 battery clip.

Input voltage.....240V AC 50Hz  
Output voltage.....6/7.5/9/12V DC  
Output current.....300mA  
Stability.....2 %  
Ripple.....10mV  
Dimensions.....82 x 58 x 60mm

ORDER CODE: POW / POO7C.

1+ £5.99      10+ £5.40



## REGULATED OUTPUT.

Plug in 650mA regulated power supply with 12V DC output. Plugs directly into 13 A socket. Internal thermal fuse for overload protection. Polarity reversing socket. Output via lead with 4 way 'Spider' plug.

Input voltage.....240V DC 50Hz  
Output voltage.....12V DC  
Output current.....650mA  
Stability.....2 %  
Ripple.....10mV  
Dimensions.....82 x 61 x 60mm

ORDER CODE: POW / POO7D.

1+ £7.50      10+ £6.75



## REGULATED OUTPUT.

Regulated power supply for use with CB rigs, auto equipment, High stability circuitry with high surge current capability. Overload protection.

Input voltage.....220 / 240V AC 50Hz  
Output voltage.....13.8V DC  
Output current.....7A continuous, 9A max  
Stability.....1 %  
Ripple.....25mV  
Connect.....4mm banana skt (screw terminals)  
Dimensions.....142 x 92 x 195mm

ORDER CODE: POW / POO1F.

1+ £29.50      4+ £26.00



## UNIVERSAL POWER SUPPLY

Regulated



Very high specification and superb quality at a very competitive price.

- Seven output selection: 1.5 - 3 - 4 - 5 - 6 - 7.5 - 12VDC; 1200mA Max.
- For use with battery operated appliances.
- Short circuit and overload protection
- Equipped with universal DC plug.

For use with TV Games, Calculators, Radio Cassette Players, Portable TV, Mini Computers, Personal Stereos, Answering machines, Electric Typewriters

ONLY £14.50 TWO FOR £27.50

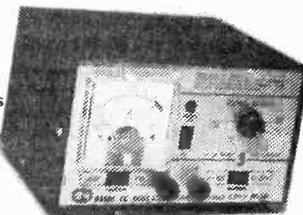
## VARIABLE REGULATED OUTPUT.

Variable regulated power supply with overload protection. Meter reads voltage or current (switched). Two voltage ranges 0 - 12 Volts and 12 - 24 Volts DC. Ideal for laboratory use.

Input voltage.....240V AC 50Hz  
Output voltage.....0 - 24V DC (two ranges)  
Output current.....5 Amp continuous  
Stability.....0.2 %  
Ripple.....4mV  
Dimensions.....180 x 180 x 110mm

ORDER CODE: POW / POO4B.

1+ £88.50      10+ £82.00

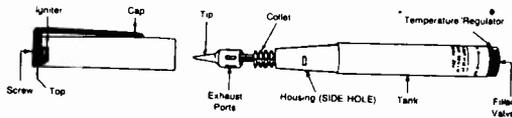


ALL PRICES  
INCLUDE VAT

# Soldering Equipment

POSTAGE  
£3.00

## PORTABLE GAS SOLDERING IRON



A lightweight, compact, fully portable gas soldering iron. The iron operates on standard butane gas, available at newsagents, tobacconists, garages, pubs etc. When full, the iron will run for about 1 hour. Heat up time is approx. 20 seconds. Fully adjustable tip temperature from equivalent 10 to 60W (max temp 400°C). Replacement bits available, see below.

Supplied with 2.4mm bit fitted. Dimensions: 170 x 19mm

Order Code SOLD/GAS

**SPECIAL PRICE £12.99**

## SPARE TIPS FOR PORTABLE GAS IRON

A range of spare bits to suit above gas iron.



Size	Order Code	1+	10+
1.0mm	SOLD/G1	£5.75	£5.00
2.4mm	SOLD/G2	£5.75	£5.00
3.2mm	SOLD/G3	£5.75	£5.00
4.8mm	SOLD/G4	£5.75	£5.00

## PORTASOL SOLDERING KIT

Made in Ireland.

Serves as Gas Soldering Iron, Blow Torch, Hot Blow and Hot Knife.

Normally £38.00



Order Code: OLD/PORTA

**Special Price: £29.99**



## DESOLDERING TOOL

Very high quality, made in Malta and assembled in UK. Very powerful fitted with Teflon Micro nozzle.

Length: 190mm. Dia: 20mm.

Order Code: SOLID/DESOL Price: £3-50

## REPLACEMENT TIPS

Teflon and micro nozzle.



Order Code: SOLD/DES/TIP Price: 75p

**SEE THE MAIN CATALOGUE FOR MORE SOLDERING LINES**

# SUPER SOLDER SALE

High grade 60/40 tin/lead alloy solder available in both 18swg & 22swg, in a choice of reel sizes from 18gms to 500gms (0.5Kg). Manufactured to BS219. Contains 5 cores of type 362 non-corrosive flux. Melting temperature is 188 C.

## NOW JUST LOOK AT OUR AMAZING PRICES

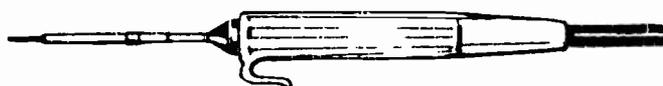
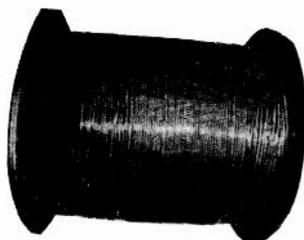
### 18swg. (1.2mm)

Reel Size	Approx. Length	ORDER CODE	1+	10+	100+
18gms	3 Metres	SOLD/18/3Y	65p	50p	40p
200gms	21 Metres	SOLD/18/200	£2.25	£2.00	£1.60
500gms (1/2 Kg)	52 Metres	SOLD/18/500	£4.75	£4.25	£3.50

### 22swg (0.71mm)

200gms	62 Metres	SOLD/22/200	£2.35	£2.10	£1.75
500gms (1/2Kg)	153 Metres	SOLD/22/500	£4.79	£4.30	£3.60

**WHOLESALE  
PRICES AND  
EX-STOCK  
NOW!**



## ANTEX SOLDERING IRON - 240V

Fitted with 2.3mm tip (Limited offer)

Catalogue Price £9.75 **SALE PRICE £8.50**

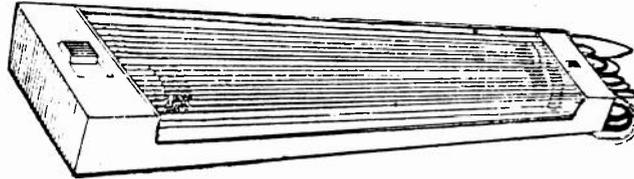
**Remember: BUY 100 REELS of 18swg 500gms & PAY ONLY £2-98 per Reel + VAT**

ALL PRICES  
INCLUDE VAT

# Lights

POSTAGE  
£3.00

## 12 Volt FLUORESCENT LIGHT (Twin)



A very attractive twin tube fluorescent light complete with two 12Volt 8Watt fluorescent standard type & size tubes. White plastic case with clear plastic ribbed diffuser and ON/OFF switch. The light is fitted with approx. 90cms. of twin flex for connection to 12V battery or other 12V power supply. Cable is colour coded for polarity identification. These lights are ideal for Caravans, Boats, Vans, Camping etc.

Overall dimensions: 370 X 65 X 41mm. ORDER CODE: OPTO/T12

1+  
£ 6.50

10+  
£5.75

50+  
£5-25

### SINGLE 12 Volt FLUORESCENT LIGHT

Identical to the above unit but SINGLE tube fitting.

Overall dimensions: 370 x 65 x 14mm. ORDER CODE: OPTO/S12

1+  
£5.50

10+  
£5.00

50+  
£4.25

### SPARE TUBES

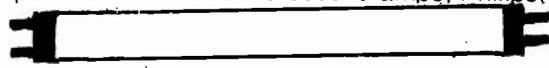
Replacement tube for above Twin and Single Fluorescent lamps Fits most 12V Fluorescent lamps, Philips, etc. Tube length is approx: 300mm incl. pins.

Colour: White. ORDER CODE: OPTO/TUBE

1+  
£1.50

10+  
£1.25

50+  
£1.00



### SPARE TUBES - 'WARM' WHITE

Identical to the above tube but more suited for the caravan/camping application. This tube gives a 'warmer' light.. ORDER CODE: TUBE/WW

1+  
£1.95

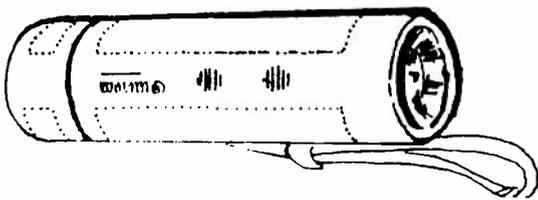
10+  
£1.75

50+  
£1-50



## SPECIAL OFFER

### Rechargeable Torch



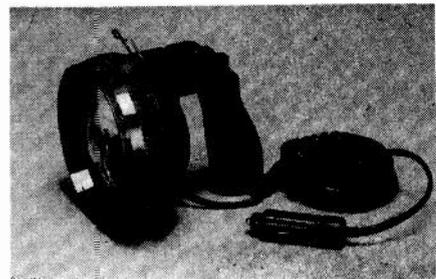
Limited Quantity. High quality, fully waterproof, rechargeable torch. Complete with in-built charger - simply plug into the mains socket for overnight charge. When charged lasts about one hour constant use. In-built charger is 2-pin, fitting shaver socket or most 13A type sockets. Snap fit cover conceals pins when in normal use. Complete with carrying strap. Ideal for cars, caravans, boats, handbags, fuse boxes etc.

Overall dimensions:

160mm length x 40mm dia. Colour: White.

Price £6.50 Two for £12.00

## QUARTZ HALOGEN SPOTLIGHT



Hand held or hanging. Heat resistant polycarbonate housing, highly polished reflector. With on/off switch and 12ft curly cable terminating in cigar lighter plug. Produces 25,000 candle power - 5 times the intensity of average car headlamps.

Power; 12Vd.c. 4.5A. 55w. Dimensions: 160 x 85 x 110mm.

THIS UNIT SUBJECT TO DESIGN CHANGE

Order Code: OPTO/QHS.

Price: 1+ £5.75 10+ £5.25

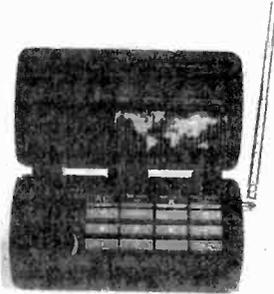
ALL PRICES  
INCLUDE VAT

# Radio Communications

POSTAGE  
£3.00

## WORLD TIME MULTI-FUNCTIONAL UNIT

A small, lightweight compact unit which has a digital display clock which shows 13 world time zones and can be switched to calculator mode. Receives the FM band and has an alarm buzzer function and will display day, date and calculator mode. Requires 2 x AAA cells. Tuning range FM: 88 to 108MHz. World time zones: (Free place), London, Paris, Cairo, Moscow, Bangkok, Hong Kong, Tokyo, Sidney, Honolulu, Los Angeles, Chicago, New York.



Order Code: HI/

PRICE: £19.99

## BROADBAND RADIO RECEIVER

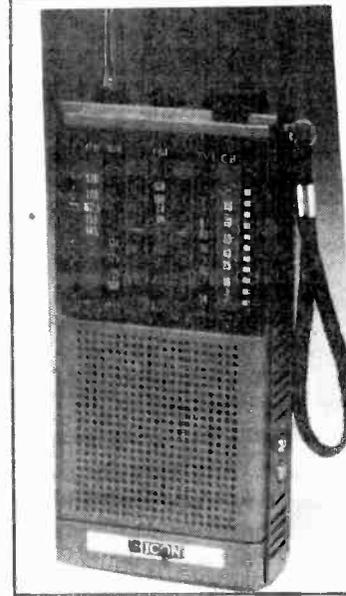
A handheld radio with a range covering: CB, FM, TV, AIR band & PB band. Built in telescopic aerial. Squelch, volume & tuning controls & band selector switch.

Frequency range:

Air: 108-145MHz, PB: 145-176MHz, WB: 162.5MHz, TV: 54-87MHz, FM: 88-108MHz, CB: 1-80 channels,

Power:

4 x AA (Batteries not included)  
Dimensions: 93 x 198 x 50.



Order Code: B118B  
Price: £17.95

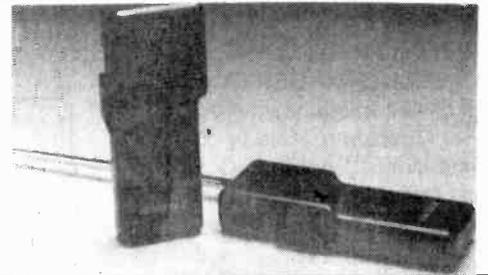
## 2 WAY HAND HELD CRYSTAL CONTROL TRANCEIVERS

Built-in Telescopic Aerial, call button, transmitter receive key, on air indicator. Each unit requires PP3 Battery for operation (not supplied.)

Operating Frequency: 49 MHz, Transition Power: 100 MHz, Frequency Tolerance: + or - 0.005%, Range: 1-2 Kilo, open field (Depends on cond Oscillation Crystal Control. Power: 9V DC (PP3 Battery), 1 pair in Box.

Order Code: B123

Price: £27.50



## CB MICROPHONE

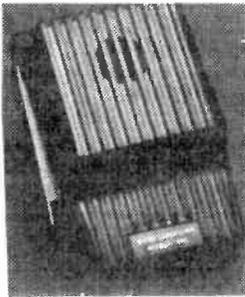
G173

DM 56

Noise cancelling hand held microphone. Rejects unwanted noise. Two built-in capsules work 180° out of phase. Only one capsule accepts close talk ensuring noise free transmission. Push to talk switch. Black plastic. Coiled lead (3 core plus screen).

Type Omni-directional Dynamic. Impedance: 160Ω, Response 400-8000HZ, Sensitivity -65dB @ 1kHz, Dims> 94 x 60 x 38mm

Price: £14.99



## CB MICROPHONE

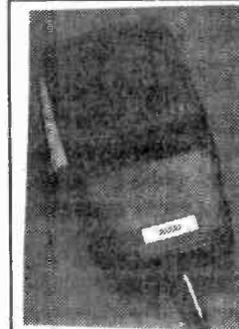
G171

MPC46

Basic hand-held microphone. Push to talk switch. Black coiled lead (3 core plus screen).

Type Omni-directional Dynamic. Impedance: 600Ω, Response 300-4500HZ, Sensitivity -76 dB @ 1kHz, Dims> 100 x 54 x 40mm

Price: £7.99



## 12 BAND RECEIVER

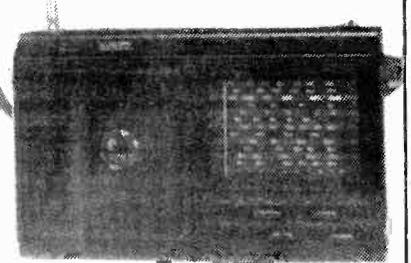
A compact 12 band radio receiver covering FM, MW, LW and 9 short wave bands. A built-in ferrite bar antenna receives the MW and LW transmissions and the telescopic rod antenna receives FM and SW transmissions. An additional 20ft wire antenna is provided to improve SW reception. The tuning LED lights when a strong signal is present. Wave band selection, tone and volume is by slider controls.

Frequency coverage: FM: 88 to 108MHz, MW: 530 to 1620kHz, LW: 150 to 270 kHz, SW1: 5.85 to 6.23MHz, SW2: 6.95 to 7.42 MHz, SW3: 9.45 to 9.95 MHz, SW4: 11.45 to 12.23MHz, SW5: 13.40 to 14.15MHz, SW6: 14.85 to 15.70MHz, SW7: 17.35 to 18.35MHz, SW8: 20.30 to 22.15MHz, SW9: 24.95 to 26.50MHz.

Power: 6Vdc (4 x AA batteries), Dims: 196 x 35 x 123mm

Order Code: B118D

Price: £22.50



## 15 BAND RECEIVER

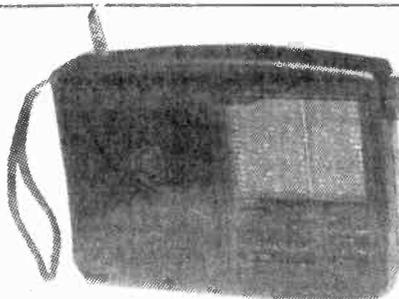
A compact 15 band receiver covering FM, LW, MW and 12 short wave radio bands. A built in ferrite rod receives the LW band and MW transmissions and a telescopic rod aerial receives the FM and SW transmissions. Band selection, volume and tune is by slider control. The tuning LED lights when a strong signal is present.

Frequency Coverage: FM: 88-108MHz, MW: 150-270kHz, LW: 530-1620kHz, SW1: 3.1-3.3MHz (90m), SW2: 3.7-3.9MHz (75m), SW3: 4.5-5.1MHz (60m), SW4: 5.85-6.23MHz (49m), SW5: 6.95-7.42MHz (41m), SW6: 9.45-9.95MHz (31m), SW7: 11.55-12.23MHz (25m), SW8: 13.4-14.15MHz (21m), SW9: 14.85-15.7MHz (19m), SW10: 17.35-18.35MHz (16m), SW11: 20.80-22.15MHz (13m), SW12: 24.95-26.50MHz (11m)

Power: 4 x AA batteries (not supplied), Dimensions: 200 x 140 x 50mm.

