APRIL 1982

Australia $1.74; New Zealand $2.00; Malaysia $5.50; I.R. £1.18 (Inc. VAT)

80p

# TELEVISION

## SERVICING-VIDEO-CONSTRUCTION-DEVELOPMENTS

# INSIDE THE PHILIPS VR2020


## Part 1:
## ROUTINE TESTS ON POPULAR TVs
## IS IT THE AERIAL?
## plus
## ALL THE REGULAR FEATURES

# PHD COMPONENTS

## RADIO & TV COMPONENT DISTRIBUTORS
## UNIT 7 CENTENARY ESTATE
## JEFFRIES RD ENFIELD MIDDX
## SHOP NOW OPEN TELEX 261295

**ALL COMPONENTS OFFERED SUBJECT TO AVAILABILITY. WE RESERVE THE RIGHT TO SUBSTITUTE REPLACEMENTS SHOULD THE ORIGINAL PART BE OUT OF STOCK OR UNAVAILABLE!**

**PLEASE ADD 50p per parcel post and packing. Allow 5 days for delivery.**

### SEMICONDUCTORS

| | |
|---|---|
| AA113 | 0.16 |
| AA116 | 0.16 |
| AA117 | 0.16 |
| AA119 | 0.16 |
| OA91 | 0.12 |
| OA95 | 0.12 |
| OA202 | 0.18 |
| BA100 | 0.18 |
| BA102 | 0.10 |
| BA130 | 0.15 |
| BA154 | 0.10 |
| BA155 | 0.20 |
| BA164 | 0.12 |
| BAX13 | 0.16 |
| BAX16 | 0.08 |
| BAY38 | 0.16 |
| BY206 | 0.20 |
| IN4148 | 0.04 |
| BY126 | 0.20 |
| BY127 | 0.15 |
| BY133 | 0.22 |
| BY164 | 0.50 |
| SKB2/08 | 1.00 |
| BY238 | 0.15 |
| BYX10 | 0.18 |
| IN4001 | 0.10 |
| IN4002 | 0.10 |
| IN4003 | 0.12 |
| IN4004 | 0.12 |
| IN4005 | 0.12 |
| IN4006 | 0.14 |
| IN4007 | 0.16 |
| IN5407 | 0.33 |
| BR100 | 0.30 |
| BR101 | 0.60 |
| BRY39 | 0.60 |
| TIC1160N | 1.50 |
| BT119 | 2.00 |
| BT120 | 2.00 |
| BYX/71/600 | 0.80 |
| 2N444 | 1.50 |
| TV106/2 | 1.50 |
| BYXB8 2V7 | 0.10 |
| BZY88 3V0 | 0.10 |
| BZY88 3V3 | 0.10 |
| BZY88 3V6 | 0.10 |
| BZY88 3V9 | 0.10 |
| BZY88 4V3 | 0.10 |
| BZY88 4V7 | 0.10 |
| BZY88 5V1 | 0.10 |
| BZY88 5V6 | 0.10 |
| BZY88 6V2 | 0.10 |
| BZY88 6V8 | 0.10 |
| BZY88 7V5 | 0.10 |
| BZY88 8V2 | 0.10 |
| BZY88 9V1 | 0.10 |
| BZY88 10V | 0.10 |
| BZY88 11V | 0.10 |
| BZY88 12V | 0.10 |
| BZY88 13V | 0.10 |
| BZY88 15V | 0.10 |
| BZY88 18V | 0.10 |
| BZY88 20V | 0.10 |
| BZY88 22V | 0.10 |
| BZY88 27V | 0.10 |
| BZY88 33V | 0.10 |
| BZX61 7V5 | 0.20 |
| BZX61 8V2 | 0.20 |
| BZX61 9V1 | 0.20 |
| BZX61 10V | 0.20 |
| BZX61 11V | 0.20 |
| BZX61 12V | 0.20 |
| BZX61 13V | 0.20 |
| BZX61 15V | 0.20 |
| BZX61 16V | 0.20 |
| BZX61 18V | 0.20 |
| BZX61 20V | 0.20 |
| BZX61 22V | 0.20 |
| BZX61 24V | 0.20 |
| BZX61 27V | 0.20 |
| BZX61 30V | 0.20 |
| BZX61 33V | 0.20 |
| BZX61 36V | 0.20 |
| BZX61 39V | 0.20 |
| BZX61 47V | 0.20 |
| BZX61 72V | 0.20 |
| AC107 | 0.35 |
| AC127 | 0.50 |
| AC127/01 | 0.60 |
| AC128 | 0.60 |
| AC128/01 | 0.60 |
| AC141 | 0.50 |
| AC141K | 0.60 |
| AC142 | 0.40 |
| AC142K | 0.60 |
| AC176 | 0.60 |
| AC176/01 | 0.60 |
| AC186 | 0.40 |
| AC187 | 0.40 |
| AC187K | 0.60 |
| AC188 | 0.40 |
| AC188K | 0.60 |
| AD140 | 1.50 |
| AD142 | 1.50 |
| AD143 | 1.50 |
| AD145 | 1.50 |
| AD149 | 1.00 |
| AD161/2 | 1.50 |
| AD162 | 0.70 |
| AD262 | 1.50 |
| AF121 | 0.60 |
| AF124 | 0.60 |
| AF125 | 0.60 |
| AF126 | 0.60 |
| AF127 | 0.60 |
| AF139 | 0.60 |
| AF239 | 1.00 |
| AL102 | 3.00 |
| AU107 | 3.00 |
| AU110 | 3.00 |
| AU113 | 3.00 |
| AL103 | 3.00 |
| AY102 | 3.00 |
| BC107 | 0.20 |
| BC108 | 0.20 |
| BC109 | 0.20 |
| BC113 | 0.15 |
| BC114 | 0.15 |
| BC115 | 0.20 |
| BC116 | 0.20 |
| BC117 | 0.20 |
| BC118 | 0.20 |
| BC119 | 0.50 |
| BC125 | 0.20 |
| BC126 | 0.20 |
| BC136 | 0.20 |
| BC137 | 0.20 |
| BC138 | 0.40 |
| BC139 | 0.40 |
| BC140 | 0.40 |
| BC142 | 0.40 |
| BC143 | 0.40 |
| BC147 | 0.15 |
| BC148 | 0.10 |
| BC149 | 0.15 |
| BC153 | 0.15 |
| BC154 | 0.15 |
| BC157 | 0.15 |
| BC158 | 0.15 |
| BC159 | 0.15 |
| BC160 | 0.40 |
| BC161 | 0.40 |
| BC170 | 0.15 |
| BC171 | 0.15 |
| BC172 | 0.20 |
| BC177 | 0.20 |
| BC178 | 0.20 |
| BC179 | 0.20 |
| BC182L | 0.15 |
| BC183L | 0.15 |
| BC184L | 0.15 |
| BC184LC | 0.15 |
| BC186 | 0.30 |
| BC187 | 0.30 |
| BC203 | 0.15 |
| BC204 | 0.15 |
| BC205 | 0.15 |
| BC206 | 0.15 |
| BC207 | 0.15 |
| BC208 | 0.15 |
| BC209 | 0.15 |
| BC212L | 0.15 |
| BC213L | 0.15 |
| BC214L | 0.15 |
| BC225 | 0.40 |
| BC237 | 0.15 |
| BC238 | 0.15 |
| BC251A | 0.15 |
| BC301 | 0.40 |
| BC303 | 0.40 |
| BC307 | 0.15 |
| BC308 | 0.15 |
| BC327 | 0.15 |
| BC328 | 0.15 |
| BC337 | 0.15 |
| BC338 | 0.15 |
| BC547 | 0.15 |
| BC141-10 | 0.80 |
| BD115 | 0.50 |
| BD124 | 1.80 |
| BD131 | 0.70 |
| BD132 | 0.60 |
| BD133 | 0.70 |
| BD134 | 0.70 |
| BD144 | 2.50 |
| BD159 | 0.80 |
| BD238 | 0.50 |
| BD380 | 0.70 |
| BD441 | 0.70 |
| BD537 | 0.70 |
| BD538 | 0.70 |
| BD507 | 0.70 |
| BD508 | 0.75 |
| 16181 | 1.20 |
| 16182 | 1.20 |
| BD709 | 1.00 |
| BD710 | 1.00 |
| BD442 | 0.70 |
| BD379 | 0.50 |
| BF115 | 0.60 |
| BF118 | 0.60 |
| BF152 | 0.40 |
| BF154 | 0.20 |
| BF157 | 0.70 |
| BF158 | 0.40 |
| BF160 | 0.60 |
| BF163 | 0.60 |
| BF167 | 0.50 |
| BF173 | 0.50 |
| BF177 | 0.50 |
| BF179 | 0.50 |
| BF180 | 0.50 |
| BF181 | 0.60 |
| BF182 | 0.50 |
| BF183 | 0.50 |
| BF184 | 0.50 |
| BF185 | 0.50 |
| BF194 | 0.20 |
| BF195 | 0.20 |
| BF196 | 0.20 |
| BF197 | 0.20 |
| BF198 | 0.15 |
| BF199 | 0.15 |
| BF200 | 0.15 |
| BF224 | 0.15 |
| BF240 | 0.45 |
| BF241 | 0.20 |
| BF256LC | 0.50 |
| BF257 | 0.50 |
| BF258 | 0.50 |
| BF271 | 0.60 |
| BF273 | 0.20 |
| BF274 | 0.25 |
| BF336 | 0.50 |
| BF337 | 0.50 |
| BF338 | 0.50 |
| BF355 | 0.80 |
| BF458 | 1.00 |
| BF459 | 1.00 |
| BFT43 | 0.50 |
| BFX29 | 0.50 |
| BFX84 | 0.50 |
| BFX88 | 0.50 |
| BFX89 | 0.50 |
| BFY50 | 0.50 |
| BFY51 | 0.50 |
| BFY52 | 0.50 |
| BFY90 | 1.20 |
| BF381 | 0.50 |
| BFR39 | 0.30 |
| BFR79 | 0.30 |
| BFR81 | 0.30 |
| BFR89 | 0.50 |
| BF259 | 0.25 |
| BDX32 | 2.50 |
| BU206 | 1.60 |
| BU208/02 | 2.80 |
| BU326S | 1.00 |
| BU406 | 2.00 |
| BU406D | 2.50 |
| BU407 | 1.70 |
| BU407D | 2.50 |
| R2008B | 2.50 |
| R2010B | 2.50 |
| R2540 | 3.00 |
| ME0402 | 0.20 |
| ME0412 | 0.20 |
| ME4003 | 0.15 |
| ME6002 | 0.20 |
| ME8001 | 0.20 |
| MJE2955 | 1.50 |
| MJE3005 | 1.30 |
| MP8113 | 1.00 |
| MPSU05 | 1.20 |
| MPSU55 | 1.20 |
| TIP2955 | 1.30 |
| TIP3055 | 1.30 |
| TIS90M | 0.30 |
| 2N2904 | 0.50 |
| 2N2905A | 0.50 |
| 2N2905 | 0.50 |
| 2N3053 | 0.50 |
| 2N3703 | 0.20 |
| 2N3075 | 0.20 |
| 2N3710 | 0.20 |
| 2N3055H | 0.60 |
| TAA350 | 0.80 |
| TAA550 | 0.50 |
| TAA570 | 1.80 |
| TAA611 | 1.75 |
| TAA630S | 2.50 |
| TAA661B | 2.00 |
| SN76540N | 1.50 |
| TAD100 | 2.00 |
| TBA120AS | 0.75 |
| TBA231 | 1.20 |
| TBA480Q | 2.20 |
| TBA520Q | 2.00 |
| TBA530 | 2.00 |
| TBA530Q | 2.00 |
| TBA540 | 2.20 |
| TBA540Q | 2.20 |
| TBA550 | 3.00 |
| TBA550Q | 3.00 |
| TBA560C | 2.20 |
| TBA560CQ | 2.20 |
| TBA570 | 2.50 |
| TBA570Q | 2.50 |
| TBA641BX | 3.00 |
| TBA641B11 | 4.00 |
| TBA651 | 3.00 |
| TBA720A | 1.50 |
| TBA730 | 1.50 |
| TBA750 | 2.00 |
| TBA750Q | 2.00 |
| TBA800 | 1.00 |
| TBA810S | 1.50 |
| TBA820 | 1.50 |
| TBA920 | 2.00 |
| TBA920Q | 2.00 |
| TBA990 | 2.00 |
| TBA990Q | 2.00 |
| TCA2205A | 3.00 |
| TCA900 | 1.00 |
| TCA940 | 2.00 |
| TDA1170 | 2.00 |
| TDA1200 | 3.00 |
| TDA1270 | 4.00 |
| TDA1412 | 1.00 |
| TDA2020 | 4.00 |
| SN76115N | 2.00 |
| SN76227N | 1.20 |
| SN76530P | 1.00 |
| SN76651N | 1.50 |
| SN76003N | 3.00 |
| SN76013N | 2.00 |
| SN76013N0 | 2.00 |
| SN76013ND | 2.00 |
| SN76023N | 2.00 |
| SN76023ND | 1.00 |
| SN76033N | 2.00 |
| SN76110N | 2.00 |
| SN76226DN | 2.00 |
| SN76227N | 1.20 |
| SN76532N | 2.00 |
| SN76533N | 2.00 |
| SN76544N | 2.00 |
| SN766504 | 1.00 |
| SN76665N | 1.50 |
| SN76666N | 1.20 |
| SL901B | 6.00 |
| SL917B | 8.00 |
| TBA396Q | 2.00 |
| TDA440 | 2.50 |
| SN76001N | 1.50 |
| TBA520 | 2.00 |
| TBA120S | 1.00 |
| TBA396 | 2.00 |
| TCA270SQ | 2.00 |
| TDA2030 | 8.00 |
| TDA2140 | 6.00 |
| TDA2150 | 6.00 |
| TDA2160 | 6.00 |
| TDA1230 | 3.00 |
| TDA3089 | 2.00 |
| TDA1054M | 2.00 |
| MC1349P | 1.50 |
| SAA661 | 0.60 |
| SAS560S | 2.00 |
| SAS570S | 2.00 |
| SN7400N | 0.40 |
| SN7413N | 0.90 |
| SN74122N | 1.00 |
| SN74141N | 1.00 |
| TBA395 | 1.80 |
| TBA395Q | 1.80 |
| TBA950 | 4.00 |
| TCA800 | 4.00 |
| TCA800Q | 4.00 |
| TDA1180 | 3.00 |
| TDA1190 | 3.30 |
| TDA2002H | 3.60 |
| TDA2590Q | 5.00 |
| TDA2600 | 5.00 |
| TDA2640 | 3.30 |
| TDA3950 | 3.00 |
| TAA621 AX1 | 3.30 |
| TBA625X5 | 2.00 |
| TCA830S | 2.00 |
| TDA2020/A2 | 5.00 |
| TDA2020P | 5.00 |
| TDA2030V | 3.60 |
| TDA2010/BD2 | 4.50 |
| TDA2002V | 5.00 |
| TCA940E | 3.00 |