Order Code: B118F

Price: £25.00



ALL PRICES  
INCLUDE VAT

# Electronic Kits & Modules

POSTAGE  
£3.00

## SAFETY IN THE HOME

Recently highlighted on 'That's Life'

### GAS SENSOR

This instrument detects gases like alcohol, acetone, benzol, propane, carbon monoxide (contained in smoke of fire). Ideal as a gas and fire warning instrument. For 12 V.



Order Code: KIT/B051

Super Price: £32.99



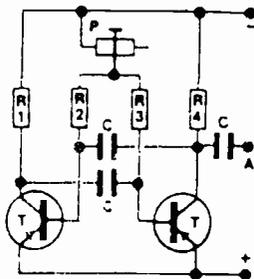
### FOGHORN 5 W

Generates a deep, noisy sound similar to the fog-horns of ships. Operating voltage: 4.5-12 V, wattage: max. 5 W depending on the voltage. For 8 Ω -loudspeakers.

Order Code: KIT/B015 Price: £7.00

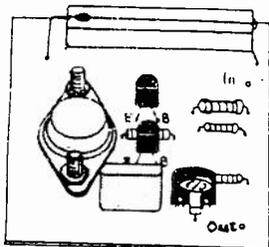
### FREQUENCY GENERATOR

Adjustable frequency: approx. 1-50 kHz. Operating voltage: 6-12 V. Short-circuit proof, capacitive output. This multivibrator generates a rectangular signal. Application: as a signal source to test amplifiers, radios, etc. The harmonics reach the VHF range.



Order Code: KIT/B103

Price: £4.50



### FUSE - ELECTRONIC

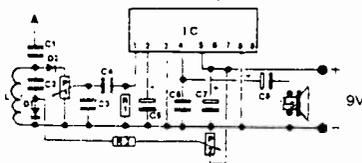
An electronic fuse, which is suitable for 5-30 V DC only and rated up to 3 A. It is fitted into the power supply lead and will interrupt the supply voltage if overloaded. The fuse is reset by switching the supply off and on again.

Order Code: KIT/B061

Price: £8.25

### IC RADIO MW-SW-LW

This radio can receive either medium wave, short wave, or long wave stations. Operation mode: single circuit. Modern, variable capacitance diode-tuning. Power output: 220 mW. 9 V.

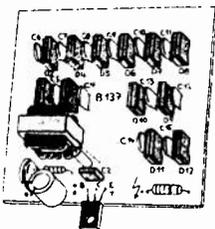


Order Code: KIT/B013

Price: £11.25

### ION GENERATOR

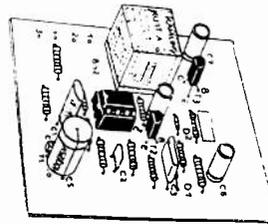
Regenerates negatively loaded air particles (air-ions) and helps to produce a healthy climate which can reduce troubled sleep, aggressiveness, headaches and weather related dispositions etc. Input: 6-18 V DC. Output: 2-7 kV. Current limit protection <math>< 200 \mu A</math>.



Order Code: KIT/B137 Price: £11.95

### INFRA-RED LIGHT BARRIER

Light-barrier with invisible infra-red light-beam. Complete kit with transmitter and receiver. Range: over 6 m. Operating voltage: transmitter 9-12 V, receiver 12 V. Relay contact: 3 A switching capacity. Ideal for warning systems.



Order Code: KIT/B062

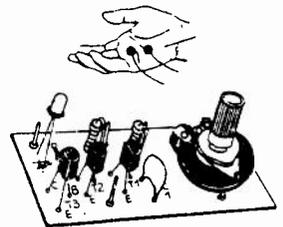
Price: £23.75

### LIE-DETECTOR

This lie detector will monitor changes of the skin's resistance due to sweating caused by lies and fear etc. which is then indicated by an LED. Requires 4.5 V

Order Code: KIT/B087

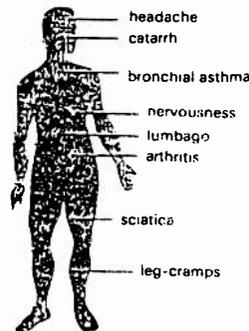
Price: £7.25



### MICRO-WAVE INDICATOR

This module is used as a microwave oven leakage tester, and will light up the LED if any radiation escapes through defective door hinges, rubber seals or shieldings. Requires a 9 V battery.

Order Code: MOD/M058 Price: £8.25



### MESMERIC INSTRUMENT

This magnetic field instrument operates on the same principle as curative instruments offered on the medical market. Alternating currents of magnetic fields are said to have a soothing effect on various kinds of sicknesses.

Order Code: KIT/B078

Price: £10.99

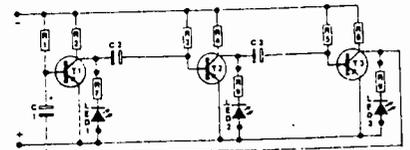
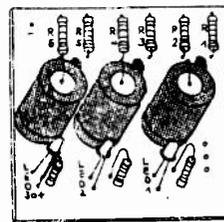
### METRONOME

An electronic metronome which has an adjustable time signature between 30 and 300 beats per min. The sound of each beat is clearly indicated by the loudspeaker. Requires 4.5-6 V supply.

Order Code: KIT/B082 Price: £9.99



### MINI TRAFFIC LIGHTS



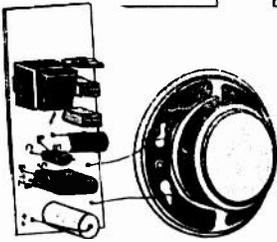
Three small LED's are switched on slowly one after another (N.B: not same as traffic light sequence). Can be used to control a complete cross-road set with additional LED's (not supplied). Requires 4.5-6 V.

Order Code: KIT/B088 Price: £7.25

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INCLUDE VAT

# Electronic Kits & Modules

POSTAGE  
£3.00

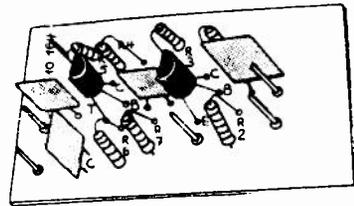


**MORSE CODE PRACTICE KIT**  
Sound-generator with loudspeaker and touchswitch as a 'morse key'. Operating voltage: 3-9 V. The tone is adjustable.

Order Code: KIT/B041  
Price: £11.75

## CAR ANTENNA AMPLIFIER

This amplifier is connected between the antenna and the radio, using co-axial cable 60-75  $\Omega$ . Gain max: 22dB. Frequency range: 0.5-150 Mhz (approx.)



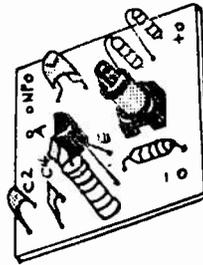
ORDER CODE: IT/B068

PRICE: £7.25

## MW TESTING TRANSMITTER

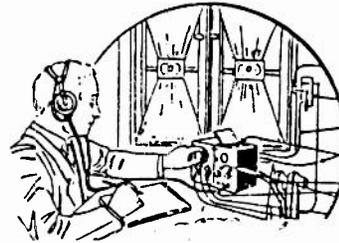
A close range test only oscillator which can be used as an unmodulated carrier to test radio receivers in the MW band. This kit must not be used to transmit over any distance.

Order Code: KIT/B144  
Price: £6.25



## DIODE RECEIVER MW AND SW

'Detector-Receiver' for middle-wave or short-wave, approx. 3-9 MHz. This radio operates on the same principle as the very first radio receivers. It does not require an operating voltage. This kit is educational for beginners.

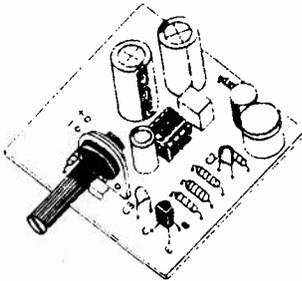


Order Code: KIT/B076 Price: £13.35

## PARABOLIC MICROPHONE

Highly sensitive microphone. If mounted into a semi-circular reflector (e.g., half of a plastic ball), noise and voices in a distance of several hundred metres may be recorded. Ideal for animal observance, for detectives, etc. For headphone-connection 8 $\Omega$ . Requires 9 V supply.

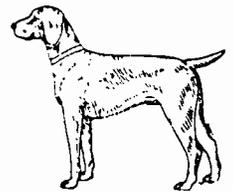
Order Code: KIT/B085  
Price: £12.50



## DOG BARKING, ELECTRONIC

Generates a dog barking sound. Suitable for use with an 8  $\Omega$  speaker. Operating voltage 9-12 V. The barking is stored on a special speech-synthesizer IC.

Order Code: KIT/B155  
Price: £23.35



## ACOUSTIC WATER DETECTOR

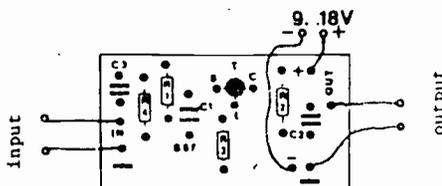
Raises a loud alarm signal on contact with water. This instrument signals broken water pipes, overflowing washing machines and bath tubs, etc. The sensor can be connected by a longer cable of up to 100 m. Power supply: 9 V battery.

Order Code: KIT/B070 Price: £7.25



## ANTENNA AMPLIFIER

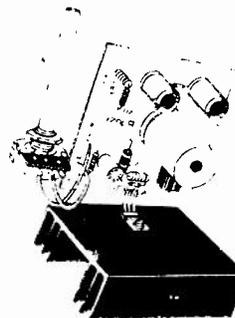
Wideband-antenna amplifier. approx. 0.15-350 MHz. 9-18 V. Gain approx. 5-20 dB (VHF: approx. 10 dB). Ideal to improve receiving qualities of radios, TV and radio sets (up to 150 MHz).



Order Code: KIT/B06 Price: £5.99

## POWER SUPPLIES

All power supplies require additional items: **KIT/B008**: Requires a mains transformer 12-15 V @ 2 A, and a heatsink size, 50 x 40 x 20mm. **KIT/B064**: Requires a mains transformer 24-27 V @ 2.2 A, and a heatsink, size 10 x 10 x 5 mm. **KIT/B102**: Requires a mains transformer with two secondary tappings 18 V and 27 V @ 2 A, and a switch DPDT type.

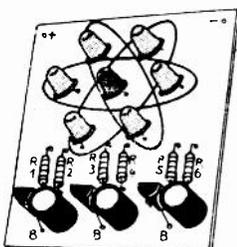


Item	Order Code	Price
Power Pack Switchable 6 V/9 V/12 V @ 2 A	KIT/B008	£8.25
Power Pack Switchable 0-28 V @ 2.2 A	KIT/B064	£14.75
Power Pack 0-34 V @ 2.2 A	KIT/B102	£26.99

## ATOMIUM

A decorative device which uses six red LEDs as 'molecules' which optically circle around a green LED. Requires a 9 V battery or other supply. Ideal for fun jewellery, brooches, etc.

Order Code: KIT/B108 Price:  
£9.50



## ROBOT VOICE

This kit modulates the human voice with an adjustable frequency to produce robot like sounds. This sound then requires amplification, i.e. by an amplifier or a tape recorder. Requires 9-12 V supply.

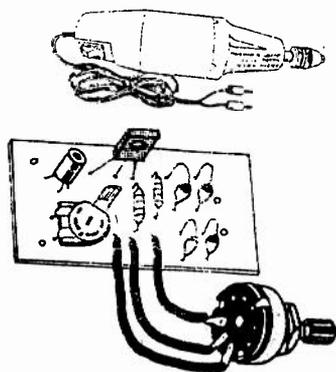
Order Code: KIT/B107 Price: £11.50



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## Electronic Kits & Modules

POSTAGE  
£3.00



### SPEED CONTROL 12-24 V

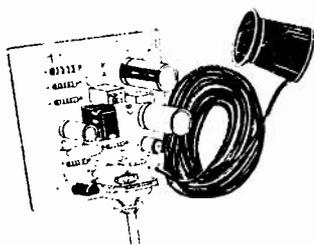
Suitable for the operation of miniature drilling machines which have DC motors. A rectifier is fitted in the kit and only requires a transformer of 12-24 V secondary depending on the required voltage. Suitable for use up to 3 A current input.

Order Code: KIT/B180  
Price: £7.50

### SPY STETHOSCOPE

Using an earpiece the spy stethoscope allows you to listen through thin walls, doors, windows etc. due to a highly sensitive pre-amplifier and microphone. Suitable for monitoring animals etc.

Order Code: KIT/B180 Price:  
£24.25



### TELEPHONE AMPLIFIER

Suitable to monitor telephone conversations via the pick up coil. This kit requires a loudspeaker of 8  $\Omega$  and an operating voltage of 9 V.

Order Code: KIT/B105  
Price: £10.99

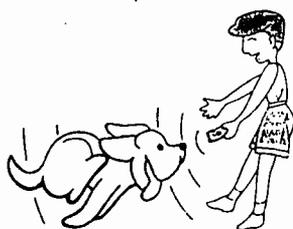
### U-STROBOSCOPE

Flashlight-stroboscope with U-flash tube and large charging capacitor for bright flashes, Adjustable speed: approx. 1-10 Hz. For 240 V. Ideal as light-shows for discotheques, for special-effect, photography, etc.

Order Code: KIT/B025 Price: £23.50

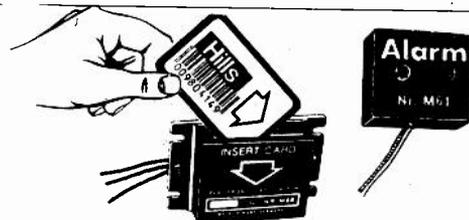


### ULTRASONIC DOG WHISTLE



The ultrasonic dog whistle emits high powered ultrasonic sounds which are widely audible for dogs, but mostly undetectable by the human ear. The output frequency is through a special piezo loudspeaker and is adjustable between 8000 and 25,000 Hz Requires a 9 V battery.

Order Code: KIT/B179 Price: £7.75



### ALARM, MOTORBIKE

This waterproof and shakeproof module will automatically switch on a horn or siren if the motorbike is moved, can also be used to protect other objects from theft. Additional items required; power supply (i.e. bike battery), SPST switch, horn or siren. Max. current 1 A.

Order Code: MOD/M073 Price: £5.50

### ALARM MONITOR

A small alarm-monitor which has two LED's (one red, one green) which flash alternately in fast sequence. Suitable for cars, window sills etc. to frighten off burglars and intruders etc. Requires a DC supply of 6-15 V.

Order Code: MOD/M061 Price: £7.50

### AMPLIFIER, UNIVERSAL 3.5 W

Has an input sensitivity of 80 mV max. and a response of between 40 and 20,000 Hz. Suitable for loudspeakers of 4-16  $\Omega$  impedance. Requires 4.5-12 V DC supply.

Order Code: MOD/M031 Price: £7.25

### DIMMER 50 W, 12 V

Will continuously control 12 V lamps (e.g. Halogen lamps) and 12 V motors etc., which require an AC 12 V supply. Max. current 4.5 A (50 W). (NB: will not work with DC supply.)

Order Code: MOD/M063 Price: £16.50

### ELECTRONIC CARD SWITCH

This card switch uses four infra-red heads to read the inserted card code, and will operate a switch which can be used to trigger a relay etc. Will only operate if the correct card code is inserted. Five cards are included in the kit. The signal output is 6 V @ 100 mA approx. Requires a 9 V DC supply.

Order Code: MOD/M068 Price: £27.50

### INTERFERENCE FILTER MAX. 20 A

This high capacity mains interference filter has a ring core choke and has to be connected within the mains supply of any equipment which requires interference filtering. Max. 20 A load, 240 V AC.

Order Code: MOD/M041 Price: £8.44

### RODENT PEST REPELLER

A waterproof module which emits at rapid intervals seismic oscillations, which are radiated underground and can repel voles, moles and similar rodents. Covers an area of about one square metre. Requires a 9 V supply.

Order Code: MOD/M069 Price: £21.50

### ULTRASONIC OSCILLATOR

This ultrasonic unit has its own special piezo speaker and produces pulsating aggressive ultrasonic sounds which can frighten certain animals, e.g., rodents, game birds, insects etc. The frequency is adjustable from low 9 kHz which is audible to the human ear, to high 27 kHz, which is outside the audio range. Requires a 9 V supply

Order Code: MOD/M07 Price: £22.50

### MICROWAVE INDICATOR

This module is used as a microwave oven leakage tester, and will light up the LED if any radiation escapes through defective door hinges, rubber seals or shieldings. Requires a 9 V battery.

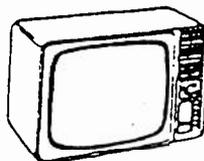
Order Code: MOD/M058 Price: £8.25

### TWILIGHT SWITCH

This waterproof electronic twilight switch will automatically control 240V light bulbs from 25W up to 200W, by switching on at dusk and switching off again at dawn.

Order Code: MOD/M013 Price: £15.50

### TV TEST CHANNEL



Screen pattern generator for connection at the antenna input of the TV-set. Adaptable for VHF and UHF channels. For 4.5-6 V. Different screen patterns may be set. For trimming and repair purposes!