We can often supply equivalents to transistors & I.C's not listed. Free list on request with any order.

### VALVES

| | |
|---|---|
| DY/86/87 | 1.30 |
| DY802 | 1.80 |
| ECC82 | 1.40 |
| ECC84 | 1.20 |
| ECH83 | 1.10 |
| ECH84 | 1.10 |
| ECL80 | 1.10 |
| ECL82 | 1.10 |
| ECL86 | 1.10 |
| EF80 | 1.10 |
| EF95 | 1.50 |
| EF183 | 1.70 |
| EF184 | 1.60 |
| EL34 | 3.00 |
| EL84 | 2.00 |
| GY501 | 3.00 |
| PC97 | 1.50 |
| PC900 | 1.50 |
| PCF80 | 1.74 |
| PCF802 | 1.60 |
| PCF806 | 1.10 |
| PCL82 | 1.70 |
| PCL84 | 1.80 |
| PCL85/805 | 1.90 |
| PCL86 | 1.90 |
| PD500/510 | 5.00 |
| PFL200 | 2.60 |
| PL36 | 2.60 |
| PL81 | 1.50 |
| PL504 | 2.50 |
| PL508 | 2.50 |
| PL509 | 4.00 |
| PL519 | 5.00 |
| PL802 | 3.00 |
| PY88 | 1.70 |
| PY500A | 2.80 |
| PY800/801 | 1.70 |
| UCL82 | 1.10 |
| 30FL2/1 | 1.40 |
| PCF805 | 1.20 |
| PCF808 | 1.20 |
| PL519 - PY500A | 5.00 |

VALVES NOT SHOWN HERE MAY BE IN STOCK. PLEASE WRITE FOR QUOTE.

### DIRECT REPLACEMENT PARTS

| | |
|---|---|
| Decca 30 Series Lopt | 8.00 |
| 173 Tuner (Repl Elc 1043/05) | 8.00 |
| 4.443MHZ Crystals | 2.00 |
| Cut Out TCE 3500 | 2.50 |
| Cut Out GEC | 2.50 |
| Cut Out TCE 8500 | 2.00 |
| TV18 Rectifier Stick | 2.00 |
| TV20 Rectifier Stick | 2.00 |
| VA 1104 Thermister | 0.80 |
| Transductor TCE 3000 | 1.50 |
| AEG Tuner (Repl Elc 1043/06) | 9.00 |
| Aeriel Isolator Kit | 1.60 |
| Philips G8 Lopt | 12.00 |
| PYE 691/697 Lopt | 11.00 |
| Bush A 774 Lopt | 18.00 |
| Bush Q823 Lopt | 5.00 |
| Pye 731 IF Gain | 10.50 |
| A823 Bush Power Panel | 20.00 |
| PL 802T Transistorised | 4.00 |

BAHCO TOOLS – Come and see the full range at our shop or send for full catalogue free, on request, with any order.

### EHT MULTIPLIERS

| | |
|---|---|
| TCE950 Doubler | 2.00 |
| TCE950/1400 Tripler | 5.04 |
| TCE1400 (Piped System Only) | 4.56 |
| TCE1500 Doubler | 4.16 |
| TCE1500 Tripler | 4.64 |
| TCE1600 1/2 Wave | 3.95 |
| DECCA CS 1730/1830 Doubler | 4.23 |
| DECCA CS 1910/2213 Tripler | 6.67 |
| DECCA 30 Series Tripler | 6.01 |
| DECCA 80 Series Tripler | 6.43 |
| DECCA 100 Series Tripler | 6.68 |
| GEC Hybrid 2028 Tripler | 6.43 |
| GEC 2110 Tripler Pre JAN77 | 7.21 |
| GEC 2110 Tripler Post JAN77 | 6.43 |
| ITT CVC 5/8/9 Tripler | 6.51 |
| ITT CVC 20/25/30 | 6.45 |
| Philips 520 Tripler | 6.51 |
| Philips 550 Tripler | 6.42 |
| Philips G9 Tripler | 6.63 |
| PYE 691/693/697 Tripler | 6.68 |
| RRI 823 Tripler | 5.48 |
| RRI Z179/823 | 6.68 |
| TCE 3000/3500 Tripler | 5.51 |
| TCE 4000 Tripler | 8.00 |
| TCE 8000 Doubler | 3.53 |
| TCE 8500 Tripler | 5.60 |
| TCE 9000 Tripler | 7.28 |
| TVK 76/13 Continental Sets | 5.50 |
| TVK 52 ITT Replacement | 6.68 |
| Korting 90% Tripler | 6.50 |
| Autovox Tripler | 6.50 |
| Rediffusion MK 1 Tripler | 6.00 |
| RRI TV 25 Quadrupler | 4.00 |
| RRI T20 | 7.04 |

### MULTISECTION CAPACITORS

| | |
|---|---|
| DECCA 400 400/350 | 3.72 |
| DECCA 80/100 400/350 - 800/250 | 4.00 |
| GEC 200 200 150 50/350 | 3.00 |
| GEC 100 2000/35 | 1.10 |
| GEC Philips G8 600/250 | 2.10 |
| GEC Philips G8 600/300 | 2.50 |
| ITT KB 200 200 75 25/350 | 3.00 |
| ITT CVC 20 200/400 | 2.20 |
| Philips G11 470/250 | 1.90 |
| PYE 691 200 300/350 | 2.80 |
| PYE 1000 1000/40 | 0.90 |
| PYE 731 800/250 | 2.50 |
| RRI 2500 2500/30 | 1.30 |
| RRI 600/300 | 2.50 |
| RRI 300 - 300/300 | 2.50 |
| TCE 950 100 300 100 16 | 1.00 |
| TCE 1400 150 100 100 - 100 150 | 3.70 |
| TCE 1500 150 150 100 | 2.10 |
| TCE 3000/3500 175/400 - 100 - 100/350 | 2.70 |
| TCE 3000/3500 600/70 | 1.00 |
| TCE 3000/3500 220/100 | 0.70 |
| TCE 8000/8500 2500-2500/63 | 1.50 |
| TCE 8000/8500 700/200 | 1.00 |
| TCE 8000/8500 400/350 | 1.00 |
| TCE 9000 400/400 | 3.00 |
| TCE 9500 220/400 | 2.20 |

### MAINS DROPPERS

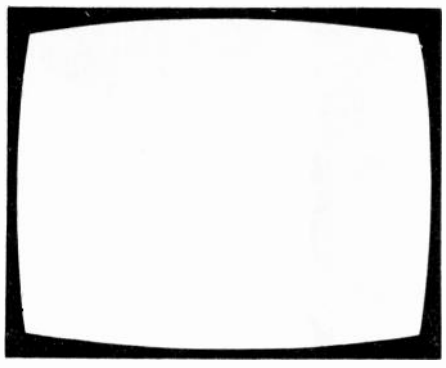
| | |
|---|---|
| TCE 140 12R - 16, IK7 - 116 462, 126 | 1.16 |
| TCE 1500 350 - 20, 128, IK5, 317 | 1.10 |
| TCE 1600 18 Thermal Link 320 - 70 39 | 1.10 |
| TCE 3000/3500 | 0.80 |
| TCE 8000/8000A 56 - 1K, 47, 12 5R - 1R - 100R | 1.00 |
| Philips G8 2.2 - 68 | 0.90 |
| Philips G8 47 | 0.80 |
| Philips 210 30 - 125, 2K85 | 0.70 |
| Philips 210 118 - 118 - 148 (Link) | 0.65 |
| RRI 154 - 50 - 16 94 | 0.60 |
| RRI A640 250 - 14 - 156 | 0.80 |
| GEC 27840 10 - 15 - 19 - 10 - 63 - 188 | 1.00 |
| GEC 2000 | 0.80 |
| PYE 731, 735 36 - 27 | 1.00 |
| PYE 11009 60 - 70 - 173 - 26 - 16 - 17 - 19 | 1.00 |
| RRI823 56R - 68R | 0.80 |

### CONNECTORS

| | |
|---|---|
| Sets of AVO Leads | 10.00 |
| Plug 13A (Box of 20) | 8.00 |
| AL Coax Plugs Pack of Ten | 1.80 |
| 6DB Attenuator | 1.00 |
| 12DB Attenuator | 1.00 |
| 18DB Attenuator | 1.00 |
| Back to Back Coax | 0.40 |

### SERVICE AIDS & TOOLS

| | |
|---|---|
| Super Servisol | 1.20 |
| Foam Cleanser | 1.20 |
| Silicone Grease | 1.20 |
| Plastic Seal | 1.20 |
| Aeroklene | 1.20 |
| Freezit | 1.20 |
| Antistatic | 1.20 |
| Solder 18 SWG 60/40 .5 KGM | 10.00 |
| SR2 Desoldering Tool | 9.70 |
| SR3AS Mini Silver | 7.00 |
| SR3A Mini Orange | 6.80 |
| Replacement Nozzles | 0.80 |
| Replacement Washers | 0.19 |
| Solder Mop Red | 0.60 |
| Solder Mop Brown | 0.60 |
| Side Cutters ORYX | 3.20 |
| TVTY 80/80 Transistor EQV A Z or 2N | 5.00 each |
| Books PR | 9.00 PP |



# TELEVISION

April 1982

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***CORRESPONDENCE***
All correspondence regarding advertisements should be addressed to the Advertisement Manager, "Television", King's Reach Tower, Stamford Street, London SE1 9LS. Editorial correspondence should be addressed to "Television", IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF.

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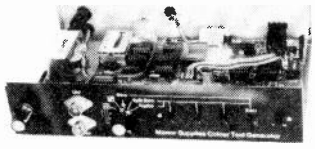
## this month



**OUR NEXT ISSUE DATED MAY WILL BE PUBLISHED ON APRIL 21**

# MANOR SUPPLIES

## NEW MKV CHEQUERBOARD & PAL COLOUR TEST GENERATOR FOR TV & VCR.



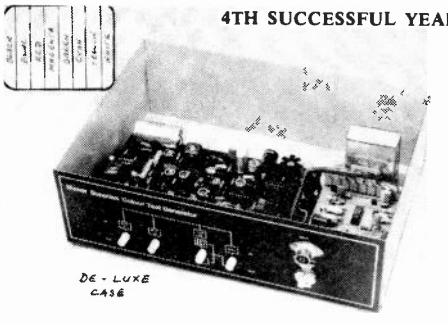
- ★ 40 different patterns and variations.
- ★ Broadcast transmission accuracy (fully interlaced sync pulses with correct picture blanking).
- ★ EBU colour bars, BBC colour bars, whole rasters & split bars (specially useful for VCR service), white, yellow, cyan, green, magenta, red, blue and black.
- ★ Chequerboard.
- ★ Mono outputs with border castellations, cross hatch, grey scale, vertical lines, horizontal lines and dots. UHF modulator output plugs straight into receiver aerial socket.
- ★ Additional video output for CCTV & VCR.
- ★ Facilities for sound output.
- ★ Easy to build kit. Only 2 adjustments. No special test equipment required.
- ★ Mains operated with stabilised power supply.
- ★ All kits fully guaranteed with back-up service.

**PRICE OF KIT £80.50.**
**DE LUXE CASE (10"×6¾"×2¼") £8.50**
**Post/Packing £2.00.**

**ALL ABOVE PRICE INCLUDE VAT 15%.**

## PAL COLOUR BAR GENERATOR (Mk 4)

**4TH SUCCESSFUL YEAR**




- ★ Output at UHF, applied to receiver aerial socket.
- ★ In addition to colour bars R–Y, B–Y etc.
- ★ Cross-hatch, grey scale, peak white and black level.
- ★ Push button controls, battery or mains operated.
- ★ Simple design, only five i.c.s. on colour bar P.C.B.