Order Code: KIT/B094

Price: £14.25

### TELEPHONE BELL, REMOTE

Enables you to install a remote telephone bell in another room or outdoor location, without interfering with the telephone. Additional requirements: 1 x 6-8 V transformer and a bell or lamp @ 6 V



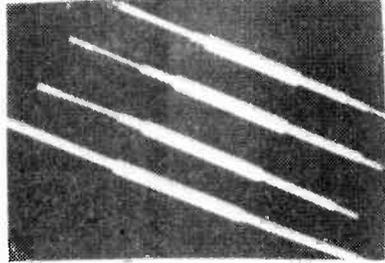
Order Code: KIT/B004

Price: £16.50

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# Electronic Kits & Modules

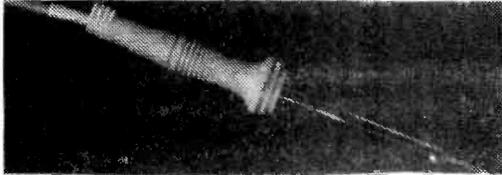
POSTAGE  
£3.00



## ALIGNMENT KIT YO13CD

Colour alignment kit for TVs, monitors, etc. Contains four good quality double ended plastic tools of assorted sizes in a plastic wallet.

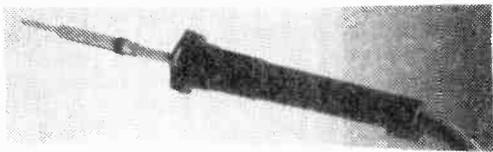
Order Code: TOOL/KIT/1 Price: £1.75



## MAINS POWERED SOLDERING IRON With stand. YO61C

Newly designed high quality mains powered soldering iron with long life ceramic element. Fitted with extra flexible cable for ease of use. Supplied packed on a blister card with one spare bit. 1.7m lead.

Order Code: TOOL/SOLD/B Price: £4.99



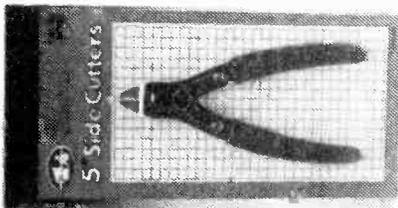
## MAINS POWERED SOLDERING IRON YO61DA

High quality mains powered, lightweight soldering iron. Designed for ease of use. Individually packed on full colour presentation card. 1.7m lead with cord grip and cable protector. Length: 195mm; Power 220/240Vac 50Hz, 15W.

Order Code: TOOL/SOL/A PRICE: £3.99

Bit for above £1.99  
Element for above £2.75  
Fine Bits £1.25

## SIDE CUTTERS



127mm

Top quality side cutters, capable of cutting wires as fine as hair. Pressed steel construction, hardened and tempered with sprung jaws. Red plastic handles. Length: 127mm.

Order Code: TOOL/HT109. Price: £2.50

## PRE-SET TYPE

A versatile insulated trimtool for preset potentiometers. Double ended with protruding steel blade for single turn presets and recessed blade for multiturn preset etc. Length: 130mm.



Order Code: TOOL/TRIM/PT Price: 1+ £1.10 98p.

## TRIM TOOL Pcket



Good quality insulated plastic double edged trim tool with metal bands and pocket clip.

Order Code: TOCL/TRIM/65A Price: 1+ 99p 10+ 88p

## TRIMTOOL KIT

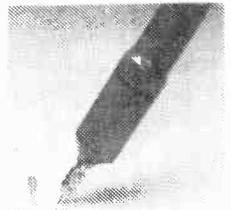
A colour alignment kit for TVs, monitors etc. Contains five good quality double ended tools of assorted sizes plus extension tube. Tools are all colour coded: Yellow, Red, Blue, White, Green and are packed in 'see-thru' wallet.



Order Code: TRIM/TOOL/KIT  
Price: 1+ £1.55 10+ £1.55

## MINI-DRILL

Precision PCB minidrill. Ideal for small or delicate work on PCB's or similar. hand held operation. Operates from any suitable dc power supply with an output voltage between 5-14dc. Power input via 3.5mm jack.



In-put voltage .....	5-14Vdc
Nominal Voltage .....	12Vdc
No-load Current .....	250mA
Stalled Current .....	3.5A
No load speed .....	6000rpm
Dimensions .....	35 dia x 165mm

Supplied complete with: 3 collets for 0.8 to 2.3mm drills. 1mm twist drill, grinding bit engraving bit and tommy bar.

Order Code: TOOL/DRILL/AD18 PRICE: £8.85

## WIRE STRIPPER SELF ADJUSTING

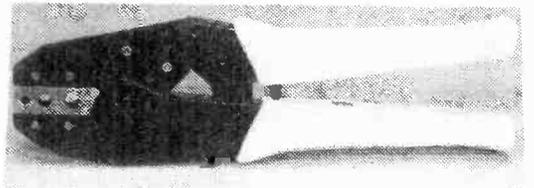
This is a must for any toolbox. Self-adjustable automatic wire stripper with built-in cable cutter. Will strip wire from 0.2mm to 6mm without damage to inner wire.



Order Code: TOOL/MS/SA.

Price: £4.50

## CRIMPING PLIERS - Ratchet, Professional



A powerful ratchet crimping tool for crimping BNC, TNC etc. connectors to RG58, RG59/V and RG62/V cables and the pin to the centre core. Cushioned plastic grips and ratchet release lever.

Order Code: TOOL/YO26C. Price: £20.50

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INCLUDE VAT

# Babani Books

POSTAGE  
£3.00

## 50 SIMPLE LED CIRCUITS-BOOK 2

R. N. Soar

A further range of uses for the simple LED which complements those shown in book number BP42

Order Code: BP87 Price: £1.95  
1981 178 x 111mm 64 pages

## 50 PROJECTS USING RELAYS, SCRs AND TRIACS

Price: £2.95 F. G. Rayer

Relays, silicon controlled rectifiers (SCR's) and bi-directional triodes (TRIAC's) have a wide range of applications in electronics. These may extend over the whole field of motor control; dimming and heat control; delayed, timing and light sensitive circuits and include warning devices, various various novelties, light modulators, priority indicators, excess voltage breakers, etc This book gives tried and practical working circuits which should present the minimum of difficulty for the enthusiast In most of the circuits there is a wide latitude in component values and types, allowing easy modification of circuits or ready adaptation of them to individual needs.

Order Code: BP37 Price: £2.95  
1977 178 x 111 mm 112 pages

## 50 (FET) FIELD EFFECT TRANSISTOR PROJECTS

F. G. Rayer

Field effect transistors (FETs) find applications in a wide variety of circuits. The projects described here include radio frequency amplifiers and converters, test equipment and receiver aids, tuners, receivers, mixers and tone controls, as well as various miscellaneous devices which are useful in the home.

The actual FET to be used in most cases, is not critical and many suitable types will perform satisfactorily The FET is a low-noise, high gain device with a multitude of uses, the dual gate being of particular use in mixers and other applications

Order Code: BP39 Price: £2.95  
1977 178 x 111 m

## REMOTE CONTROL HANDBOOK

O. Bishop

Replaces the original book BP73 and is aimed at the electronics enthusiast who wishes to experiment with remote control in its many aspects and forms.

Order Code: BP240 Price: £3.95  
1988 173x 111 mm 240 pages

## POPULAR ELECTRONIC CIRCUITS BOOK 1

R. A. Penfold

Contains a wide range of circuits which are accompanied by a short text giving a brief introduction, circuit description and any special instruction and setting-up that may be necessary

Order Code: BP80 Price: £2.95  
1980 178 x 111mm 160 pages

## POPULAR ELECTRONIC CIRCUITS BOOK 2

R. A. Penfold

Again provides a wide range of designs for electronic enthusiasts who are capable of producing working projects from just a circuit diagram without the aid of detailed constructional information. However, where relevant, any special setting-up procedures are described.

Order Code: BP98 Price: £2.95  
1982 178 x 111mm 160 pages

## HOW TO USE OP-AMPS

Price: £2.95

This book has been written as a designer's guide covering operational amplifiers, serving both as a source book of circuits and a reference book for design calculations. The approach made as non-mathematical as possible and it is hoped, easily understandable by most readers, be they they engineers or hobbyists.

Order Code: BP88 Price: £2.95  
1982 178 x 111mm 160 pages

## IC 555 PROJECTS

E. A. Parr

Every so often a device appears that is so useful that one wonders how life went on before without it. The 555 timer is such a device. Included in this book are basic and general circuits, motorcar and model circuits, alarms and noise makers as well as a section on the 556, 558 and 559 timers.

Order Code: BP44 Price: £2.95  
1982 178x 111mm 176 pages

## MORE ADVANCED ELECTRONIC SECURITY PROJECTS

R. A. Penfold

Contains a number of more up-to-date and sophisticated projects, complete with PCB or stripboard layout, than our original book number BP56.

Covers:- Opto alarms including pyro sensor, infra-red and fibre-optic loop types A computer based system showing how a home micro fitted with a user port can form the basis of a sophisticated alarm and monitoring system Various alarms using mercury switches, magnetic dependent resistors, doppler shift and capacity effect on an RF oscillator, etc, are included

Order Code: BP190 Price: £2.95  
1988 178 x 111mm 112 pages

## SHORT WAVE SUPERHET RECEIVER CONSTRUCTION

R. A. Penfold

Gives the reader full constructional details, including coil winding, of a number of advanced design receivers which should have levels of performance at least equal to that of commercially built sets of similar complexity

Order Code: BP276 Price: £2.95  
1991 178 x 111mm 80 pages

## AN INTRODUCTION TO ANTENNA THEORY

H. C. Wright

Deals with the basic concepts relevant to receiving and transmitting antennas in a manner which emphasises the mechanism involved and with strong diagrammatic support minimises the mathematics used. The bibliography provided offers the next stage of reading and understanding while the outline set of original papers listed should allow a particular interest to be followed up in detail.

Order Code: BP198 Price: £2.95  
1987 178 x 111mm 96 pages

## AUDIO PROJECTS

F. G. Rayer

This book covers in detail the construction of a wide range of audio projects The text has been divided into the following main sections Pre-amplifiers and Mixers, Power Amplifiers, Tone Controls and Matching, Miscellaneous Projects. All the projects are fairly simple to build and to assist the newcomer to the hobby, the author has included a number of board layouts and wiring diagrams

Order Code: BP90 Price: £2.50  
1981 178 x 111mm 96 pages

## INTERNATIONAL TRANSISTOR EQUIVALENTS GUIDE

A. Michaels

Helps the reader to find possible substitutes for a popular user-orientated selection of European, American and Japanese transistors. Also shows material type, polarity, manufacturer and use. Order Code: BP85 Price: £3.95

1981 178 x 111 mm 320 Pages

## C 555 PROJECTS

E. A. Parr

Every so often a device appears that is so useful that one wonders how life went on before without it. The 555 timer is such a device. Included in this book are basic and general circuits, motorcar and model circuits, alarms and noise makers as well as a section on the 556, 558 and 559 timers.

Order Code: BP44 Price: £2.95  
1982 178x 111mm 176 pages

## 50 SIMPLE LED CIRCUITS

R. N. Soar

Contains 50 interesting and useful circuits and applications, covering many different branches of electronics, using one of the most inexpensive and freely available components the light-emitting diode (LED). Also includes circuits for the 707 common anode display.

Order Code: BP42 Price: £1.95  
1977 178 x 111 mm 64 pages

## ELECTRONIC CIRCUITS FOR COMPUTER CONTROL OF ROBOTS

R. A. Penfold

Provides information and circuits on computer control of electric motors (including stepper types), plus a range of useful sensors including visible light, infra-red, and ultrasonic types.

Order Code: BP179 Price: £2.95  
1986 178 x 111mm 96 pages

## TEST EQUIPMENT CONSTRUCTION

R. A. Penfold

Shows you how to build a wide range of simple test equipment that will be useful in the pursuance of your hobby after you have had the enjoyment of constructing it

Order Code: BP76  
Price: £2.50  
1989 178 x 111mm 112 pages

## MORE ADVANCED TEST EQUIPMENT CONSTRUCTION

R. A. Penfold

Follows on from book BP248 with constructional details of more advanced projects that will help you with your hobby

Order Code: BP249 Price: £3.50  
1989 178 x 111mm 112 pages

## AN INTRODUCTION TO SCANNERS AND SCANNING

Covers details of VHF/UHF propagation and types of transmission, and then leads on to what a scanner is and why it differs from other types of receiver. How to use a scanner is then dealt with and this includes a guide to the various functions most scanners have. Aerials and the radio spectrum are next covered including the sorts of thing one is likely to be able to hear

Order Code: BP311 Price: £4.95  
1992 178 x 111mm 144 pages

## GETTING THE MOST FROM YOUR MULTIMETER

R. A. Penfold

It is amazing just what you can check and test with a simple multimeter if you know what you are doing. This book tells the story, with Chapter 1 covering the basics and relative merits of analogue and digital instruments. Chapter 2 discussing component checking and Chapter 3 dealing with circuit testing.

Order Code: BP239 Price: £2.95

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INCLUDE VAT

# Babani/PC Books

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£3.00

## AERIAL PROJECTS

R. A. Penfold

Whether you have built a very simple short wave receiver or have purchased a most sophisticated piece of equipment, the performance you achieve will ultimately depend on the aerial to which your set is connected. The subject of aerials is vast but in this book the author has considered practical aerial designs, including active, loop and ferrite aerials which give good performances and are relatively simple and inexpensive to build. The complex theory and mathematics of aerial design have been avoided. Also included are constructional details of a number of aerial accessories including a pre-selector, attenuator, filters and tuning unit.

Order Code: BP105 Price: £2.50  
1982 178 x 111mm 96 pages

## 25 SIMPLE AMATEUR BAND AERIALS

E. M. Noll

This concise book describes how to build 25 amateur band aerials that are simple and inexpensive to construct and perform well. The designs start with the simple dipole and proceed to beam, triangle and even a minirhombic made from four TV masts and about 400 feet of wire. After the aerial discussion you will find a complete set of dimension tables that will help you spot an aerial on a particular frequency. Dimensions are given for various style aerials and other data needed for spacing and cutting phasing lengths. Also included are dimensions for the new WARC bands.

Order Code: BP125 Price: £1.95  
1983 178 x 111mm 80 pages

## 25 SIMPLE SHORTWAVE BROADCAST BAND AERIALS

E. M. Noll

Fortunately good aerials can be erected at low cost, and for a small fractional part of the cost of your receiving equipment. This book tells the story. A series of 25 aerials of many different types are covered, ranging from a simple dipole through helical designs to a multi-band umbrella.

Order Code: BP132 Price: £1.95  
1984 178 x 111mm 80 pages

## 25 SIMPLE INDOOR AND WINDOW AERIALS

E. M. Noll

Written for those people who live in flats or have no gardens, or have other space-limiting restrictions which prevent them from constructing a conventional aerial system. The 25 aerials included in this book have been especially designed, built and tested by Mr Noll to be sure performers and give surprisingly good results considering their limited dimensions.

Order Code: BP136 Price: £1.75  
1984 178 x 111mm 64 pages

## HOW TO EXPAND, MODERNISE AND REPAIR PC'S AND COMPATIBLES

R. A. Penfold

All the practical information you are likely to need to upgrade your PC and compatible. Also contains useful information to help you with repairs.

Order Code: BP271 Price: £4.95  
1990 198 x 130mm 176 pages

## AN INTRODUCTION TO COMPUTER COMMUNICATIONS

R. A. Penfold

Provides details of the various types of modem and their suitability for specific applications, plus details of connecting various computers to modems, and modems to the telephone system. Also includes information on common networking systems and RTTY.

Order Code: BP177 Price: £2.95  
1986 178 x 111mm 80 pages

## GETTING THE MOST FROM YOUR MULTIMETER

R. A. Penfold

It is amazing just what you can check and test with a simple multimeter if you know what you are doing. This book tells the story, with Chapter 1 covering the basics and relative merits of analogue and digital instruments. Chapter 2 discussing component checking and Chapter 3 dealing with circuit testing.

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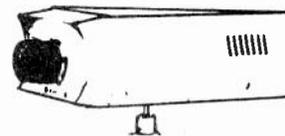
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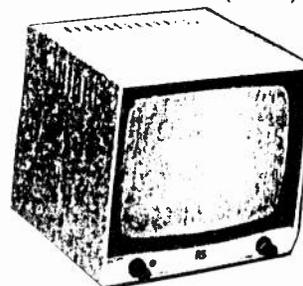


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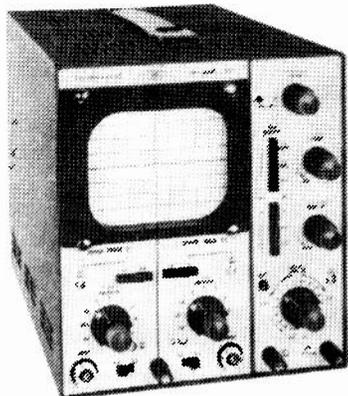


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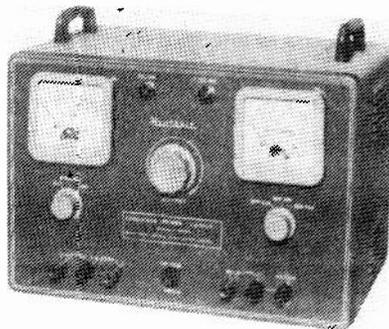
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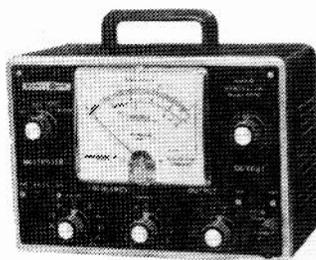
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# Panasonic's Digital TV Chassis

## Part 1

Ray Meadows

An introductory article on the Panasonic Euro 1 digital TV chassis in the July issue briefly described its features and the service modes. As it's a new chassis there is to date little experience of failures in the field. This new series of articles will look at the circuitry used and the construction of the chassis so that those who become involved in repairs will know what to expect, indicating in the process likely routes to tracking down the cause of any faults that may develop. It seems logical to start with the non-digital parts of the set, i.e. those that link it to the outside world. So we'll start with the power supply.

### Power Supply Circuitry

Previous Panasonic chassis used either the Sanken STR54041 chopper control chip or else employed discrete component circuitry. The Euro 1 chassis however is of European design. This is reflected in the choice of the SGS-Thomson TDA4601 chopper control chip. The power supply circuit is similar to that used in many other models by various manufacturers, being of the self-oscillating

flyback converter type. As some features are not always understood too thoroughly, we'll run over the operation of the circuit.

Fig. 1 shows the non-mains isolated side of the power supply, excluding the mains switch, the fuse, the line filter and the degaussing circuit components. Chopper transformer T639 has three primary windings, P1-2 being the main power winding, F1 the winding that provides a feed so that the supply is self-powering, and F2 the feedback control winding. P1 is connected to the output from the mains bridge rectifier and P2 to the collector of the chopper transistor Q624, regulation being achieved by controlling the width of the drive pulses applied to its base. The pulse width is determined by the chip which samples, at pin 3, rectified pulses fed back from winding F2.

At switch on a start-up voltage is applied to pin 9 of IC611 via R621 and R622. It's used to provide, internally, a 4V reference voltage at pin 1. When the voltage at pin 9 reaches 12V, the reference voltage appears and the circuit starts up. Once the circuit is oscillating, a 20V supply becomes available from winding F1 and the associated rectifier circuit consisting of D622 and C622: this takes over the supply to IC611. The timing of the very first drive pulse to Q624 must be calculated by IC611. This is done by measuring the collector current via the network connected to pin 4. The second and subsequent drive pulses are timed by detecting the zero crossover of the feedback pulses from F2 at pin 2 of IC611.

In normal operation the circuit oscillates at frequencies between 20kHz and 35kHz depending on the load conditions and the input supply voltage. In these circumstances the conduction period of the chopper transistor remains at an almost constant 33 per cent of the drive waveform's duty cycle. In the standby mode, when the power consumption is reduced to several watts, the oscillation frequency can increase to 70kHz with the conduction period of Q624 falling to less than ten per cent.

Overload protection is provided by monitoring the

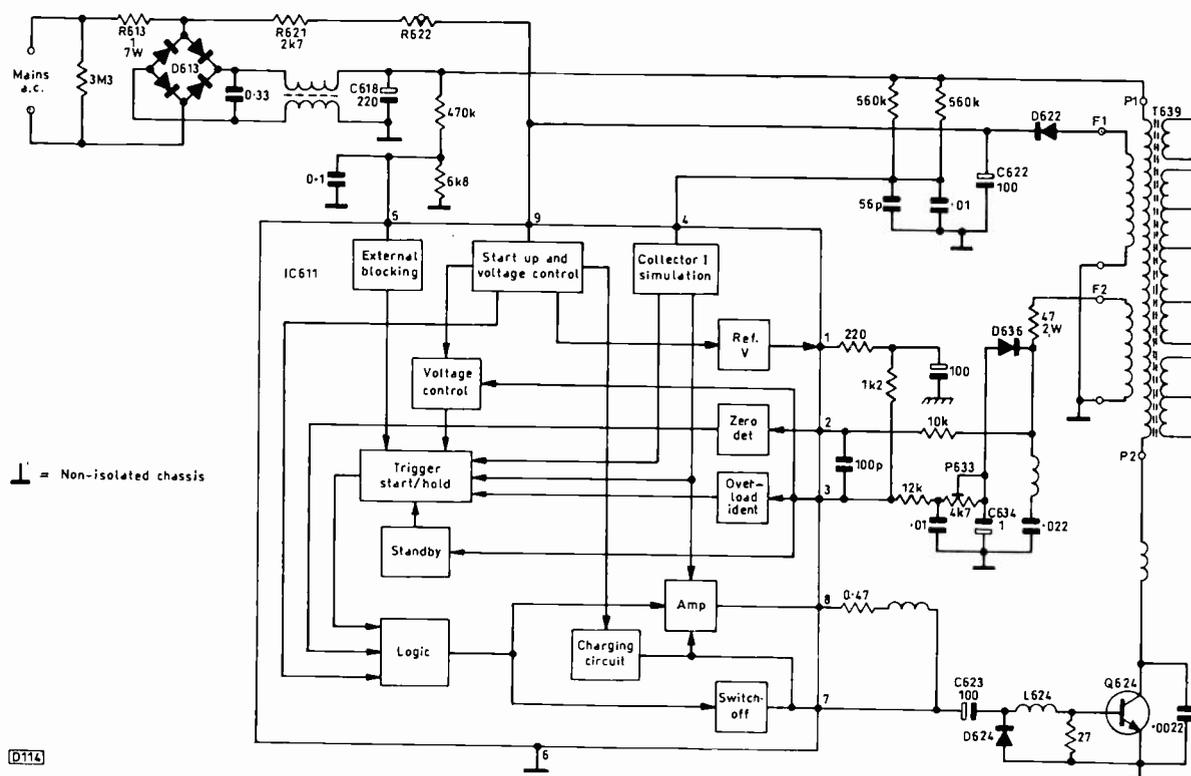


Fig. 1: Primary (non-isolated) side of the power supply circuit.

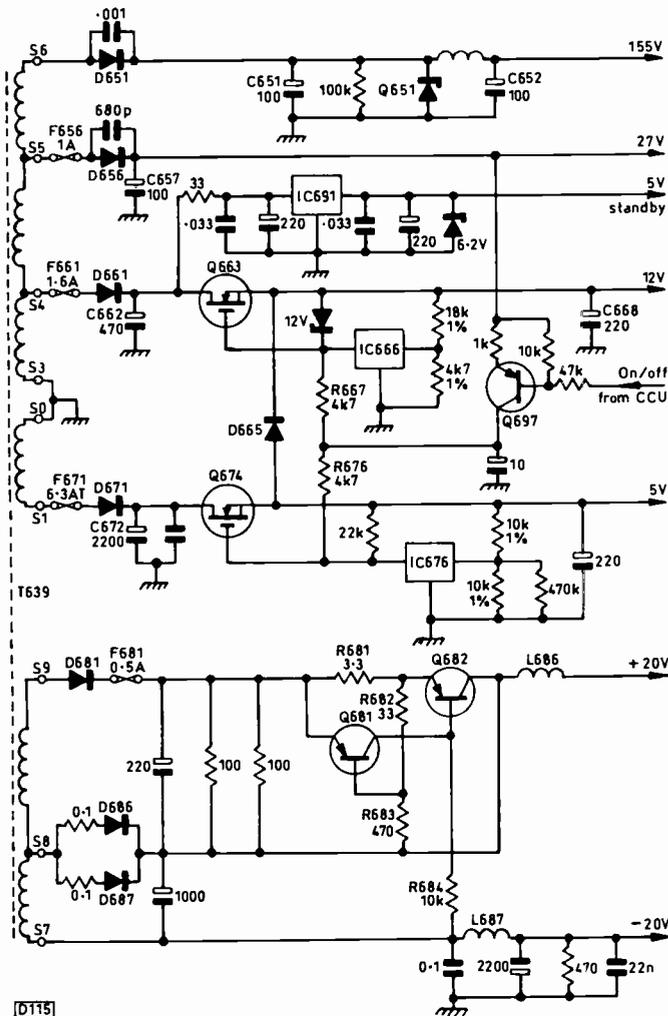


Fig. 2: Secondary side (mains isolated) of the power supply circuit.

voltage at pin 9 of IC611. Under heavy load conditions the voltage, also that at pin 5, falls. IC611 will then cut off its chopper transistor base drive amplifier, thus stopping Q624. The circuit will next try to start up again, as described above. An additional overload protector and a standby monitor function are connected to pin 3, where feedback pulses from F2 provide a control voltage after rectification by D636 and C634. By using this voltage in conjunction with the collector current sensing at pin 4, the chip can limit its output drive. P633 enables the sensitivity to be adjusted so that the output voltages can be set up.

The mains-isolated side of the chopper transformer provides several separate supplies: Fig. 2 shows the circuitry used here. These supplies are the main 155V line, fused 5V, 12V and 27V supplies, a fused 5V standby supply and split +20V and -20V supplies for the audio amplifiers. In the standby mode the main 5V and 12V supplies are shut down by removing the gate drive to the field-effect transistors Q663 and Q674. This is done by applying a positive voltage, which comes from the CCU (central control unit) processor chip on the digital board, to the base of Q697. Switching off the 155V h.t. and 27V line driver stage supplies is not necessary because, in this mode, the CCU prevents line drive. Thus only the 5V standby supply is active, powering the infra-red remote control receiver, the CCU (microprocessor) chip and the start-up circuit for the deflection processor chip. When the CCU brings the set out of standby, the main 5V and 12V supplies are reinstated and line drive is enabled. As the 5V line rises, the line output stage is soft-started.

As mentioned in the previous article, field-effect transistors are used to stabilise the main 5V and 12V supplies – because of their large current capacity and low source-drain voltage. They are used in conjunction with normal TL431 regulator chips to provide the control action, the f.e.t.s being used as series elements to boost the current and provide standby switching. One per cent tolerance resistors are used to set the exact reference levels for both the TL431 devices (IC666 and IC676).

The split supplies for the audio amplifiers are not regulated. They are obtained from a half-wave rectifier arrangement. At first sight the circuit looks strange because the two half-wave rectifier circuits are effectively in parallel. The reason for using this arrangement is to reduce the power consumption in the standby mode. In normal operation Q682 is switched on, its base being at a negative voltage with respect to its emitter. It thus supplies current to the audio circuits. In the standby mode the current demand from the audio circuits is reduced. Because of this, current is shunted via R681/2/3. Q681's base voltage moves negatively with respect to its emitter and it switches on. Q682 is thus switched off, because Q681 shorts its base and emitter. The net result is a reduction in the supply to the audio chips. Audio muting will be described later.

Because of the power supply design, all the secondary voltages are present even when the set is in the standby mode. It's advisable, before repairing the unit, to disconnect the mains supply and carefully discharge the mains bridge rectifier's reservoir capacitor C618. As an aid to fault location in a dead set, the power supply can be isolated by removing the h.t. rectifier diode D651, the 27V supply rectifier diode D656 and the 5V and 12V supply rectifier diodes D671 and D661. The h.t. supply line can then be loaded using a 60W bulb. You can isolate the line output stage simply by omitting the connection to the DPU (deflection processor unit) chip. When using the extension lead kit this is easily done by omitting the lead that connects W1451 on the digital pack to W511 on the main PCB.

### Line Scanning

Fig. 3 shows in simplified form the line driver, output and EW correction circuitry. The arrangements are similar

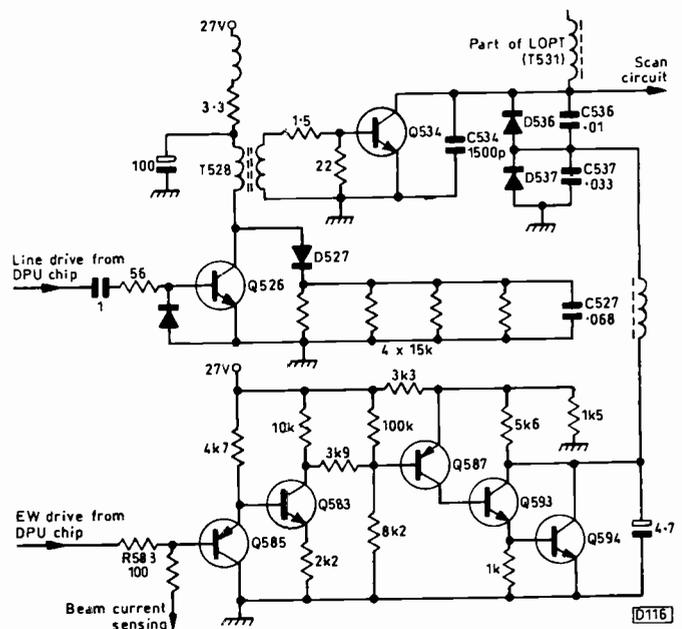


Fig. 3: The line driver, output and EW correction arrangements – simplified circuit.

to those used in other sets, so only a few points will be made. Line drive pulses from the DPU chip are applied to the base of the line driver transistor Q526 which provides the necessary current to operate the line driver transformer T528. This has a winding ratio of seven to one. With no 27V supply there is of course no drive to the line output transistor Q534, which has a low-impedance base circuit to ensure rapid switching. Note that the line output and chopper transistors are of the same type, S2000AF, with an internal diode (not shown).

D536 and D537 are the EW modulator diodes. The EW

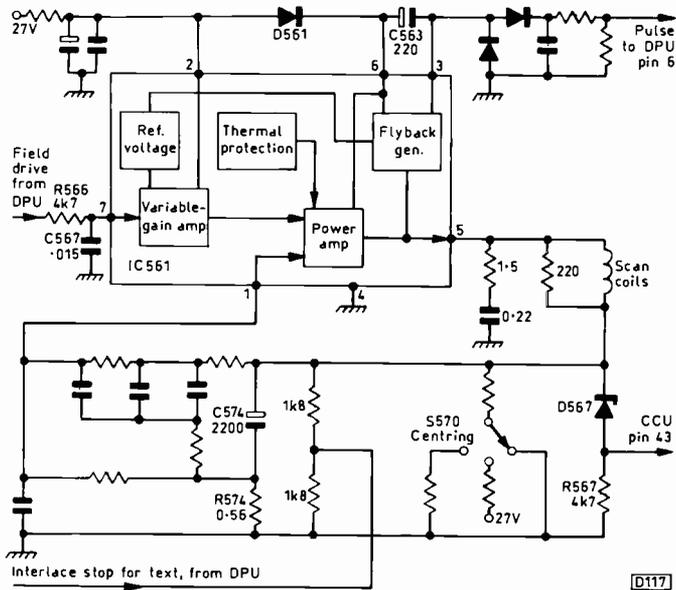


Fig. 4: The field output stage circuitry.

correction circuit is driven by a field-frequency waveform that's derived from the DPU's field output section. It arrives at R583 and is then buffered and amplified by the d.c.-coupled circuitry shown.

### Field Scanning

The TDA8175 chip IC561 drives the field scan coils. This chip is basically a power amplifier with a built-in flyback generator to virtually double the available supply voltage. D561 and C563 form part of this arrangement. The circuitry here is again conventional (see Fig. 4). The input from the DPU is a pulse waveform that's integrated by R566 and C567.

There are two separate protection circuits here. To avoid the possibility of c.r.t. screen burn because of loss of field drive, a sample of the pulse waveform present at pin 3 of IC561 is fed back to the DPU. If the pulses are missing, the DPU generates a continuous blanking signal that cuts off the RGB outputs from the VDU (video display unit) chip. Beam current is thus minimised.

The second circuit provides protection in the event of the field output coupling capacitor C574 going short-circuit – otherwise the supply to the field output circuit would directly heat the scan coils! Zener diode D567 monitors the field drive. If C574 becomes short-circuit the voltage applied to D567 will fall: this voltage change is fed back to pin 43 of the CCU chip IC1801 (see Fig. 6) which will then initiate the shut-down mode. Other faults will result in the CCU chip shutting the set down with a characteristic five-second flash of the standby LED as the system tries to restart. These will be covered in a later instalment.

### RGB Output Circuitry

The RGB output stages are mounted on the c.r.t. base board. They are more complex than those used in previous Panasonic chassis and thus call for some explanation. Fig. 5 shows the blue output stage and the spot-suppression circuit which is common to all three channels.

The RGB drives from the VDU chip come via the scan-velocity modulation board. Each RGB channel has four transistors. In the B channel shown the first transistor Q3371 is an emitter-follower which provides a low-impedance, d.c. drive at the base of the class A amplifier Q3373. This provides the required voltage gain. For optimum h.f. response a low-impedance output is essential to rapidly charge/discharge the load capacitance present. On a positive-going voltage transition at the collector of Q3373, Q3374 switches on to provide, by emitter-follower action, a low-impedance charging path via D3377. With a negative-going transition D3377 is cut off and Q3377, again acting as an emitter-follower, provides a low-impedance discharge path. D3374 and Q3373 ensure that Q3377's base current is rapidly dissipated so that the process can be repeated.