**PRICE OF MK4 COLOUR BAR & CROSS HATCH KIT £40.25 P&P £1.20. DE-LUXE CASE £5.95. ALUMINIUM CASE £3.30, P&P £1.20, BATT HOLDERS £1.70 P&P 85p, ALTERNATIVE STAB. MAINS SUPPLY KIT £5.55 (Combined P&P £1.80).**

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**VHF MODULATOR (CHI to 4) FOR OVERSEAS £4.60.**
**EASILY ADAPTED FOR VIDEO OUTPUT & C.C.T.V.**

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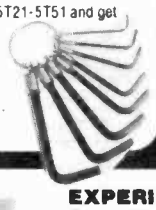

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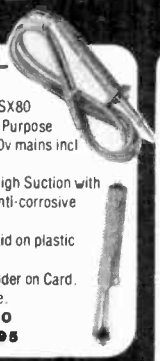

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| Polarity indication | Negative only. Positive readings appear without + sign |
| Input impedance | 10 Megohms |
| Zero adjust | Automatic |
| Sampling time | 250 milliseconcs |
| Temperature range | – 5°C to 50°C |
| Power Supply | 1 x PP3 or equivalent 9V battery |
| Consumption | 20mW |
| Size | 155 x 88 x 31mm |

RANGES
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AC Voltage 0-200-1000V.
Acc. 1.2% DC Current 0-200uA.
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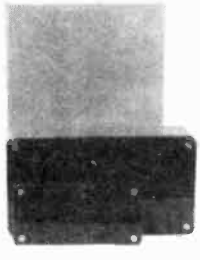

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| MC1330P | 90 | MRF475 | 2.50 | SN76532N | 1.50 | TAA300 | 58 | | 2.75 | TBA820 | 1.70 | TDA1327 | 1.00 | TDA2611A | 1.95 |
| MC1349 | 1.20 | MRF477 | 10.00 | SN76533N | 1.38 | TAA310 | 2.83 | TBA440P | 2.50 | TBA890 | 3.94 | TDA1352B | 1.80 | TDA2640 | 2.25 |
| MC1350 | 96 | SAS560S | 1.80 | SN76033N | 1.53 | TAA320 | 59 | TBA480 | 1.20 | TBA920 | 1.80 | TDA1412 | 1.20 | TDA2680 | 3.15 |
| MC1351 | 1.00 | SAS570S | 1.80 | SN76544N | 1.35 | TAA550 | 28 | TBA4800 | 1.20 | TBA920Q | 1.80 | TDA2002 | 2.50 | TDA2690 | 1.00 |
| MC1352 | 1.00 | SA5580 | 2.80 | SN76650N | 89 | TAA570 | 1.80 | TBA500P | 1.58 | TBA950(2X) | 2.40 | TDA2140 | 5.95 | TDA3560 | 2.95 |
| MC1358P | 1.50 | SA5590 | 2.90 | SN76660N | 60 | TAA630 | 2.50 | TBA510 | 3.00 | TBA970 | 4.09 | TDA2190 | 4.70 | TDA3950 | 2.38 |
| MC1495L | 1.00 | SL901B | 4.45 | SN76666N | 70 | TAA630S | 2.50 | TBA5200 | 1.20 | TBA990 | 1.49 | TDA2020 | 4.68 | TDA3960 | 2.95 |
| MC1401/BCP | 42 | SL917B | 6.25 | SW153 | 2.74 | TAA621 AX1 | 3.00 | TBA5300 | 1.28 | TBA1441 | 2.95 | TDA2030 | 2.80 | TDA9400 | 2.95 |
| MC1409U8 | 43 | SL1310 | 1.80 | TA7050P | 95 | TAA840/S1 | 1.95 | TBA530 | 1.20 | TCA160 | 1.20 | TDA2521 | 4.17 | UPC566H | 2.95 |
| ML231B/ETT6016 | 2.20 | SL1327Q | 1.20 | TA7051P | 95 | TAA700B | 1.70 | TBA540 | 1.49 | TCA780 | 2.30 | TDA2522 | 2.40 | UPC575C2 | 3.40 |
| ML232/ETT6016 | | SL76544 | 2.00 | TA7074P | 1.00 | TAA700 | 1.70 | TBA550 | 1.58 | TCA270SQ | 1.25 | TDA2523 | 2.20 | UPC1025H | 2.95 |
| CA3065 | 2.20 | SN76003N | 1.75 | TA7108P | 3.43 | TAA661B | 1.20 | TBA5500 | 1.58 | TCA800 | 1.99 | TDA2530 | 1.95 | UPC1025HI | 4.50 |
| ML236 | 5.35 | SN76013N | 1.50 | TA7120P | 2.43 | TBA120A | 70 | TBA5600 | 1.59 | TCA940 | 1.60 | TDA2532 | 2.45 | UPC1182H | 2.95 |
| ML237 | 1.95 | SN76013ND | 1.50 | TA7141P | 95 | TBA120S | 70 | TBA570 | 1.00 | TDA440 | 2.20 | TDA2524 | 2.25 | UPC1350C | 4.15 |
| ML238 | 4.20 | SN76023N | 1.45 | TA7193P | 5.67 | TBA120SA | 70 | TBA690 | 1.50 | TDA1002 | 1.95 | TDA2540 | 3.84 | **SOCKETS IC** | |
| ML239 | 2.50 | SN76023ND | 95 | TA7171P | 1.80 | TBA120AS | 70 | TBA673 | 1.10 | TDA1003A | 5.50 | TDA2541 | 2.65 | 8 pin 24 16 pin | 20 |
| | | | | TA7172P | 1.80 | TBA120B | 1.30 | TBA700 | 2.12 | TDA1004A | 2.95 | TDA2560 | 1.90 | 14 pin 18 14 pin Dil/Quil | 28 |