Q3377 serves a second purpose, as part of the automatic grey-scale adjustment system. Its collector is earthed via R3379 and the ACVP (active comb filter and video

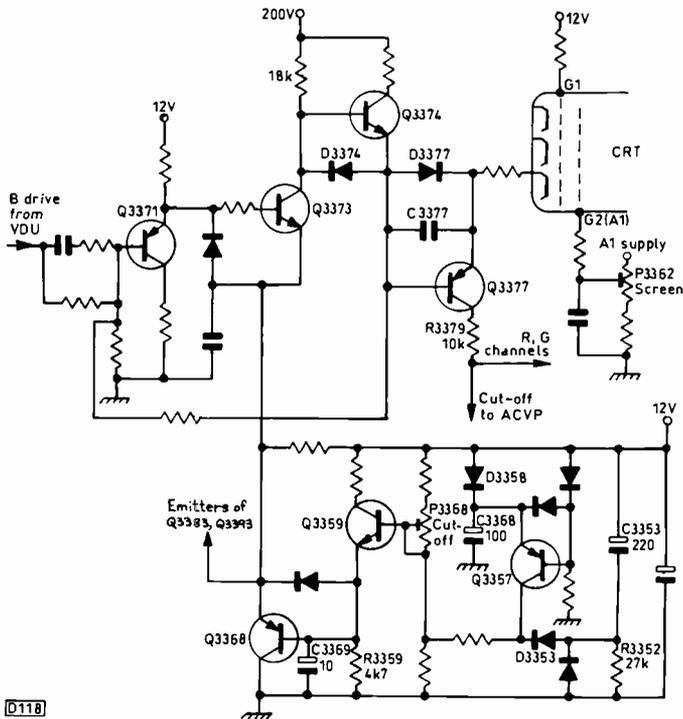


Fig. 5: One of the RGB output stage circuits (blue) and the spot-suppression and cut-off control circuit.

processor) chip on the digital board. During the course of the field blanking (flyback) period the transistor (and its equivalents in the red and green channels, Q3397 and Q3387 respectively) is used to sample the black and peak-white levels. There is also a c.r.t. leakage measurement. This is done over a four-field cycle as follows:

- Field one:** c.r.t. leakage.
- Field two:** black and peak-white levels, red channel.
- Field three:** black and peak-white levels, green channel.
- Field four:** black and peak-white levels, blue channel.

Transistors Q3377/87/97 are connected to the ACVP chip via connector W191 on the scan-velocity modulation

board. During the leakage check there is no drive to Q3377/87/97 and whatever current flows is measured. During the next three fields Q3377/87/97 are switched on in turn to check the black and peak-white currents. The measurements are made by the ACVP chip, which communicates the results to the CCU chip. This compares them with values stored in the associated memory chip. If any differences are detected, the RGB drives are automatically adjusted to compensate.

This is useful during the tube's warm-up period, when uneven emission could cause a colour tint. It is also useful over the long term, enabling the grey-scale tracking to be maintained as the tube ages. It also means that all colour temperature and white-balance adjustments can be carried out via the software during service mode one.

Despite the fact that c.r.t. cut-off automatically tracks the setting of the screen (first anode) control P3362, it may be necessary to carry out realignment when a new tube is fitted. To do so the set is put into service mode 1, as

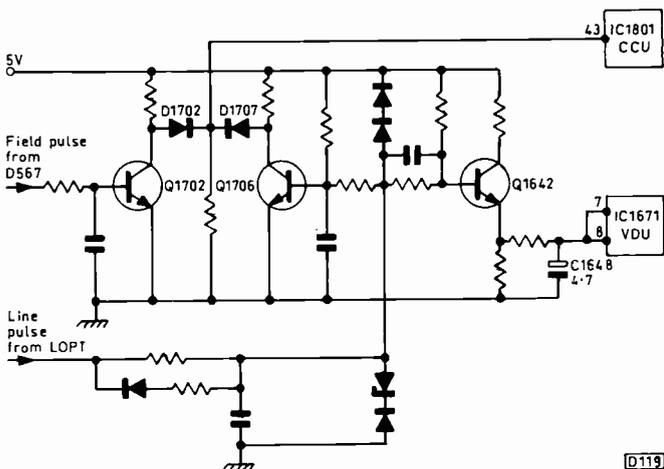


Fig. 6: Protection circuitry on the digital board, shown simplified.

described in the previous article, and the 'screen' option is selected. P3362 should then be turned to minimum: use a non-conductive trimmer, as a metal screwdriver can bridge the potentiometer's spark gap rather nicely! The set will now display numeric values for the red, green and blue channels. Select the channel with the highest value and connect a high-impedance scope probe directly to the relevant cathode. With the scope set to the field frequency, the blanking interval test signal can be seen as a pair of steps. Adjust the cut-off control P3368 (see Fig. 5) so that the voltage from the top step to earth is 150V. Remove the scope connection and increase the setting of the screen control P3362 until the highest channel numeric display reads approximately 40. Alignment is now complete.

This set-up procedure is one of the few physical alignments possible with the set. You can adopt the time-honoured method of using a high-impedance voltmeter to set the cut-off (at approximately 180V) but this is not so accurate. Factory software settings for the RGB low- and high-light levels don't need to be adjusted when a new tube has been fitted as the automatic grey-scale tracking will ensure that the tube operates correctly.

### Spot Suppression

The possibility of spot burn at switch on and switch off is prevented by the components around transistor Q3357 and in

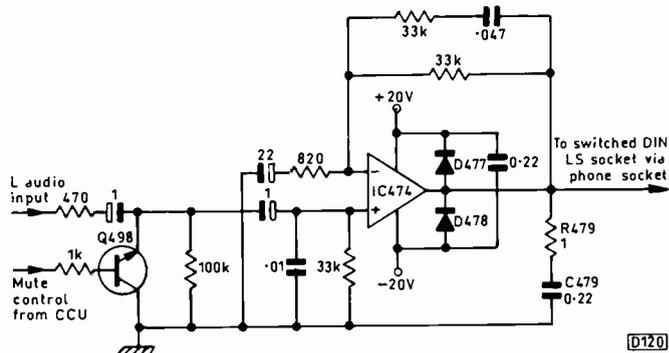


Fig. 7: The left-channel audio amplifier circuit.

the cut-off circuit. At switch on C3353 charges slowly via R3352. Thus a voltage appears at the anode of D3353 which conducts. Q3359 switches on and Q3368 switches off. The full 12V is therefore applied to the emitter of Q3373 and the equivalent transistors in the red and green channels, and all three are cut off. When C3353 has fully charged the voltage at the anode of D3353 falls and the circuit reverts to normal operation.

At switch off the voltage on the 12V line falls. As C3358 has been charged to 12V, the voltage at the base of Q3357 falls below that at its emitter and it conducts, switching Q3359 on and Q3368 off. The action at this point is the same as during the switch-on spot suppression period and lasts until C3369 has discharged via R3359.

### Beam Limiting

Beam limiting is carried out within the VDU chip, determined by the voltage at pins 7 and 8, see Fig. 6. This voltage is derived from a sampled line flyback pulse, which is processed by transistor Q1642 and the associated circuitry. With excessive beam current the pulses at the base of Q1642 become negative and it can no longer charge C1648. If the voltage at pins 7/8 of the VDU chip falls below a 4V threshold, contrast limiting is initiated. If the voltage falls below 3V brightness limiting is also applied. At 0V the beam current is reduced to zero.

### The Audio Amplifiers

A pair of TDA2030A chips provide the audio outputs. They are powered by split supplies, as we have seen. The audio signals from the ACP (audio control processor) chip are buffered on the digital board and are fed to the non-inverting chip inputs. Fig. 7 shows the left-hand audio circuit. It's of conventional design, with the protection diodes D477 and D478 clamping the supply lines to the output. Audio-frequency roll-off is set by the RC networks in the feedback and non-inverting input circuits. A Zobell network (C479, R479) at the output helps to prevent any instability.

In addition to audio signal muting within the ACP chip during the channel change and search operations, switch-on muting is provided by Q498 and the equivalent transistor in the right channel. These transistors are controlled by the CCU chip. When switched on, they short the audio inputs to chassis.

### Part 2

In the next instalment we'll look at the rest of the analogue circuitry, starting with the tuner and the i.f. section.

# Teletopics

## DIGITAL VCR FORMAT

Ten leading manufacturers have reached agreement on a basic specification for a new consumer VCR system that will store the video signal on tape in digital form. The specification is to be submitted to the IEC (International Electrotechnical Commission) as a proposed international standard. Brief details are as follows: mechanical system slant-azimuth with rotating heads; tape width 0.25in. (6.25mm); type of tape metal evaporated or tape with the same performance; data recording rate 25Mbits/sec after signal bit reduction using discrete cosine transformation; playing time 4.5 hours for a standard cassette, one hour for a compact cassette for portable use; sound system PCM digital with stereo and four-channel modes. There is provision for HDTV; in this mode the machine would be switched to double speed with a 50Mbits/sec data rate and halved playing time. Machines will be able to record PAL, NTSC and SECAM signals by converting them to digital form, using a system similar to the MPEG of CD-i. The firms involved are Hitachi, JVC, Matsushita, Mitsubishi, Philips, Sanyo, Sharp, Sony, Thomson and Toshiba.

## NEW VIDEO DISPLAY SYSTEM

A new digital video projection system, called DMD (digital micromirror device), has been developed by Texas Instruments. It uses a series of tiny mirrors, each one just 17 microns across, to project the image on to a screen. The basis of the system is a half-inch square section of silicon chip that contains an array of CMOS devices which act as memory cells. The mirrors are highly reflective and are hinged at diagonal corners so that they can be tilted by ten degrees in either direction.

To create an image a bright light is shone on to the chip while an electrical current is passed through the cells. A positive pulse results in a mirror element flipping in one direction to reflect the light while a negative pulse twists the mirror in the opposite direction to block the light: the mirror switching time is around 10µsec. This system produces a display with a large number of grey-scale steps. For a coloured image light from red, green and blue sources is shone on to the chip in sequence while the switching time of the mirrors is varied to allow the colours to be mixed in the correct proportions. Infra-red radiation from the light source is filtered out to keep the chip cool, and the mass of the mirrors is so small that they absorb very little heat energy. TI says that the mirrors can be switched billions of times with no stress damage to the hinges.

TI has demonstrated a DMD projector that displays 640 x 480 pixel NTSC and VGA pictures: a 1kW xenon arc lamp was used as the light source. The device would be used for large-screen projection. No price or launch details have been announced.

## CHANNEL 5 AGAIN

The ITC has called for "expressions of interest" from prospective operators of Channel 5 – these must reach the Commission by October 15th. In its just published *Consultation Document on the Future of Channel 5* the ITC lists three options for Channel 5 and asks for comment. These

options are: (1) If clear interest is expressed, to re-advertise the licence. An ITC study has looked at ways of using different frequencies to reduce the problem of interference to VCRs and other equipment, and ways of reducing the number of locations where an additional aerial would be required, but the ITC does not feel that such measures would make enough difference for it to be worthwhile changing the original plan. (2) To use the available frequencies for local TV services. (3) Use of the frequencies as part of a move to the introduction of digital TV services.

## AMIGA CD32 LAUNCHED

Commodore has launched Amiga CD32, a 32-bit CD-ROM games system. The games console plugs into a TV set and will play CD audio, CDTV, CD-ROM games and Video CD discs (the latter store up to 74 minutes of video on a CD, see elsewhere in this issue). A 14MHz Motorola 68020 processor and 2Mbytes of RAM are used, while the AGA (advanced graphics architecture) chipset can display 256,000 colours from a palette of 16.8 million. A proprietary operating system is used.

The console has two joystick/controller ports; r.f., composite video and S-video sockets; and stereo audio and headphone jacks. In addition a keyboard can be plugged in. There's space for an MPEG module, required for Video CD playback. Suggested price of the console is £300 while the MPEG module is to be made available this autumn at "under £200". Fifty to a hundred games titles are promised by Christmas at £20 to £30 each.

## SONY ANNOUNCES MD DATA FORMAT

Sony has announced a new standard, called MD DATA, that enables computer data to be stored on mini discs. Up to 140Mbytes of data can be stored on the 64m disc, enough for 2,000 colour images or around fifteen minutes of full-motion video. The data transfer rate is 150kbits/sec, the same as a CD-ROM disc. Each sector has 2,048 bytes. Three types of MD DATA discs are to be made available: pre-mastered MD-ROMs, which will be used for electronic publishing and prerecorded software; recordable discs using magneto-optical technology – these can be used and re-used, like floppy discs; and hybrid discs that contain blank and prerecorded sections. The new discs will be distinguishable from ordinary MDs and will not play in an audio MD deck. The MD file system is designed to work with different computer platforms. Sony expects to launch the system in 1995.

## HARDWARE

JVC has launched both Mini Disc and Digital Compact Cassette machines in Japan. The XMD1 at Y99,800 (£620) is a portable MD recorder with edit facilities, remote control and a three-way power supply: JVC markets sixty-minute MDs at Y1,400 (£8.75) each. Model ZD-1 is a portable DCC player selling at Y59,800 (£370). No UK launch details have been released.

Aiwa has introduced, at £1,290, a 'personal home cinema' system. It consists of a VX-S140 televideo and NSX-D909 digital surround sound mini system.

## SATELLITE TV

Eutelsat II F6, to be launched in the autumn of 1994, will provide sixteen 36MHz TV channels from 13°E, in co-location with II F1. It will use 70W transmitting tubes to provide

a 49dBW footprint that extends from Ireland and Portugal in the west to the Ukraine and Turkey in the east. Transmissions will be in the band 11.2-11.55GHz. Eutelsat call it F6 the Hot-Bird and expect it to be used mainly for DTH broadcasting.

Schlumberger Technologies has announced a new encryption system, SmartCrypt, that will free cable and satellite TV broadcasters from the traditional subscription-based methods of charging for services. Its unique dual smart card interface enables viewers to receive programmes on a 'pay per view' basis, by paying for entitlements by means of a smart card.

The 1994 Cable and Satellite Exhibition will be held at the Grand Hall, Olympia on April 11-13th.

## PUBLICATIONS

To coincide with the thirtieth anniversary of his collection of BBC archive material Keith Hamer has launched the BBC Test Card Club. Members will receive a quarterly 20-page, A4-size magazine called *Test Card* which will cover many aspects of BBC engineering including, naturally, trade test transmissions. An annual subscription costs £8.50 in the UK or £11 world-wide via air mail. A leaflet can be obtained by sending a stamped, addressed envelope to Keith at 7 Epping Close, Mackworth Estate, Derby DE3 4HR (0332 513 399).

TV aerial and accessory manufacturer Maxview has published a *Guide to terrestrial TV and FM Radio Broadcasting*. This sixteen-page, two-colour booklet is aimed at consumers, providing a guide to the selection and installation of aerial equipment. Copies can be obtained via Maxview's Customer Helpline, 0553 811 000, or by writing to Maxview Ltd., CSD, Common Lane, Setchey, King's Lynn, Norfolk PE33 0AT.

## ANSWER TO TEST CASE 369

– see page 795 –

Wild West Repairs is still operational on an as-and-when basis – we may well hear more of it in this column in due course. Television Ted doesn't put up aerials, but he's seldom stumped for long by a TV fault. This one was no exception to the rule.

Regulated TV power supplies operate on the closed-loop principle: a rise in the output voltage is fed back to the circuitry that drives the regulating device, in this case the chopper transistor TP29, so that the latter reduces the energy level and the correct voltage conditions are thus restored. This feedback system means that there is automatic compensation for changes in component values and minor faults within the loop. The two crucial factors are the sample voltage being monitored and the voltage that's used as a reference so that, by comparison, an error voltage can be produced. In the IKC2 chassis the sample voltage is provided by the potential-divider network centred on PP52, while the reference voltage is supplied by the 4.7V zener diode DP55 (plus a 1N4148 diode in series to provide temperature compensation). If either voltage changes, the h.t. voltage and the picture size will alter with it.

Ray had concentrated on the components associated with the sample voltage, overlooking the reference voltage source. This is where the cause of the trouble lay, the culprit being the zener diode. Ted very soon found this out by using his hairdryer and aerosol freezer. We are not to know the fate of the Rhondda Rentals technician, whose role in the affair can have done him no good at all.

# Next Month in TELEVISION

## TV/VCR SPARES GUIDE

Free with the October issue, our latest TV/VCR spares guide listing sources of spares for most brands of TV and video equipment.

## SERVICING THE PHILIPS 3A CHASSIS

The 3A was Philips' flagship chassis during the period 1986-8, with many 'extras' including some firsts in the UK. It's not the easiest set to work on however. Richard Newman provides guidance on servicing, including access.

## MODERN TV RECEIVER TECHNIQUES

Next month's instalment looks at timebase generator synchronisation and the techniques used in practice in today's receivers, also the line driver stage.

## CAR RADIO/AUDIO SERVICING

The radio and audio equipment installed in cars present their own problems when it comes to servicing - many technicians balk at the idea of becoming involved. It's possible to do profitable business however. Alan Bouskill provides advice on diagnostic techniques.

## SERVICE BRIEFS FROM TOSHIBA

Official guidance on repairs to CTVs and VCRs in the Toshiba ranges.

## TEST REPORT: WAVETEK DMMs

David Botto reviews the Wavetek series 2000 digital multimeters. These are advanced, hand-held instruments that contain an impressive range of newly-developed features.

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# Satellite Notebook

**Nick Beer**

Last month I mentioned what appeared to be a problem caused by a Manhattan LNB. How could I have supposed that my favourite LNB had lost its meticulous record? The case I described related to an installation with a Beosat LM receiver built into an Beovision MX3500 TV set, the problem being bars on vision after a period of time. It remained when a second LM unit was tried, but a second LNB seemed to put matters right. Conclusive evidence, you might think. Well, not so! A technical bulletin received from Bang and Olufsen describes the exact fault, which occurs when the LNB voltage is 18V. There are two causes. First 20IC5 in the LM unit being disturbed by line pulses picked up from the deflection coils – this happens only with MX type (monitor style) TV sets and the AV9000, B and O's Pro-Logic system. Secondly 20IC5 being intermittently unstable, depending on the LNB's power consumption. The solutions are to fit a metal shield plate (part no. 3302519) to the LM unit, see Fig. 1, and to fit a standard diode, e.g. a 1N4148, in place of 20R22 with its anode towards 20IC5. These modifications are being implemented in production.

## Satmaster for Windows

Another thing I discussed last month was the Satmaster Pro PC program (page 714) for use when designing satellite TV installations. I can now report on the new version for use with the Microsoft Windows operating system. It has the following extra features: operation with more than one link budget on the screen at a time; mixed displays of maps, charts and data are possible; a notepad editor, with full cut-paste-search and replace facilities; and the possibility of using a scanner to import your own BMP files for graphics. They result from the presentational abilities of the Windows system.

In my opinion the Windows system provides a better presentation of any software program, making it easier to use. Satmaster Pro undoubtedly benefits from the treatment. Mouse or pointer support is standard, unlike the DOS version. On the whole the graphics are much improved – use of colour being not the least enhancement. For example in the DOS version the Far East rain climatic zone map is at first sight very unclear with respect to what is a zone

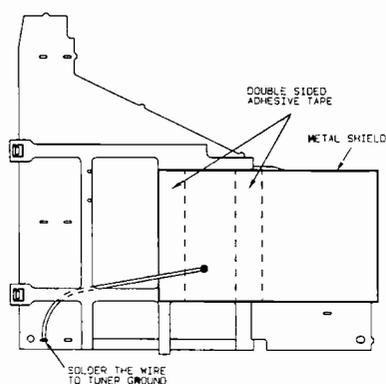


Fig. 1: Shield plate modification for the Beosat LM receiver.

boundary and what is a coastline: in the Windows version colour gives a marked improvement. Standard installation procedures apply, using Windows 3.1 or higher. The program requires 4Mbytes of RAM and 2Mbytes of space on the hard drive – also a mouse or other pointer.

The Pro Windows 1.0 package costs £99 and is available from Swift Television Publications, 17 Pittsfield, Cricklade, Wilts SN6 6AN (telephone 0793 750 620).

## Pace Releases

In the June issue Ian Martin mentioned recent additions to the Pace range. The Pro-Logic decoder is of particular interest – I find Pro-Logic sound fantastic. Several Astra channels feature it and provide, with VHS tapes and CDs, ideal demonstration material. If you haven't experienced the effect yet, I strongly advise you to find someone with a system and listen to it!

## Fault File

A fault we've had with several Pace SS9000 receivers (and clones) recently is no output from the tuner. It is not a cheap repair, so it's worth shopping around for a replacement tuner. Pace supply it at around £37 trade plus VAT. CPC have had it on special offer at as low as £32, though the official catalogue price is in line with Pace's. The Ferguson part from WVE costs rather more.

One polarity not working has been the fault with a couple of SS9000/Ferguson SRV1-S receivers. No surprise to find that Q3 (FXT749) is the culprit. We've had it go both open- and short-circuit.

Another fault we've had with this model is no signals, no test signal etc. due to loss of the switched 12V supply because Q4 (another FXT749) had gone short-circuit base-to-collector. A BC327 will do for test purposes, but the correct type should be fitted to complete the repair.

.....  
**John Hepworth adds:** Here is a summary of some faults we've encountered recently in the satellite receiver field.

**Pace SS3000:** These receivers are coming in with various symptoms such as hum bars, incomplete menus, channel numbers staying on the screen and what I call overnight tuning drift. The problem is easy to deal with. Replace the four electrolytic capacitors (three 2,200µF, one 100µF) in the power supply, also the bridge rectifiers. Once you have a healthy, smooth supply the receivers work as well as when new.

**Amstrad SRX100/200:** There was mention in the May issue of C504 causing oscillation on the 5V line. This usually results in a dead set, but in one case I had the symptom was a 'woodgrain' pattern over the picture, especially with MTV. When tested the capacitor showed no leak or capacitance loss, but a scope confirmed its guilt. In later models its value was increased from 220µF to 470µF.

**SVA1 VideoCrypt decoder:** This unit would display 'insert card' at random on any channel. When I examined the mains transformer connections with a magnifying glass I could see that they were becoming dry-jointed. Resoldering them all cured the trouble. These units are also becoming well-known for cracked print in the corner of the PCB nearest the power-on LED. The symptoms range from dead to strange messages such as 'no programmes remaining' and 'no tokens left'. In this condition the unit will often decode UK Gold but no pay channels.

# Modern TV Receiver Techniques

## Part 9: Liquid-crystal Displays

Eugene Trundle

The shadowmask colour c.r.t. described last month in effect combines three separate picture-producing systems within the same glass envelope so that they share a common deflection system. It's difficult to produce very large sized direct-view tubes, so for picture sizes greater than about one metre (diagonal) the usual solution is a projection system.

### Projection TV

Colour projection TV systems that use tubes require one each for red, green and blue, with three separate lens systems to project and superimpose the images they produce on to a common screen. The tubes are generally 5in. (12.7cm) types run at about 30kV (e.h.t.), the deflection angle being about 70°. They have a large-diameter electron gun which can thus produce a very small scanning spot, and are set up to produce an underscanned, intensely bright raster.

There are three common projection TV arrangements. The projector may be separate from the screen, projecting the three images, via lenses, on to it from a distance. Alternatively the three tubes and their lenses may be mounted at the bottom of a large console unit, arranged in line facing a mirror at 45° which reflects the three images on to the front of a concave screen. A reduction in the size of the console unit is obtained when back-projection is used: the three tubes with their lenses are mounted behind the screen, facing upwards, a 45° mirror reflecting the images on to the rear of the screen. Fig. 1 illustrates these arrangements.

With a projection TV system no energy is wasted in a shadowmask. But there are several drawbacks – apart from the greater cost than a single direct-view tube. Because the

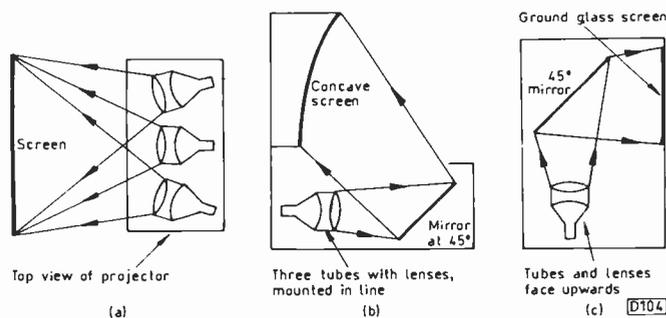


Fig. 1: Three projection TV systems using primary-colour tubes. (a) Separate table-top or overhead projection unit and screen. (b) A console with reflection from a concave screen. (c) A back-projection system with ground-glass screen.

three tubes are separately scanned, there are image-registration problems to overcome. Since the tubes cannot be on the same projection axis, keystone correction has to be provided for the two outer tubes. At the high brightness levels used to make good light loss in the system the tubes have a limited life, during which manual grey-scale adjustment must be carried out from time to time. And finally the reflective screens generally used are directional, offering full-brightness pictures only to viewers who face the screen directly.

For these reasons liquid-crystal display (LCD) projectors have in recent times come into favour. They use an electric lamp as the light source, and need a rather complex optical system. But as there's a single projection lens and beam there's no need for image registration adjustments during installation or in day-to-day use. The maximum projected image size is proportional to the distance between the projector and the screen, though there's of course a trade-off between image size and brightness. The user has two simple lens controls, focus and zoom, as with a camera. But before we go into LCD projector technology we need to consider the basic operation of an LCD panel. The principles here are the same for both direct-view and projection TV systems.

### Liquid-crystal Displays

The basic difference between a picture tube and an LCD panel is that the former generates a point-source light while the LCD controls, at each picture element (pixel), the amount of light that passes through. Liquid-crystal material combines the fluidity of a liquid with the regular molecular

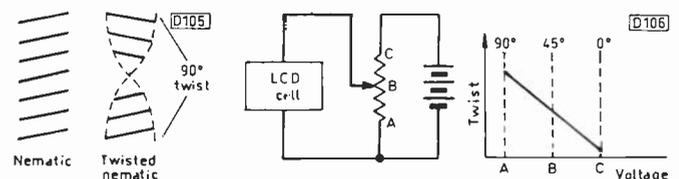


Fig. 2 (left): In manufacture the nematic crystals are twisted through 90° – by rubbing them.

Fig. 3 (right): Use of a variable electric field to control the twist of the crystal's molecules.

structure of a solid crystal. There are many types of liquid crystal. They all have their molecules arranged in the form of thin bars or flat plates. For TV displays the nematic type is used. It has long, thin molecules that are all aligned in the same direction. In production the molecular structure is twisted through 90° (see Fig. 2) so that the polarisation of light passing through will be similarly twisted. This is known as a twisted-nematic (TN) crystal. The feature that enables these properties to be used is that the degree of twist of the molecules can be controlled by applying an electrical field at right-angles to their axes, see Fig. 3. A practical LCD element has a ten-micron liquid-crystal layer sandwiched between two transparent electrodes: by varying the voltage applied across these electrodes the rotational polarisation of the molecules in the layer can be varied between zero and 90°. How is this property used to control the light transmission of a liquid-crystal display?

Fig. 4 shows the basic action of an LCD. The polarisation of natural light is random – its photons vibrate in all directions. A polarising filter can be used to pass only light that's polarised in one plane. The LCD element is sandwiched between two polarising filters whose characteristics are opposite, one passing vertically-polarised light and the other horizontally-polarised light. The amount of light that can

pass through this assembly depends on the crystal twist and hence the applied voltage. Vertically-polarised light passes through the first filter. If it's twisted through 90° by the LCD element (TN cell) it will pass through the second polariser which passes only horizontally-polarised light. This occurs when the applied voltage is zero. As the voltage increases, the LC twist decreases and the light that passes through it becomes steadily less able to pass through the output polariser. Eventually the point is reached where all the light is blocked and the screen is black. With some LCDs the polarisation of the two polarising filters is the same. In this case the screen is black with zero applied voltage and white with the maximum voltage present. The voltage/opacity characteristic of the device is reasonably

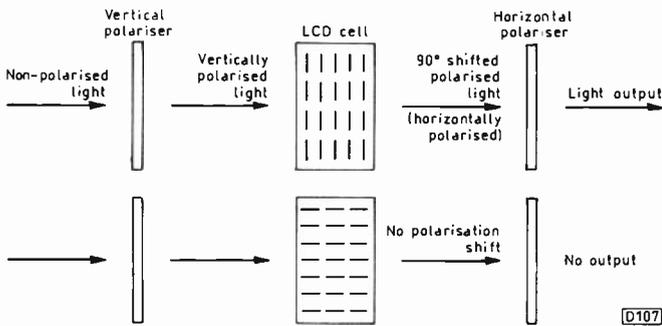


Fig. 4: The addition of light polarising filters at the input and output enable the LCD cell to act as a light valve.

linear, and the polarising voltage can be applied in either way – in fact in order to prevent ionisation and consequent deterioration of the liquid-crystal material a.c. drive is used.

The basic arrangement used in a practical LCD display panel is illustrated in Fig. 5. It shows three picture elements – a display panel has typically 100,000 elements (pixels), each one of which is controlled by a thin-film field-effect transistor (TFT). When an a.c. drive signal is applied to the

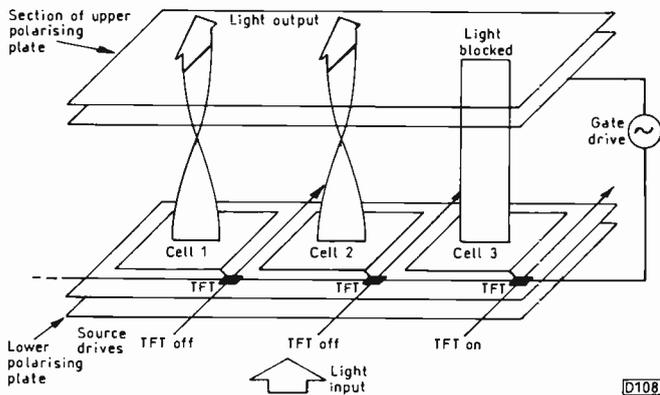


Fig. 5: Representation of three adjacent LCD panel cells, showing the control transistors and bus drive lines. The sandwich is only a few microns thick.

gate bus line, an off signal is fed to the source bus line for elements one and two and an on signal is fed to the source bus line for element three, light will pass through elements one and two and be blocked by element three. To an observer looking at the screen elements one and two are illuminated and element three is black. By building a matrix of such cells and individually controlling the conduction of the TFTs, a complete pattern of light and shade is built up on the screen – a monochrome TV picture whose definition is governed by the number of elements in the matrix.

This is called active-matrix drive. Fig. 6 shows the equiv-

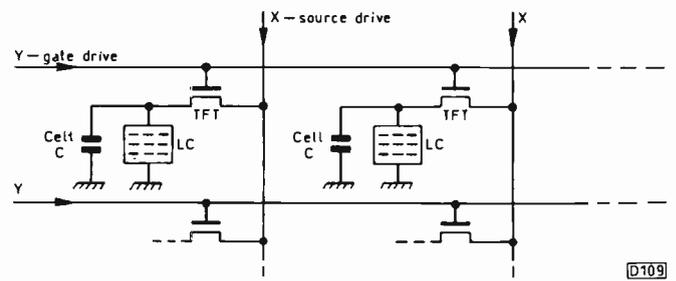


Fig. 6: Equivalent circuit of two adjacent LCD cells. The individual TFTs in the LCD matrix are addressed simultaneously via the X (source) and Y (gate) lines.

alent circuit of two adjacent elements (cells). Scanning and signal pulses are fed to the Y (gate) and X (source) lines respectively. When a TFT is switched on, the display data is stored as an electric charge in the capacitor formed by the LCD cell. The charge remains, and the cell's light transmittance remains at the same level, until the pixel is updated when the next frame is scanned. This gives the best possible picture contrast and brightness.

Broadcast TV signals and those from video cameras and camcorders have a luminance signal which has been pre-distorted in a gamma-correcting stage to compensate for the non-linear light-output characteristic of a picture tube. Thus in a set with an LCD it's necessary to adjust the signal's gamma characteristic to match that of the LCD.

## LCD Drive

There are several ways of driving an LCD panel. One is shown in Fig. 7. In this example there are 384 pixels per horizontal line and 288 lines, making a total of 110,592 pixels in all. Vertical interlaced scanning is used. This is done by having two horizontal scanning circuits, one for the odd lines and one for the even lines of the TV picture. A separate vertical scanning circuit is used to scan down the screen line by line. We'll follow the sequence involved in tracing out a complete picture.

At the start of line one, field one of the picture, the upper scanning circuit is triggered on by the arrival of a start pulse (STH) which opens the upper horizontal shift register. 192 clock pulses (half the number of pixels in the horizontal line) are fed into the register, their total duration corresponding with that of one TV line. The sample-and-hold gates take 192 samples of the analogue video signal. These are then buffered and fed to the source bus lines (S1, S3, S5 etc.) for alternate horizontal pixel TFTs. At the same starting time an STV1 start pulse is applied to the vertical shift register, which loads CKV clock pulses. The first one turns on the gates of all the TFTs in the top row of the display, enabling them to respond to the video signal on the vertical (source) bus lines. Only half the TFTs switch on in sequence, the ones fed with a video signal via the S1, S3, S5 etc. lines.

The next TV line is the second one in the first field. It's clocked, sampled and buffered out of the upper horizontal scanning circuit in exactly the same way as the first line, but this time the vertical shift register has clocked down once to turn on the gates in the second row of TFTs. Again alternate pixels (1, 3, 5 etc.) respond to the video signal, producing the second line of the picture.

The process continues until the end of field one, which in this case will be the display's line 288 as there are only 288 lines.

We now come to the start of field two, which is vertically interlaced with field one. The lower horizontal scanning

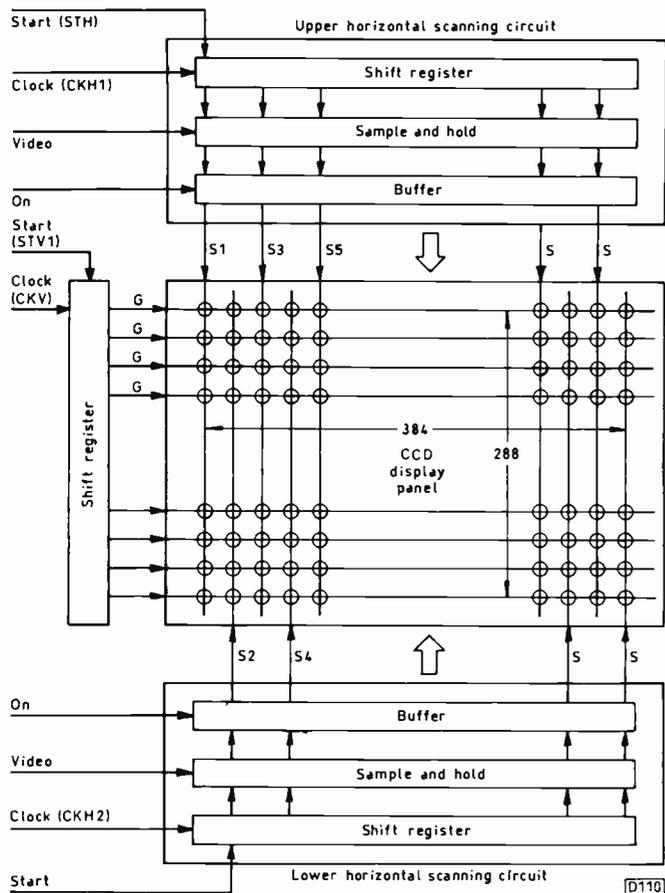


Fig. 7: Operation of an LCD panel. The pulse inputs at the left come from a timing pulse generator.

circuit now comes into action, triggered by the start pulse fed to its shift register. Operation is identical to that of the upper horizontal scanning circuit, but this time the 192 video samples per line, timed by clock pulse train CKH2, are fed to the even-numbered source bus lines (S2, S4 etc.) so that the second set of TFTs comes into operation, displaying field two's video information alongside field one. Thus vertical interlacing has been achieved, to suit the physical structure and line make-up of the LCD panel.