## SEMICONDUCTORS

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AC107 | 35 | BC107 | 20 | BC178 | 26 | BC328 | 9 | BD183 | 75 | BF154 | 12 | BF273 | 12 | BR103 | 59 |
| AC126 | 22 | BC107A | 20 | BC182 | 9 | BC337 | 11 | BD201 | 85 | BF158 | 18 | BF274 | 24 | BRC4443 | 80 |
| AC127 | 22 | BC107B | 20 | BC182LB | 10 | BC338 | 9 | BD202 | 80 | BF160 | 27 | BF310 | 30 | BRX48 | 40 |
| AC128 | 20 | BC108 | 20 | BC183LB | 10 | BC461 | 30 | BD203 | 80 | BF167 | 24 | BF311 | 30 | BRY39 | 30 |
| AC128K | 32 | BC108A | 20 | BC184/L/B/C | 10 | BC547 | 10 | BD204 | 84 | BF173 | 22 | BF336 | 36 | BRY56 | 57 |
| AC141K | 34 | BC108B | 20 | BC204 | 10 | BC548 | 10 | BD222 | 46 | BF177 | 35 | BF337 | 30 | BT106 | 1.00 |
| AC142K | 30 | BC108C | 20 | BC208 | 13 | BC549 | 8 | BD223 | 56 | BF178 | 26 | BF338 | 34 | BT108 | 1.24 |
| AC176 | 25 | BC109 | 20 | BC209 | 10 | BC550 | 7 | BD225 | 47 | BF179 | 28 | BF355 | 37 | BT109/500R | 1.20 |
| AC176K | 32 | BC109B | 20 | BC212 | 9 | BC557 | 8 | BD232 | 45 | BF180 | 36 | BF362 | 37 | BT116 | 1.21 |
| AC186 | 41 | BC109C | 20 | BC212L | 9 | BC558 | 9 | BD233 | 35 | BF181 | 36 | BF363 | 33 | BT119 | 3.66 |
| AC187 | 26 | BC114 | 12 | BC213 | 9 | BCX34 | 27 | BD234 | 37 | BF182 | 30 | BF371 | 30 | BT120 | 3.66 |
| AC187K | 28 | BC116A | 12 | BC213B | 10 | BCY72 | 13 | BD235 | 33 | BF183 | 29 | BF457 | 35 | BT151/800R | 1.20 |
| AC188 | 25 | BC117 | 20 | BC213L | 9 | BD115 | 32 | BD236 | 40 | BF184 | 30 | BF458 | 28 | BT151/800R | 1.20 |
| AC188K | 37 | BC119 | 24 | BC214 | 9 | BD116A | 65 | BD237 | 33 | BF185 | 30 | BF459 | 35 | BU104 | 2.00 |
| AD143 | 82 | BC140 | 32 | BC214L | 10 | BD124P | 60 | BD238 | 35 | BF194 | 11 | BF639 | 28 | BU105 | 1.25 |
| AD149 | 79 | BC141 | 26 | BC237B | 12 | BD131 | 33 | BD410 | 55 | BF195 | 11 | BF839 | 27 | BU108 | 1.80 |
| AD161 | 42 | BC142 | 21 | BC238A/B/C | 8 | BD132 | 35 | BD434 | 55 | BF196 | 10 | BFR39 | 27 | BU124 | 1.30 |
| AD161/2 | 1.15 | BC143 | 24 | BC251A | 12 | BD133 | 40 | BD437 | 86 | BF197 | 11 | BFR90 | 1.74 | BU126 | 1.49 |
| AD162 | 42 | BC147 | 9 | BC252A | 12 | BD135 | 26 | BD438 | 94 | BF198 | 18 | BFT42 | 28 | BU204 | 1.50 |
| AF106 | 49 | BC148 | 9 | BC252B | 12 | BD136 | 27 | BD507 | 52 | BF199 | 15 | BFT43 | 28 | BU205 | 1.34 |
| AF114 | 40 | BC149 | 10 | BC261A | 18 | BD137 | 26 | BD508 | 55 | BF200 | 30 | BFW10 | 60 | BU206 | 1.80 |
| AF118 | 82 | BC157 | 11 | BC261B | 15 | BD138 | 23 | BD509 | 56 | BF224 | 18 | BFX29 | 30 | BU208 | 1.80 |
| AF121 | 56 | BC158 | 10 | BC262A | 15 | BD139 | 28 | BD510 | 80 | BF241 | 15 | BFX84 | 27 | BU208A | 1.65 |
| AF124 | 34 | BC159 | 10 | BC262B | 15 | BD140 | 31 | BD517 | 80 | BF256LC | 28 | BFX85 | 28 | BU208/02 | 2.10 |
| AF125 | 35 | BC160 | 25 | BC300 | 33 | BD144 | 1.20 | BD520 | 75 | BF256 | 28 | BFX86 | 30 | BU326A | 1.42 |
| AF126 | 34 | BC161 | 28 | BC301 | 28 | BD159 | 65 | BD696A | 1.49 | BF257 | 28 | BFX88 | 25 | BU407 | 1.25 |
| AF127 | 32 | BC170B | 15 | BC303 | 28 | BD160 | 1.30 | BDX32 | 1.50 | BF258 | 25 | BFY50 | 20 | BU500 | 1.95 |
| AF139 | 42 | BC171 | 9 | BC307 | 10 | BD166 | 52 | BF115 | 35 | BF259 | 24 | BFY51 | 22 | EI222 | 28 |
| AF178 | 1.54 | BC171A | 10 | BC308A/B | 17 | BD179 | 52 | BF117 | 36 | BF262 | 84 | BFY52 | 20 | MJE340 | 40 |
| AF239 | 45 | BC171B | 10 | BC327 | 11 | BD182 | 72 | BF125 | 26 | BF263 | 50 | BFY90 | 75 | MJE520 | 44 |
| AF279 | 97 | BC172 | 9 | | | | | BF127 | 26 | BF271 | 24 | BR100 | 17 | MJ3000 | 2.36 |
| AL102 | 2.00 | BC172B | 10 | | | | | | | | | BR101 | 30 | | |
| AU106 | 2.50 | BC172C | 10 | | | | | | | | | | | | |
| AU107 | 2.00 | BC173C | 12 | | | | | | | | | | | | |
| AU110 | 2.00 | BC174A/B | 10 | | | | | | | | | | | | |
| AU113 | 1.40 | BC177 | 27 | | | | | | | | | | | | |

## WE NOW HAVE THESE SPECIAL CB INTEGRATED CIRCUITS

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|---|---|---|---|---|---|---|---|
| TA7205AP | 3.72 | | | | | | |
| 2SC1909 | 1.41 | MSN5807 | 7.87 | PLL02AG | 9.89 | LC7120 | 5.87 |
| 2SC495 | 1.10 | AN7150 | 3.97 | MC1351P | 1.00 | TA7204P | 3.77 |
| LC7130 | 5.93 | TA7222 | 4.07 | AN214Q | 3.91 | TA7130P | 1.93 |
| AN240 | 3.64 | TA7310P | 2.78 | LA4031P | 3.21 | UPC1156H | 4.28 |

Please enquire for others

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OC71 | 27 | 2N5496 | 53 | 2SA715 | 1.98 | 2SC1296 | 1.72 | 2SC1973Y | 1.68 | 2SC1306 | 2.73 | 2SC1307 | 3.00 | 2SC1449 | 1.67 |
| OC79 | 20 | 2N6107 | 75 | 2SC495 | 1.10 | 2SC1172Y | 2.20 | TIP30A | 47 | TIP30C | 43 | TIP31C | 41 | TIP32C | 42 |
| R20088 | 1.80 | 2N6109 | 81 | 2SC496 | 1.31 | 2SC1173Y | 1.68 | 2SC1306 | 2.73 | 2SC1307 | 3.00 | 2SC1449 | 1.67 | 2SC1520 | 68 |
| R20108 | 1.80 | 2SA715 | 1.98 | 2SC643A | 1.50 | 2SC1306 | 2.73 | 2SC1307 | 3.00 | 2SC1449 | 1.67 | 2SC1520 | 68 | 2SC1678 | 2.67 |
| R2285 | 1.40 | 2SC495 | 1.10 | 2SC1096 | 1.72 | 2SC1307 | 3.00 | 2SC1449 | 1.67 | 2SC1520 | 68 | 2SC1678 | 2.67 | 2SC1909 | 2.90 |
| R2322 | 58 | 2SC496 | 1.31 | 2SC1172Y | 2.20 | 2SC1449 | 1.67 | 2SC1520 | 68 | 2SC1678 | 2.67 | 2SC1909 | 2.90 | 2SC1953 | 1.44 |
| R2323 | 67 | 2SC643A | 1.50 | 2SC1173Y | 1.68 | 2SC1520 | 68 | 2SC1678 | 2.67 | 2SC1909 | 2.90 | 2SC1953 | 1.44 | 2SC2028 | 1.82 |
| R2461 | 1.50 | 2SC1096 | 1.72 | 2SC1306 | 2.73 | 2SC1678 | 2.67 | 2SC1909 | 2.90 | 2SC1953 | 1.44 | 2SC2028 | 1.82 | 2SC2029 | 2.60 |
| R2540 | 2.80 | 2SC1172Y | 2.20 | 2SC1307 | 3.00 | 2SC1909 | 2.90 | 2SC1953 | 1.44 | 2SC2028 | 1.82 | 2SC2029 | 2.60 | 2SC2078 | 2.90 |
| RCA16334 | 90 | 2SC1173Y | 1.68 | 2SC1449 | 1.67 | 2SC1953 | 1.44 | 2SC2028 | 1.82 | 2SC2029 | 2.60 | 2SC2078 | 2.90 | 2SC2091 | 1.34 |
| RCA16335 | 80 | 2SC1306 | 2.73 | 2SC1520 | 68 | 2SC2028 | 1.82 | 2SC2029 | 2.60 | 2SC2078 | 2.90 | 2SC2091 | 1.34 | 2SC2166 | 2.73 |
| TIP29C | 43 | 2SC1307 | 3.00 | 2SC1678 | 2.67 | 2SC2029 | 2.60 | 2SC2078 | 2.90 | 2SC2091 | 1.34 | 2SC2166 | 2.73 | OT112 | 1.91 |
| TIP30A | 47 | 2SC1449 | 1.67 | 2SC1909 | 2.90 | 2SC2078 | 2.90 | 2SC2091 | 1.34 | 2SC2166 | 2.73 | OT112 | 1.91 | OT121 | 1.91 |
| TIP30C | 43 | 2SC1520 | 68 | 2SC1953 | 1.44 | 2SC2091 | 1.34 | 2SC2166 | 2.73 | OT112 | 1.91 | OT121 | 1.91 | EF89 | 1.43 |
| TIP31C | 41 | 2SC1678 | 2.67 | 2SC2028 | 1.82 | 2SC2166 | 2.73 | OT112 | 1.91 | OT121 | 1.91 | EF89 | 1.43 | EF183 | 68 |
| TIP32C | 42 | 2SC1909 | 2.90 | 2SC2029 | 2.60 | OT112 | 1.91 | OT121 | 1.91 | EF89 | 1.43 | EF183 | 68 | EF184 | 68 |
| TIP33B | 75 | 2SC1953 | 1.44 | 2SC2078 | 2.90 | OT121 | 1.91 | EF89 | 1.43 | EF183 | 68 | EF184 | 68 | EH90 | 1.02 |
| TIP41C | 48 | 2SC2028 | 1.82 | 2SC2091 | 1.34 | EF89 | 1.43 | EF183 | 68 | EF184 | 68 | EH90 | 1.02 | EL34 | 1.63 |
| TIP42C | 47 | 2SC2029 | 2.60 | 2SC2166 | 2.73 | EF183 | 68 | EF184 | 68 | EH90 | 1.02 | EL34 | 1.63 | EL81 | 2.05 |
| TIP47 | 70 | 2SC2078 | 2.90 | OT112 | 1.91 | EF184 | 68 | EH90 | 1.02 | EL34 | 1.63 | EL81 | 2.05 | EL84 | 68 |
| TIP2955 | 90 | 2SC2091 | 1.34 | OT121 | 1.91 | EH90 | 1.02 | EL34 | 1.63 | EL81 | 2.05 | EL84 | 68 | EL90 | 82 |
| TIP3055 | 63 | 2SC2166 | 2.73 | EF89 | 1.43 | EL34 | 1.63 | EL81 | 2.05 | EL84 | 68 | EL90 | 82 | EL509 | 4.50 |
| TIS91 | 21 | OT112 | 1.91 | EF183 | 68 | EL81 | 2.05 | EL84 | 68 | EL90 | 82 | EL509 | 4.50 | EY86/7 | 88 |
| TV106/02 | 1.55 | OT121 | 1.91 | EF184 | 68 | EL84 | 68 | EL90 | 82 | EL509 | 4.50 | EY86/7 | 88 | EY500A | 1.50 |
| 2N696 | 21 | EF89 | 1.43 | EH90 | 1.02 | EL90 | 82 | EL509 | 4.50 | EY86/7 | 88 | EY500A | 1.50 | | |
| 2N2904 | 51 | SW150 | 3.90 | EL34 | 1.63 | EL509 | 4.50 | EY86/7 | 88 | EY500A | 1.50 | | | | |
| 2N2905 | 28 | SW153A | 2.74 | EL81 | 2.05 | EY86/7 | 88 | EY500A | 1.50 | | | | | | |
| 2N3054 | 60 | BU105/02 | 1.58 | EL84 | 68 | EY500A | 1.50 | | | | | | | | |
| 2N3055 | 60 | **THERMISTORS** | | EL90 | 82 | | | | | | | | | | |
| 2N3702 | 11 | VA1104 | 75 | EL509 | 4.50 | | | | | | | | | | |
| | | VA8650 | 55 | EY86/7 | 88 | | | | | | | | | | |
| 2N3703 | 10 | VA1039 | 35 | EY500A | 1.50 | | | | | | | | | | |
| 2N3705 | 10 | GEC Dual Posistor 2040 | 1.50 | | | | | | | | | | | | |
| 2N3706 | 10 | | | | | | | | | | | | | | |
| 2N3708 | 17 | | | | | | | | | | | | | | |
| 2N2904 | 30 | **CRYSTALS** | | | | | | | | | | | | | |
| 2N5294 | 48 | 4.3Mhz | 1.30 | | | | | | | | | | | | |
| 2N5296 | 48 | 8.8Mhz | 1.30 | | | | | | | | | | | | |
| 2N5298 | 69 | | | | | | | | | | | | | | |

**CERAMIC FILTERS**

| | |
|---|---|
| 6Mhz | 74 |
| 5.5Mhz | 74 |

## NEW VALVES

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 30FL2 | 1.41 | EZ80/1 | 56 | PD500 | 2.93 | | |
| DY802 | 72 | GY501 | 1.45 | PFL200 | 1.35 | | |
| DY86/7 | 68 | GZ34 | 1.56 | PL36 | 1.15 | | |
| ECC81 | 80 | KT66 | 7.00 | PL81 | 94 | | |
| ECC82 | 68 | KT88 | 6.00 | PL82 | 46 | | |
| ECC83 | 80 | PC86 | 81 | PL83 | 1.43 | | |
| ECC84 | 80 | PC88 | 81 | PL84 | 84 | | |
| ECC85 | 98 | PC92 | 80 | PL95 | 1.00 | | |
| ECC88 | 1.35 | PC97 | 1.14 | PL504 | 1.50 | | |
| ECF80 | 80 | PC900 | 80 | PL508 | 1.50 | | |
| ECF82 | 88 | PCC84 | 70 | PL509/19 | 3.50 | | |
| ECF86 | 1.50 | PCC85 | 85 | PL802 | 3.00 | | |
| ECH81 | 1.04 | PCC88 | 82 | PY33 | 61 | | |
| ECH84 | 1.13 | PCC89 | 79 | PY88 | 81 | | |
| ECL80 | 84 | PCC189 | 1.02 | PY500A | 1.40 | | |
| ECL82 | 77 | PCC805 | 1.40 | PY800/1 | 69 | | |
| ECL86 | 84 | PCF80 | 75 | UCF80 | 67 | | |
| EF80 | 68 | PCF86 | 1.13 | UCH81 | 1.43 | | |
| EF85 | 68 | PCF200 | 1.35 | UCL82 | 84 | | |
| EF86 | 1.19 | PCF800 | 1.38 | UCL83 | 94 | | |
| EF89 | 1.43 | PCF801 | 1.13 | UL84 | 1.02 | | |
| EF183 | 68 | PCF802 | 86 | U26 | 1.30 | | |
| EF184 | 68 | PCF805 | 1.80 | U191 | 95 | | |
| EH90 | 1.02 | PCF806 | 1.30 | 6F23 | 86 | | |
| EL34 | 1.63 | PCF808 | 1.63 | UY85 | 80 | | |
| EL81 | 2.05 | PCH200 | 1.46 | PL802T | 2.75 | | |
| EL84 | 68 | PCL82 | 78 | 40KD6 | 4.50 | | |
| EL90 | 82 | PCL83 | 2.00 | 21LU8 | 3.00 | | |
| EL509 | 4.50 | PCL84 | 81 | 17DW4A | 1.80 | | |
| EY86/7 | 88 | PCL85/805 | 90 | 3AT2B | 2.25 | | |
| EY500A | 1.50 | PCL86 | 81 | | | | |

**All valves are new – boxed – guaranteed.**

Please add 15% VAT to **ALL** items.

## DIODES

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|---|---|---|---|---|---|
| AA119 | 9 | BY210/800 | 33 | IN4448 | 10 |
| BA102 | 17 | BY223 | 90 | IN5401 | 12 |
| BA115 | 13 | BY227 | 28 | IN5402 | 14 |
| BA145 | 17 | BY298 | 22 | IN5403 | 12 |
| BA148 | 17 | BY299 | 22 | IN5404 | 12 |
| BA154 | 6 | BYX10 | 20 | IN5405 | 13 |
| BA155 | 14 | BYX38/10 | 30 | IN5406 | 16 |
| BA156 | 15 | BYX36/600 | 35 | IN5407 | 16 |
| BA317 | 26 | BYX55/600 | 30 | IN5408 | 16 |
| BAX13 | 4 | BYX71/600 | 90 | ITT44 | 4 |
| BAX18 | 8 | OA47 | 9 | ITT2002 | 11 |
| BB1058 | 30 | OA90 | 5 | Y969 (30V Thorn 3500) | 89 |
| BB105G | 30 | OA91 | 6 | | |
| BY126 | 12 | OA95 | 6 | | |
| BY127 | 11 | OA202 | 11 | | |
| BY133 | 15 | IN914 | 4 | | |
| BY184 | 45 | IN4001 | 4 | | |
| BY176 | 85 | IN4002 | 4 | | |
| BY179 | 83 | IN4003 | 4 | | |
| BY182 | 87 | IN4004 | 5 | | |
| BY184 | 55 | IN4005 | 5 | | |
| BY199 | 28 | IN4006 | 5 | | |
| BY206 | 14 | IN4007 | 6 | | |
| BY210/600 | 28 | IN4148 | 2 | | |

## ZENER DIODES

| BZX61/BZX85C(1.3W) | BZY88-(400MW) |
|---|---|
| 6V2-7V5-8V2-9V1 | 2V7-3V-3V3-3V6 |
| 10V-11V-12V-13V-15V | 3V9-4V3-4V7-5V1 |
| 16V-18V-20V-22V-24V- | 5V6-6V2-6V8-7V5 |
| 27V-30V-33V-36V | 8V2-9V1-10V-11V |
| 39V-47V-56V-68V | 12V-13V-15V-18V |
| 75V | 24V-27V |
| Price **20p** each | Price **10p** each |