The lack of correlation between the broadcast lines and the lines of the LCD panel during each 20msec field cycle is overcome by the short-term memory characteristic of the output buffers in the horizontal scanning circuits.

All the circuit sections shown in Fig. 7 are integral with the LCD panel – it would not be practical to have 672 separate leadouts going to external chips. The type of display shown has about sixteen connections to the external circuitry, nine of which go to a timing controller chip which is under the control of the broadcast or video sync pulses.

The number of lines and pixels in the panel depends on its size, application and price, which vary from cheap pocket TV sets to relatively high-definition flat-panel displays and projection systems.

### Colour LCDs

What we've looked at so far is a monochrome liquid-crystal display. To add colour it's necessary to put colour filters over individual liquid-crystal cells, producing an RGB matrix like that shown in Fig. 8, with the R, G and B video signals routed to the appropriate LCD cells. Because we now have three cells per pixel, the definition capability is reduced. In practice this is overcome by using more,

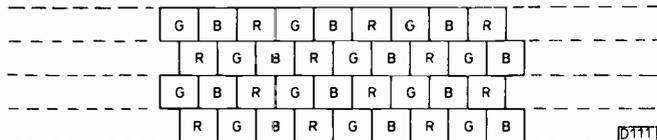


Fig. 8: RGB colour filters in an offset matrix.

smaller LCD elements. This principle of having individual pixel colour filters is similar to, though on a larger scale, the arrangement used (in reverse) in the CCD imagers of solid-state colour TV cameras.

### Backlighting

In small LCD TV sets the backlighting required is generally provided by a tiny fluorescent tube with a reflector and diffuser to provide bright, even illumination over the whole area of the LCD panel.

### LCD Projection Systems

The brightness produced by a single-colour c.r.t. is limited by the energy that can be imparted to its electron beam and dissipated at the screen. When, as with a three-tube projector, the available light has to be spread over a large picture area the results, even with a directional viewing screen, may be barely adequate. Because the LCD panel in an LCD projection system acts as a light valve there are no such constraints: a very bright electric lamp can be used as the light source, its output being intensity modulated by the LCD matrix between the lamp and the screen. The latter can be flat, cinema style.

Some LCD projectors use a single RGB panel that operates in the manner already described, with a strong backlight and a lens system, but it's difficult to achieve sufficient definition in a large picture produced by an LCD panel in which three cells are required for each pixel. Hence the three-panel projection systems from manufacturers like Sharp and Sanyo. These separate the light into its R, G and B components, which can be individually modulated.

### Three-panel Projectors

A typical three-LCD panel projector offers a horizontal resolution of 300-450 lines, using three separate (R, G and B) panels each with a diagonal measurement of about three inches (7.6cm) and over 100,000 pixels. That's about 300,000 transistors in the display alone! A 150W metal-halide lamp serves as the light source, the contrast ratio being 100:1. An f4.5 projection lens is used with a 2:1 zoom ratio.

Fig. 9 shows the optical system. The light source is surrounded by a parabolic reflector (1) which absorbs infrared (IR) radiation (heat) while reflecting visible light. The light is next reflected from a 90° cold mirror (2) which absorbs IR and ultra-violet (UV) energy, before being passed through an IR/UV cut filter (3). Now 'cold', with its energy confined to the visible part of the light spectrum, the beam reaches the first, red dichroic lens (4). This reflects the red light while allowing the green and blue light to pass through. An ordinary aluminium reflector (5) turns the red light through 90°, passing it to a condenser lens that makes the light rays parallel. The next item in this path is the 'red' LCD, which forms the red component of the picture. A second dichroic lens (6) separates the green and blue light, the green and blue beams being passed to their own condenser lenses and LCD modulators. Two further dichroic

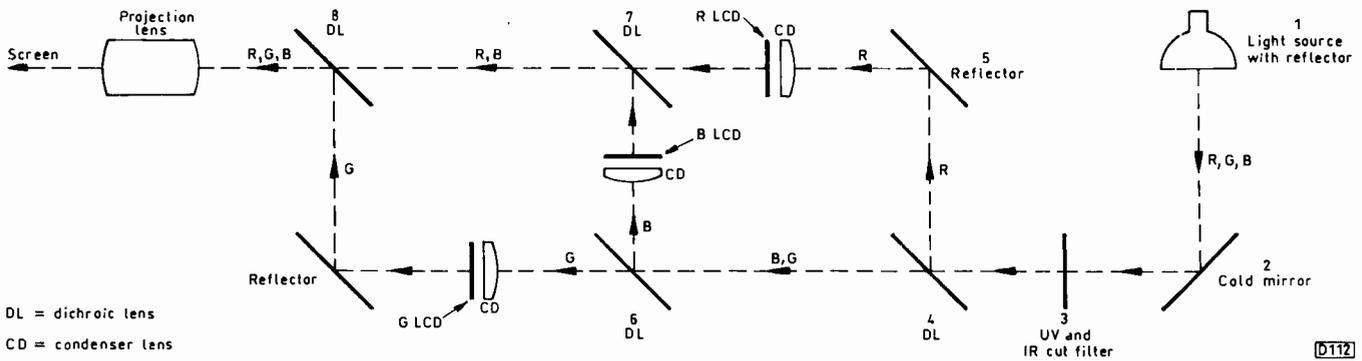


Fig. 9: A three LCD-panel projector optical system.

lenses, (7) and (8), are used to recombine the three beams which then pass to the projection lens. This focuses the picture on the separate screen. A forced fan-ventilation system is incorporated to keep the LCD panels at a temperature below 50°C: it sucks air in at the back of the projector and blows it out at the top.

Note that the image produced by the R-LCD is not reflected on its way to the projection lens, the image produced by the B-LCD is reflected once while the image from the G-LCD is reflected twice. Without compensation, the blue image would appear on the screen reversed in comparison to the other two images. This problem is overcome by scanning the B-LCD in the opposite direction to the other two LCDs.

### The Light Source

The metal-halide lamp used as the point-light source is very efficient: it's claimed to be four times as powerful as the equivalent halogen lamp. It takes the form of a mercury-arc lamp with a quartz glass 'blob' in the centre. For it to strike, a 12kV pulse has to be applied to its electrodes,

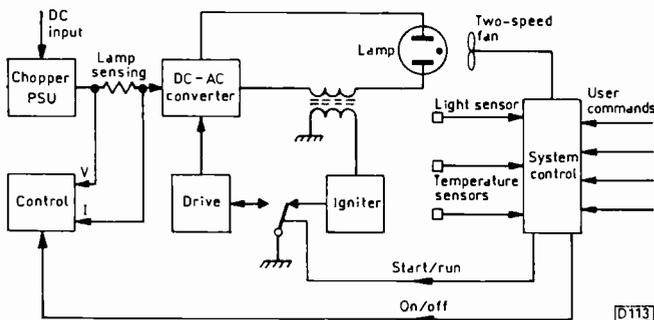


Fig. 10: Lamp- and system-control arrangement for a typical three-panel LCD projector.

which are a millimetre or two apart. The resulting arc vapourises a blob of liquid mercury which gives off an intense glow. Once the mercury is vaporised, hot and glowing, the arc is maintained through what has become a low-resistance path. So the bulb is fed through a current-limiting system designed to maintain the energy at 150W. In

this mode the voltage across the electrodes is about 80V.

The light-emission spectrum of a mercury-vapour lamp is very uneven, with four well-defined peaks in the visible region and two in the UV area. Its major output is in the blue part of the spectrum. This is of little use for colour TV! The solution is to add various metal halides, e.g. caesium, to the mercury and operate the arc in argon gas. This produces a very even distribution of light emission across the spectrum from 380-760nm. The lamp is not a user plug-in device, nor is it cheap: it costs a three-figure sum to supply and fit a replacement, whose operating life is about 1,000 hours.

### Lamp Drive and System Control

The 12kV lamp igniter doesn't have to supply much energy: it's a simple circuit with a couple of semiconductor devices and a pulse transformer. A relay powers it for 1.4sec, after which a light sensor checks whether the lamp is lit. If not, the igniter fires three more times at 25sec intervals. The projector shuts down if the lamp is still off.

Once the lamp is alight, it's kept on by an a.c. drive circuit that consists of four power f.e.t.s in a bridge configuration (a d.c.-a.c. converter). Fig. 10 shows an outline block diagram of the arrangement, including the control system. The d.c.-a.c. converter is fed from a chopper circuit whose control system monitors the lamp current and voltage, maintaining it at the required 150W level.

The system control section is concerned mainly with monitoring the lamp and the internal temperature of the projector. Two thermal sensors that govern the fan speed and, if the internal temperature rises to 73°C, shut the projector down ensure the safety of the LCD panels.

The other functions of the control system are the usual TV ones: key scanning, remote control, standby switching and analogue function control. There's also an hour counter that keeps a record, in a non-volatile memory, of the lamp running time, providing an indication of this and a life-expiry warning as necessary.

### Next Month

Having followed the course of the signal from the aerial input through to the screen display, we'll next month start on the picture tube control and scanning arrangements.

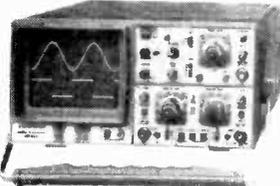
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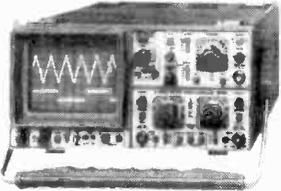
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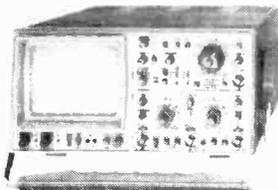
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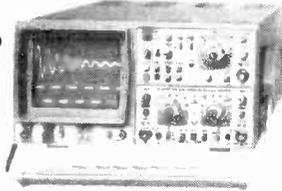
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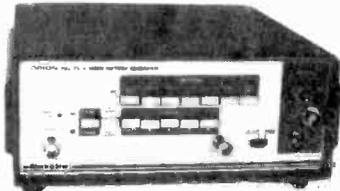
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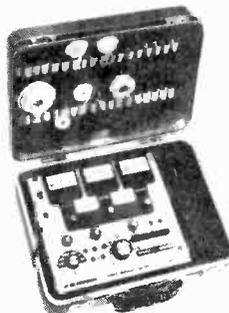


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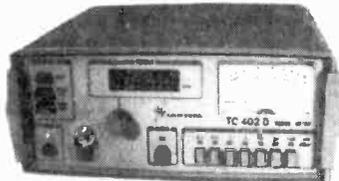
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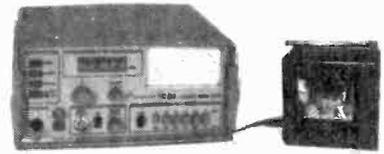
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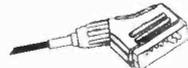
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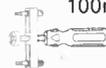
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C.M. TELECOM (K5) 1.2dB LNB, C120 flange, 11.475 GHz LO	£60.00 + pp
C.M. TWIN (K1) LNB, 40mm collar, 10.00 GHz LO	£64.00 + pp
C.M. DUAL (K1) LNB, 40mm collar, 10.00 GHz LO	£64.00 + pp
STC TWIN (K1) LNB 23mm collar	£70.00 + pp
CALIFORNIA AMPLIFIER (C1) Fully integrated LNB, adj. scalar, voltage switched V & H, 60mm collar	£150.00 + pp
30 K Version	£165.00 + pp
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For our 80-100cm dish – the H to H Pole Mount and Motor	£95.00 + pp
For our 90-120cm dish – 12" Jack	£62.98 + pp
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PACE MSP 991 – Fully integrates with above Pace receivers, operating under one remote control	£115.00 + pp
NOKIA POSITIONER	£140.00 + pp
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1977

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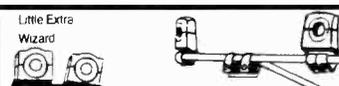
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VIEWING CARDS AVAILABLE ON REQUEST

DECODERS

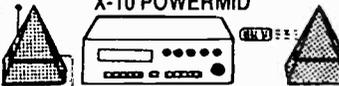
THOMPSONS Secondhand, Videocrypt	around £79.00 + pp
PACE VC100 Videocrypt	£115.00 + pp
PACE D100 D2 Mac	£225.00 + pp
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7mm Cable Clips for above coax, Black, Brown, White	Per 100 clips £1.90 + pp
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2-Way Splitter, DC Pass, One leg only	£10.25 + pp
"F" Coax Wallplate, DC Pass	£4.21 + pp
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Polyrod Feed only with 23mm collar, C120 output	£18.00 + pp
Polyrod Lens Fed Magnetic Polarota with 23mm collar – 4 variants	Each £40.00 + pp
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all 22 off sat reflectors	
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80cm Oval Black Solid 39dB	£56.00
1 mtr Oval Light Solid 41dB	£90.00
1 mtr Oval Black Solid 41dB	£90.00

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9ft Mast side entry Black	£21.81
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40mm LNB clamp (replacement)	£3.75
60mm LNB clamp (replacement)	£3.75
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Uni LNB Carrier Round Adp	£2.50
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2" – 1.5" 2" Mast Coupler	£11.14