**ACCESS ACCEPTED**

## RECTIFIER TRAYS

| | |
|---|---|
| THORN 950 Mk II | 4.25 |
| THORN 1400 3 Stick | 4.25 |
| THORN 1500 3 Stick | 4.55 |
| THORN 1500 5 Stick | 4.85 |
| THORN 1600 | 3.90 |
| THORN 3000/3500 | 7.39 |
| THORN 8000 | 4.25 |
| THORN 8500/8800 | 6.10 |
| THORN 9000 | 7.93 |
| DECCA 1730/1830 | 4.08 |
| DECCA 1910/2213 Bradford | 5.92 |
| DECCA 30 | 6.26 |
| DECCA 80 | 6.40 |
| DECCA 100 | 6.14 |
| UNIVERSAL I.T.T | 8.00 |
| GEC 2100 | 7.40 |
| GEC 2200 (20AX) | 6.50 |
| GEC 2040/2028 | 5.79 |
| GEC 2110 Pre Jan '77 | 7.00 |
| GEC 2110 Post Jan '77 | 7.00 |
| PHILIPS G8 Short Focus Lead | 6.35 |
| PHILIPS G8 Long Focus 550 | 6.35 |
| PHILIPS G9 | 8.33 |
| PYE 691/3 | 5.83 |
| PYE 713 4 Lead | 7.00 |
| PYE 731/25 | 8.75 |
| R.B.M A823 (plug in) AV | 6.45 |
| R.B.M. A823 | 6.45 |
| KORTING (similar to Siemens TVK1) | 6.85 |
| ITT KB CVC5/9 | 5.95 |
| ITT KB CVC20/25/30 (Mullard Type) | 5.95 |
| RRI T20 | 6.80 |

## RECTIFIER STICKS

| | |
|---|---|
| TV11 | 74 |
| TV18 | 61 |
| TV20 | 95 |
| TV13 | 75 |

## TRANSFORMERS L.O.P.T.

| | |
|---|---|
| R.B.M A774 Mono | 11.74 |
| R.B.M. Z179 | 15.00 |
| R.B.M. Z718 22" | 19.50 |
| R.B.M T20A | 13.95 |
| PHILIPS 210/300 Mono | 10.00 |
| PHILIPS G8 | 8.75 |
| PHILIPS G9 | 7.75 |
| PHILIPS G11 | 13.50 |
| PYE 691/3 | 17.75 |
| PYE 697 (Printed) | 14.50 |
| PYE 713 | 10.00 |
| PYE 731 | 10.00 |
| PYE 725 90° | 10.50 |
| PYE 169 | 10.00 |
| DECCA 80 | 8.58 |
| DECCA 100 | 8.58 |
| DECCA 1700 | 9.00 |
| DECCA 1730 | 8.56 |
| DECCA 2230 | 8.58 |
| GEC 2110 | 9.45 |
| GEC 2040 | 9.50 |
| GEC 2200 | 8.85 |
| ITT CVC 1-9 | 9.60 |
| ITT CVC 25/30/32 | 8.00 |
| ITT CVC 20 | 7.75 |
| THORN 3000 EHT | 6.90 |
| THORN 3000 SCAN | 6.90 |
| THORN 8000 | 11.33 |
| THORN 8500 | 11.33 |
| THORN 9000 | 10.85 |
| THORN 3000/3500 Mains Trans | 10.00 |
| THORN 1591 | 8.68 |
| THORN 1691 | 9.68 |
| THORN 9800 | 1800 |

## PANELS

| | |
|---|---|
| I.F Gain Module (Pye, Philips) | 9.00 |
| C.O.A PANEL (Pye, Ecko, Invicta, Oynatron) | 20.00 |
| CONVERGENCE PANEL Philips G8 | 20.00 |

## NEW MONO TUBES

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|---|---|
| MULLARD A31/510 110° 12" | 17.00 |
| MULLARD A34/510 110° 14" | 18.50 |
| VEGA A50/120WR .20" | 13.50 |
| VEGA A61/120WR 24" | 15.00 |
| VEGA 12" 90° (Japanese Types) | 15.00 |

## REBUILT COLOUR TUBES

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| 17"-18"-19"-20"-22" | £30.00 |
| 26"-25" | £34.00 |
| 26" 110° | £36.00 |

Glass for Glass exchange
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## MULLARD COLOUREX TUBES OR THORN NEW LIFE TUBES

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| 18" A47/342X-A47/343X | 50.00 |
| 19" A49/120X | 52.00 |
| 20" A51/120X | 52.00 |
| 22" A56/120X | 42.00 |
| 25" A63/120X | 54.00 |
| 26" A66/120X | 53.00 |
| 28" A67/120X | 53.00 |

**"COLOUR TUBES COLLECTION FROM TRADE COUNTER ONLY."**

# P. V. TUBES

Telephone: Accrington (0254) 36521

## REPLACEMENT ELECTROLYTICS

| | |
|---|---|
| DECCA 30 (400/400/350V) | 2.98 |
| DECCA 80 (400/350V) | 3.15 |
| DECCA 100 (800/250V) | 3.15 |
| DECCA 1700 (200/200/400/350V) | 4.83 |
| PHILIPS G8 (600/300V) | 2.21 |
| PHILIPS G9 (600/300V) | 2.21 |
| PHILIPS G11 (470/250V) | 2.90 |
| PYE 691/7 (200/300/350V) | 2.39 |
| PYE 731 (600/300V) | 2.31 |
| RBM A823 (2500/2500/30V) | 1.28 |
| RBM A823 (600/300V) | 2.30 |
| RBM Z146 (300/300/350V) | 3.15 |
| RR1 T20A (200/400V) | 2.00 |
| ITT CVC5/9 (200/200/75/25) | 2.47 |
| ITT CVC 20 (220/400V) | 2.00 |
| GEC 2110 (600/250V) | 1.94 |
| GEC 2040 (1000/2000/35V) | 1.19 |
| GEC 2040 (300/300/150/100/50) | 4.10 |
| THORN 3500 (400/40V) | 30 |
| THORN 950 (100/300/100/16/275V) | 1.83 |
| THORN 1400 (150/100/100/100/150/320V) | 2.79 |
| THORN 1500 (150/150/100/300V) | 2.01 |
| THORN 1500 (12/300V) | 31 |
| THORN 3500 (175/100/100/400/350V) | 2.48 |
| THORN 3500 (1000/63V) | 85 |
| THORN 3500 (1000/70V) | 84 |
| THORN 8000/8500 (2500/2500/63V) | 1.54 |
| THORN 8000/8500 (700/250V) | 2.31 |
| THORN 8000/8500 (400/350V) | 2.58 |
| THORN 9000 (400/400V) | 3.05 |

## MIXED DIELECTRIC CAPACITORS

| Volts DC | | |
|---|---|---|
| 250V | 0.91 MF (Philips) | 84 |
| 400V | 0.022 MF | 15 |
| 600V | 0.1 mFd | 38 |
| 1000V | 0.01 mFd | 20 |
| | 0.047 mFd | 29 |
| | 0.1 mFd | 32 |
| | 0.22 mFd | 48 |
| | 0.47 mFd | 75 |
| 1250V | 0.1 mFd | 45 |
| 1500V | 0.0022 mFd | 18 |
| | kD 0047 mFd | 20 |
| | 0.022 mFd | 24 |
| | 0.033 mFd | 59 |

## CAPACITORS

AXIAL TYPE

| Volt | MF | price | Volt | MF | Price |
|---|---|---|---|---|---|
| 10 | 22 | 7 | 63 | 10 | 9 |
| | 47 | 7 | | 22 | 11 |
| | 100 | 8 | | 47 | 16 |
| | 220 | 11 | | 100 | 18 |
| | 470 | 18 | | 220 | 30 |
| 16 | 1000 | 20 | | 470 | 38 |
| 25 | 10 | 7 | | 1000 | 53 |
| | 22 | 7 | | 2200 | 85 |
| | 47 | 9 | 100 | 10 | 12 |
| | 100 | 10 | | 22 | 14 |
| | 220 | 17 | | 47 | 19 |
| | 470 | 22 | | 100 | 29 |
| | 1000 | 35 | | 220 | 35 |
| | 2200 | 48 | 300 | 12 | 30 |
| | 4700 | 60 | 450 | 1 | 23 |
| 40 | 22 | 9 | | 4.7 | 28 |
| 50 | 500 | 38 | | 10 | 28 |
| 63 | 1 | 7 | | 22 | 56 |
| | 2.2 | 7 | | 33 | 62 |
| | 4.7 | 7 | 500V | 1 | 30 |

## DISC CERAMIC CAPACITORS

| | | High Voltage | | |
|---|---|---|---|---|
| 8KV d.c.-12KV d.c. | 30 | 180pF | | 30 |
| 39 pF | 30 | 200pF | | 30 |
| 140pF | 30 | 220pF | | 30 |
| 150pF | 30 | 250pF | | 30 |

## TEST EQUIPMENT

| | |
|---|---|
| Portable Oscilloscope | 150.00 |
| Probes × 10 | £10.90 |
| TF200 Frequency Metre | 155.00 |
| CRT Tester/Rejuvenator | 172.00 |
| Degausing Coil (stick type) | 16.50 |
| KHP 30N Measuring Probe (30KV) EHT | 29.95 |

## WIREWOUND RESISTORS

PREFERRED VALUES

| | | price each |
|---|---|---|
| 4W/5W | | |
| | 1R-1K5 | 20 |
| | 2K2-3K3 | 20 |
| | 4K7-6K8 | 20 |
| | 10K | 25 |
| 7W | | |
| | 1R-4K7 | 21 |
| | 5K6-12K | 21 |
| | 15K-22K | 21 |
| 11W | | |
| | 1R-6K8 | 24 |
| | 10K-15K | 24 |
| | 22K | 24 |
| 17W | | |
| | 1R-10K0 | 28 |
| | 15K-22K | 28 |

## RESISTORS

A range of the following at Preferred Values

| | | Price per 10 pack |
|---|---|---|
| 0.25W | | 20p |
| 0.5W | 3R3 to 8M2 | 20p |
| 1W | 10R to 10M | 36p |
| 2W | 10R to 10M | 62p |

## SKELETON PRESET POTENTIOMETER HORIZONTAL and VERTICAL

**MINIATURE** price each 14

100R-220R-470R-1K0-2K2-4K7-10K-22K-47K 100K
220K-470K-1M0

**STANDARD** price each 14

100R-220R-470R-1K0-2K2-4K7-10K-22K-47K
100K-220K-470K-1M0-2M2-4M7

## 'MIDGET' CONTROLS

Insulated spindle length 44mm.