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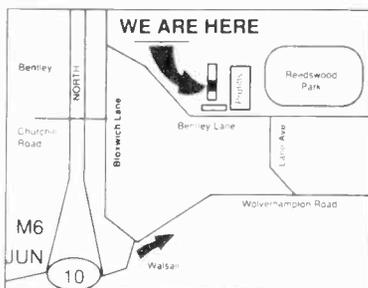
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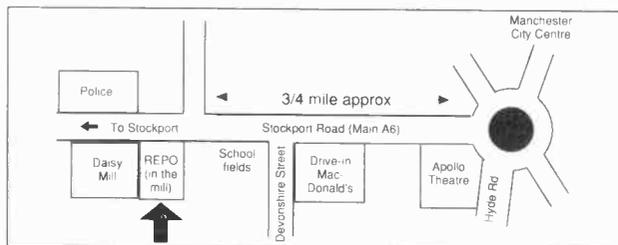
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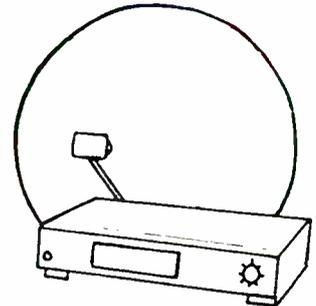
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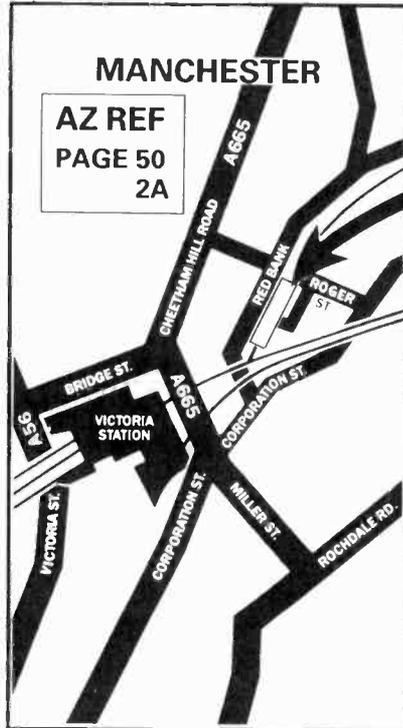
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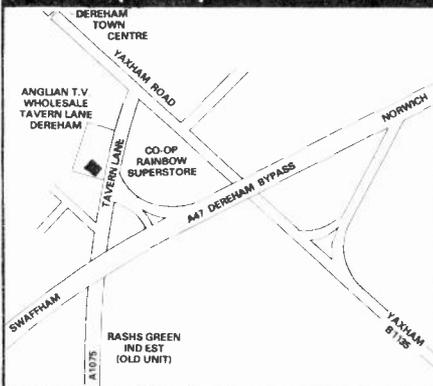
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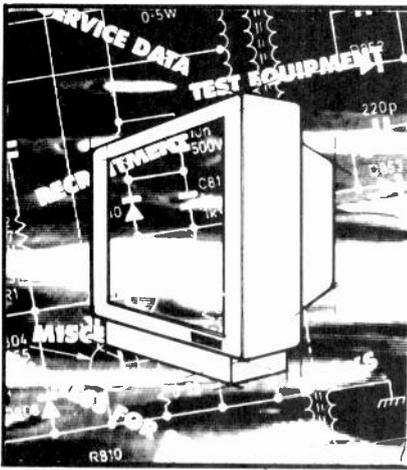
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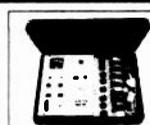
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<b>MARCONI COMPACT L.N.B.</b> <b>1.2DB</b> <b>£30</b> <b>10.7 TO 11.7GHZ</b>		<b>60cm BACK MESH DISH</b> <b>£25, £5 post</b>		<b>VIDEO AMSTRAD HANDSETS (EXPORT) £3.50</b> <b>WILL WORK IN HOME MARKET</b> <b>6.000 and 4.600 4.700 £6</b>		<b>SEND FOR DATA D2 MAC SATELLITE RECEIVER, LNB AND DISH. £50 (£10 Post)</b>			
<b>SATELLITE RECEIVERS — New Ferguson BSB Chassis with Tuner, Modulator etc</b> <b>Hand Set</b> <b>£1.50</b> <b>£4 Post</b>		<b>60cm SATELLITE DISH £35 Postage £5</b>		Replaces 90% of Philips Handsets Philips Video RTV Handsets with LCD display AV561 £6 AV569 £6		<b>SATELLITE FINDER KIT AND LNB TESTER WITH METER BOX £25</b>			
SMALL SATELLITE TUNERS (950 to 1750 MHz), L.F. frequency 4000MHz ..... £9.00 each VHF/UHF S.BAND TUNER ..... £3.00 NEW PLASTIC CASE 32 C.H. SAT-RECEIVER (no hand set) ..... £35 (Post £5) NEW METAL CASE SAT-RECEIVER, 32 C.H. WITH DOLBY C & CHANNEL C (no hand set) ..... £35 (Post £5) DAM MAINS CHASSIS AMSTRAD MONITOR C ..... £10 UNIVERSAL TRIPLER, NEW TYPE ..... £4.00 VIDEO LEADS ..... £1.00 AMSTRAD Line O.P. Transistors with Diode 2SD453 ..... £1.00 BU208A ..... £1.00 VIDEO LAMPS, Long Lead ..... £2.40 HITACHI & GEC FRAME, Thick Film ..... £6.00 FIDELITY SPLIT DIODE, FCC2215AE, £20 FCC2015BL, £10 FCC2215BL, £10 K30 FRONT PANEL, TEL-TEX TYPE ..... £5.00 NEW G11 LINE OF PANEL ..... £8.00 PHILIPS YEARS AHEAD THE CREDIT CARD CALCULATOR Solar Powered ..... £3.75 NEW PHILIPS SBC 1835 Solar & Battery Powered Calculator ..... £9.00 THORN PANEL, TX9 REC & REMOTE PANELS with Mains Trans ..... £5.00 TX10 REC & REMOTE PANELS with Mains Trans ..... £5.00 TX10 FRONT PANEL ..... £3.00 TX10 TUBE BASE ON PANEL ..... £3.00 TX9IF ..... £2.00 THORN PANEL, No. 515-353, 548-02, 565-01, 509/102, 515/173, 506/161 ..... £5.00 THORN TX STEREO SOUND O.P. PANEL (I.C. TA727P) ..... £1.00 THORN VIDEO AERIAL AMP 01 M4-597-001 ..... £6.00 ULTRASONIC TRANSDUCER ..... 15p		<b>CAMCORDER SANYO NP22</b> <b>6v 1300mah Rechargeable Battery Pack £6.00</b>		<b>SATELLITE UNIT Video Out/Audio Out, L and R Polariser ± 35M/A and Decoder Socket £10</b>		Gas Soldering Irons Variety Nickel Cadmium Batteries from Telephone Type to Sub-C 50p per cell. Mainly in packs of 6 to 8 New Type £10.00 <b>THORN FRAME IC TX100 etc IC TDA 3652 IS OBSOLETE. REPLACEMENT TDA 3654 £2.00</b>			
<b>TX100 REMOTE PANEL No.56413IC M293B/and SAA5012 £10 etc</b>		Philips Stereo Headphones No. SBC 3140 144MHz Changed Over Relay Aerial ..... £4.00 <b>6251 FRAME O/P THICK FILM HITACHI GEC £9.00</b> <b>THICK FILM HITACHI HM9205A £4.00</b> <b>TX 85 FERGUSON BATTERY MAINS CONVERTOR £5 each</b> <b>TX9-TX100 FRONT PANEL, £5 WITH REMOTE £10 NON REMOTE 8 push button £10</b>		<b>PHILIPS UNIVERSAL BATTERY TESTER SBC 1695 £5.00</b> <b>BATTERY CONVERTER FOR TA185 FERGUSON TX85 £8.00</b> <b>ONE I.C. K15 Decoder £10.00 PHILIPS Deck Calculator £7.00</b> <b>REGULATED PWR. SUP. 500MA 1.5V 12VDC switched + &amp; - £5.00</b> <b>ITT Tuner &amp; IF Can HF-module 2 UK £10.00</b> <b>KT3-K30 IF £5.00 STR5481 £5.00</b> <b>TX100 Push Button Unit 16 C11 £10.00</b> <b>WIRE PIPE stud detector £4.00</b> <b>MICROWAVE leak detector £4.00</b> <b>WIRE &amp; PIPE detector £4.00</b>		<b>TX100 SWITCH MODE TRANS 5157/48 £5 AND 00D4-252-001 06D3-482-001</b> <b>STEREO SOLAR RADIO VHF AND MW £10.00</b> <b>100V AC 100V DC ETC. PHILIPS METER ANALOG £11</b> <b>G11 470 MFD 250v £1.35</b> <b>420M/400 £1 220M 3850 £1</b> <b>CASSETTE SCART MAINS Socket, Print LEADS 30p Type 20p</b> <b>TELEPHONE LEAD 3 Metre ..... 30p</b> <b>LEAD SCART TO D PLUG ..... 50p</b> <b>BRIDGES RECTIFIER Mixed BR-31 to 34 2 Amp to 5 Amp ..... 8 for £1.00</b> <b>NEW LUXOR SATELLITE ANTENNA POWER DRIVER £15.00</b> <b>G11 8 WAY TIP SWITCH WITH DARW ASS £10</b> <b>1 METRE SCART LEAD £1.00</b> <b>VIDEO SCART TO SCART ALL PIN, LONG LEAD £3.00 ALL PINS</b> <b>TX90 TX925 TX100 Mains Switch with Stand-by and Lead 50p each</b> <b>BURGLAR ALARM USE INFRA RED DETECTOR WIDE AND SHORT ANGLE WALL MOUNT £8 WITH RELAY</b>			
<b>NICAM UNIT — Ferguson made for ICC5 Chassis — home market and export — has circuit diagram and can be converted to most sets — £15.</b>		<b>PHILIPS NEW TYPE U/V HANDSET £10</b>		<b>CAR ADAPTOR fused 3 Amp Long Lead with plug for TV etc 25p 500 off, 15p Each</b>		<b>TX100 SWITCH MODE TRANS 5157/48 £5 AND 00D4-252-001 06D3-482-001</b> <b>STEREO SOLAR RADIO VHF AND MW £10.00</b> <b>100V AC 100V DC ETC. PHILIPS METER ANALOG £11</b> <b>G11 470 MFD 250v £1.35</b> <b>420M/400 £1 220M 3850 £1</b> <b>CASSETTE SCART MAINS Socket, Print LEADS 30p Type 20p</b> <b>TELEPHONE LEAD 3 Metre ..... 30p</b> <b>LEAD SCART TO D PLUG ..... 50p</b> <b>BRIDGES RECTIFIER Mixed BR-31 to 34 2 Amp to 5 Amp ..... 8 for £1.00</b> <b>NEW LUXOR SATELLITE ANTENNA POWER DRIVER £15.00</b> <b>G11 8 WAY TIP SWITCH WITH DARW ASS £10</b> <b>1 METRE SCART LEAD £1.00</b> <b>VIDEO SCART TO SCART ALL PIN, LONG LEAD £3.00 ALL PINS</b> <b>TX90 TX925 TX100 Mains Switch with Stand-by and Lead 50p each</b> <b>BURGLAR ALARM USE INFRA RED DETECTOR WIDE AND SHORT ANGLE WALL MOUNT £8 WITH RELAY</b>			
<b>LARGE Foocs Pots, Fits Pyc, GEC, ITT, Decca 75p</b>		<b>BSB SAT/REC HALF COMPLETED, CHASSIS, TUNER AND MOD £5 + Post £3</b>		<b>PHILIPS NEW TYPE U/V HANDSET £10</b>		<b>GLASS BEADS Diodes 20kV1.2A 50 for £1.00</b>			
<b>G11 LOP1 Panel £4.00</b> <b>G11 Tip Switch £20.00</b> <b>G11 IF Panel £3.00</b> <b>G11 Decoder Panel £2.00</b> <b>G8 Push Button Unit £2.00</b> <b>G8 Con/Panel New Back Type £4.00</b>		<b>MIXED TOSHIBA HANDSETS FIVE FOR £12</b>		<b>EACH 10 off £1.00 MDA2062</b>		<b>WIRE &amp; PIPE detector £4.00</b>			
<b>Have you got Acid Rain in your garden? PH METER Video Power Supply for Amstrad. Last year mods. Mains Transformer for Amstrad Video £5.00 £1.50 25p (£1 post)</b>		<b>DAMAGED AMSTRAD 1640 Colour Monitor Chassis £6 + post £3.</b>		<b>DECODER C-CAM PHILIPS MADE for K40 CHASSIS IC No. TDA 3590 £5.00</b>		<b>56420A 20A/600V THYRISTOR £1.75</b>			
<b>LATEST VIDEO For Latest Philips, GEC, Pyc and Hitachi, Front panel with memory chip and bush button and pots and LEDs £6.00 NEW</b>		<b>FERGUSON CHASSIS IKC-7000 £20 IKC-2000 £25 TX86 Chassis AND TX90 White Spot 20" REMOTE TX90 Chassis 14" 8 PUSH BUTTON Post each, £5</b>		<b>TX100 FRONT PANEL £5 8 Button</b>		<b>LCD VIDEO AMSTRAD HANDSET for models 1900 £8 each</b> <b>ITT BG2032-642A TRIPLER £5.00</b> <b>ITT/NOKIA RF IF MODULE £20</b> <b>COAX PLUG TO PHONO LEADS £1</b> <b>SCART TO SCART LEAD £1</b> <b>TV GAMES AERIAL VIDEO COMBINER SWITCH £1.50</b> <b>MIXED 20 BRIDGE RECTIFIERS (1 Amp to 5 Amp) £1.50</b>			
<b>GEC, HITACHI DECODER PANEL TBA10AS, TBA120, HA1215A, UPC1365 £10</b>		<b>SCART TO SCART LEADS TX90 REMOTE PANEL IC TMS1000 AND M293 £12</b>		<b>SALORA SAT RECEIVER CONVERSION KIT For models 24M60, 25M90, 28M90, SB1206E, SB1365 £15</b>		<b>5 Mixed AMSTRAD VIDEO MOTORS £5.00</b>			
<b>SATELLITE TUNER UNIT 2427611 with Base Band, Video Out £8.00</b>		<b>TX90 TO TX100 8 BUTTON UNIT £4.00</b>		<b>TRANSFORMERS AT2036/01 AT2040/11 AT2045 AT2076/35 AT2076/38 AT2076/51 CVC 820 CVC 800 AT2076/55 AT2076/71T AT2080/15 RCO ST C73325 OT3041 FB165KA Orion 2076/51 2432461 2433451</b>		<b>SHARP MSHIFC09 £10 EACH FIT MOST SETS New Thorn 0004-235 Hand Set 002-01 Type u/v (£10)</b>			
<b>TX10 8 way button unit £8.00</b> <b>24v 0.24v 3amp MAINS TRANSFORMER £3.00</b> <b>10 MIXED FERGUSON CIRCUIT DIAGRAMS £5.00</b> <b>MSHIFC P09 £2.27</b>		<b>TX85 2435701</b> <b>2434393</b> <b>2435016</b> <b>2435014 £10</b> <b>2436797 £15</b>		<b>BRIDGE RECTIFIERS 10 FOR £1.00 4 Amp for Video Power Supply</b>		<b>VIDEO MOTOR for VT568 type VC62D8 AMP TUNER IF for VT568 Hitachi &amp; GEC £9.00</b>			
<b>2433752 £20</b> <b>2432964</b> <b>2432871</b> <b>2432901</b> <b>2435016</b> <b>2433952</b> <b>2434093</b> <b>2432211</b> <b>TW048A</b> <b>DS185B243</b> <b>TFB3069D</b> <b>K41 L O P T</b> <b>K41 L O P T</b> <b>K40</b> <b>2433452</b> <b>2432904</b> <b>2434451</b>		<b>SPLIT-DIODE 2433752 £15</b> <b>TX100 Green Spot £15.00</b> <b>TX100 Yellow Spot L O P T £10.00</b> <b>TX90 White Spot L O P T £15.00</b> <b>Split Diode 110" £12.50</b> <b>Orion 65 3M GEC 85-9793-6</b> <b>TX90 Thorn 2432101-2 £5</b> <b>2434141 EACH</b> <b>2434452</b> <b>2435066</b> <b>2434493 £10</b>		<b>36761</b> <b>36881</b> <b>2692120/10</b> <b>37051</b> <b>CTK Lopt</b> <b>36212</b> <b>33651</b> <b>36972</b> <b>36362</b> <b>36482</b> <b>36761</b> <b>36831</b> <b>36832</b> <b>36833</b> <b>36921/79</b> <b>36922/79</b>		<b>TX85 2435701</b> <b>2434393</b> <b>2435016</b> <b>2435014 £10</b> <b>2436797 £15</b>		<b>BRIDGE RECTIFIERS 10 FOR £1.00 4 Amp for Video Power Supply</b>	
<b>SATELLITE TUNER 950MHz-1750MHz £5.00</b>		<b>BURGLAR ALARM £2.00 with siren 9 VOLT</b>		<b>PHILIPS HALOGEN LIGHT. NEW. NO ON/OFF SWITCH. NO HANDLE WITH CORD. BLACK IN COLOUR £5</b>		<b>U/V 6, DIODE TRIPLERS £2.00</b>			
<b>TTT PANEL CMC 301 CMC 111 CMC 302 CMC 115 CMC £5 (0.303 CMC 964)</b>		<b>RELAYS 35p 5V-12V-24V-48V Large and Small</b>		<b>PHILIPS HAND SET G11 TEXT IN RED HAND SET £15.00</b>		<b>4600 TO 8600 AMSTRAD VIDEO HAND SET WITH LCD £10</b>			
<b>VIDEO LEADS 4 for £1</b>		<b>25 Way Plug and Socket with Case £1.50</b>		<b>G11 HAND SET ULTRASONIC £10</b>		<b>PHILIPS RC5 EASY CONTROL £10</b>			
<b>SEL ITT IIB254F/2 Front Panel £15.00</b>		<b>TRV3 Amstrad Cassette Mechanisms. New with 2 motors and sound head. £15</b> <b>TVR3 Power Supply. £5. Amstrad Television Tuner UHF. Small, Fits most Amstrads. £6.</b>		<b>PHILIPS SBC 522 RGB1 GENERATOR £90</b> <b>PHILIPS SBS 850 ANALOG MULTIMETER £11.50</b> <b>PHILIPS SBS 521 RF SIG GENERATOR £90.00</b> <b>FERGUSON TX110 — IK2 and IK7 MANUAL £1 each</b>		<b>FERGUSON ICC5 STEREO O.P. PANEL, ICs TDA8405 TDA8421 TBA1204 £10</b>			
<b>DECCA — GEC — ITT 6 push button £5.00</b>		<b>SENDZ SEE BACK PAGE</b>		<b>Burglar Alarm Has time delay to set £2</b> <b>Mains Transformer 240v in 110v to 120v out 1 amp post £3</b>					





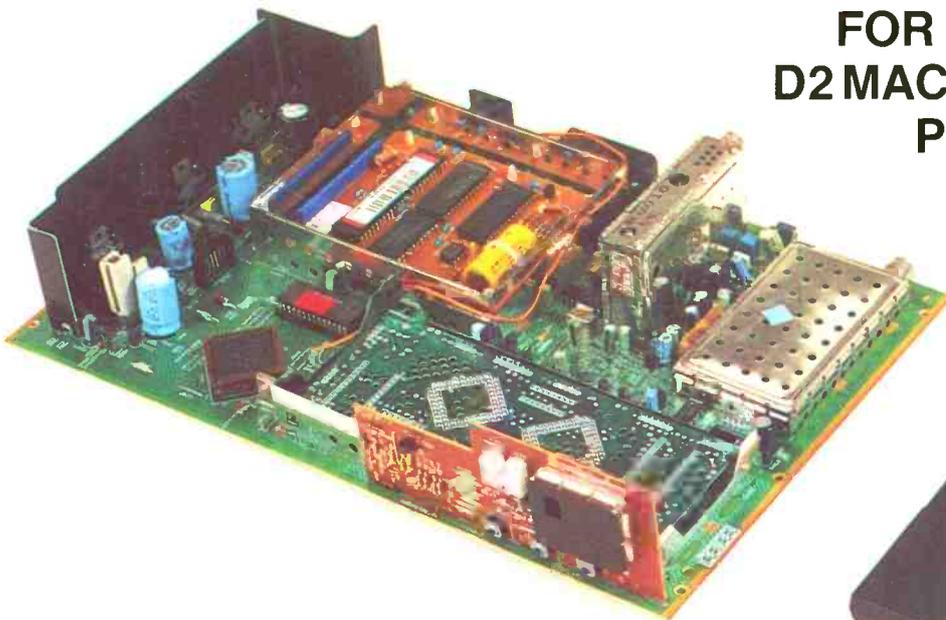
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