**LESS SWITCH** 39p
Log or Lin
5K-10K-25K-50K-100K-250K-500K-1M

**WITH D.P.S.T. SWITCH**
**Log:** 5K-10K-25K-50K-100K 81p
250K, 500K, 1M, 2M

## SLIDER POTENTIOMETERS

Lin or Log

| | | | |
|---|---|---|---|
| 470R | 55p | 4K7 | 55p |
| 1K | 55p | 10K | 55p |
| 2K2 | 55p | 47K | 55p |

## MULTITURN POTENTIOMETERS

| | |
|---|---|
| 100K | |
| GEC/TCE | 55p |
| PHILIPS G8 | 55p |
| DECCA/RANK | 55p |

## THICK FILM RESISTOR NETWORKS

| | |
|---|---|
| THORN 3500 (5 pin connection) | 1.98 |
| PYE 731 (6 pin connection) | 2.20 |
| THORN 9000 (Circuit Ref R704/7) | 1.98 |

## CONVERGENCE PRE-SET POTS

| | |
|---|---|
| 3 Watt complete with knob | each |
| 5R0-6R8-10R-15R-20R | |
| 50R-100R-200R-500R | 35 |

## METRIC CONVERGENCE POTS

| | |
|---|---|
| Philips G8 | |
| 5R-10R-20R-50R | 35 |

## EAGLE PRODUCTS

Please send large S.A.E. for full EAGLE Catalogue.

| | | |
|---|---|---|
| SE500 Headphones | | 3.75 |
| SE540 Headphones with Volume Control | | 5.50 |
| SE600 Lightweight Headphones | | 7.95 |
| **Multimeters** | | |
| KEW 7N | 2,000 opv | 5.25 |
| EM5 | 5,000 opv | 9.95 |
| EM10 | 10,000 opv | 11.50 |
| EM50 | 50,000 opv | 19.95 |
| EMC321 Carrying Case for above | | 2.25 |
| Digital Meter TS1000 | | 44.50 |
| MM20 20,000 O P V | | 21.95 |
| MM50 50,000 O P V | | 25.95 |
| MM100 100,000 O P V | | 36.50 |
| Case for MM100 | | 15.95 |
| T1206 2 Station Intercom. | | 8.95 |

## DATA BOOKS (No VAT)

| | |
|---|---|
| Transistor Equivalent | |
| TVT 80 A-Z only | 3.75 |
| TVT 80 2N/2S series only | 4.00 |
| TVT 80/80 A-Z and 2N/2S together | 7.50 |
| LIN IC Books LIN 1 | 5.95 |
| LIN 2 | 5.95 |

## ELECTRONIC TUNERS AND ASSEMBLIES

| | |
|---|---|
| Mullard ELC1043/05 | 7.80 |
| Mullard ELC1043/06 | 7.80 |
| 4 P/B DECCA/GEC/ITT | 6.80 |
| 6 P/B DECCA/GEC/ITT | 7.00 |
| 4 P/B PYE | 9.00 |
| 6 P/B PYE | 10.00 |
| PHILIPS G8 Tuner | 10.50 |
| PHILIPS G8 Ass. (Square/Early) | 13.50 |
| PHILIPS G8 Ass (Sloping/Late) | 13.90 |
| PHILIPS G9 Tuner | 10.50 |
| PHILIPS G11 Tuner | 9.00 |
| ITT/PYE/GEC 7 Button P/B | 13.95 |
| GEC 2110 6 way P/B | 7.75 |
| U321 UHF Tuner | 7.50 |
| THORN 8800 SELECTOR (HMV Model 2725/6 way round button) | 7.50 |
| THORN 9000 SELECTOR | 11.40 |
| U322 | 7.20 |
| HITACHI 4 way Chan. Selector | 9.00 |
| RR1 T20A 6 way Chan. Selector | 9.75 |

## SUNDRY TUNER ACCESSORIES

| | |
|---|---|
| RANK Tuner Push Button 1¼" × ¼" dia. | 35p |
| RANK Tuner Push Button 2" long ¼ dia. | 35p |
| GEC Tuner Neons 2110 chassis | 14p |
| Drive Cams | each 10p |

## SWITCHES

| | |
|---|---|
| 4A Double Pole On/Off Switch General Purpose Push/push | 62 |
| Philips G8 Push On/Off Switch | 1.38 |
| 4A Double Pole Rotary On/off | 62 |
| A1 Beam Switch (THORN 3500) | 50 |
| A1 Controls 5m (THORN 3500) | 89 |
| GEC 2110 A1 Control IM5 (Red, Blue, Green) | each 58p |
| GEC 2040 On/Off Switch | each 68p |
| On/Off Switch G11/G12 | 1.58 |
| On/Off Switch GEC 2040/TCE TX9-10 | 1.08 |

## THERMAL CUT OUT

| | |
|---|---|
| THORN 3000 2A Metal | 1.60 |
| THORN 8500 2 5 Plastic | 1.60 |
| GEC 2040 Metal | 2.50 |

## PYE LABGEAR

| | |
|---|---|
| CM6040/WB UHF Masthead (ch21-68) | 18.86 |
| CM7025 UHF High Gain M.H.A. 24V (specify group A, B or C0) | 15.88 |
| CM7061 Power Unit (12V) | 11.38 |
| CM7065/WB VHF/UHF M.H.Amp (12V) | 13.44 |
| CM7073 VHF/UHF Dist Amp (8+1) | 38.85 |
| CM7053 'Behind the set' UHF Amp. (mains) | 11.27 |
| CM7043 'Behind the set' 2nd Set Amp. (UHF-2 outputs) | 10.58 |
| CM6006 UHF 6 way Passive Splitter | 11.28 |
| CM7042 TV Games Combiner | 3.48 |
| CM9003 Flush Mount Single Outlet Isolated | 1.84 |
| CM9009 Flush TV/FM Diplex Outlet Isolated | 3.15 |
| CM7069 Tri Star Amplified Set Top Aerial (ch21-68) UHF | 18.38 |
| CM6038 VHF/UHF 625 TV Patt Generator | 102.38 |
| CM6052 UHF/VHF Pal Colour Bar Generator | 226.75 |
| 7056 TELETEXT ADAPTOR (Converts any set to remote) | 219.30 |
| AMPLIFIED CARAVAN AERIAL (All Channels) | 19.43 |

## FUSES

| | Pack of 10 |
|---|---|
| 1¼" QUICK BLOW | |
| 100ma | 73 |
| 250ma-500ma-750ma-1A | 54 |
| 1.5A-2A-2.5A-3A-5A | 45 |
| 1¼" ANTISURGE | |
| 250ma, 500ma 600ma, 630ma, 750ma, 850ma, 1A, 1.25A | |
| 1.5A, 2A | 1.60 |
| 2.5A, 3A, 5A | 2.49 |
| 20m ANTISURGE | |
| 80ma | 3.43 |
| 100ma | 2.30 |
| 160ma, 200ma | 2.09 |
| 315ma, 500ma, 630ma, 800ma, 1A, 1.25A, 1.6A, 2A | 1.18 |
| 2.5A, 3.15A | 1.59 |
| 20mm QUICK BLOW | |
| 100ma, 250ma, 500ma, 630ma, 800ma, | 61 |
| 1A, 1.25A, 1.6A, 2A, 2.5A, 3.15A, 5A | 40 |
| 1" MAINS | |
| 2A, 3A, 5A, 10A, 13A | 91 |

## MAINS DROPPERS

| | |
|---|---|
| OECCA 20 | 2.20 |
| OECCA 2R5 | 50 |
| OECCA 27R/47R | 75 |
| OECCA 56R/68R | 75 |
| R.B.M. A823 | 88 |
| R.B.M. 161 | 62 |
| GEC 2000/2018 | 70 |
| GEC27840 | 84 |
| PYE 713/15 3R5/15/45R | 1.70 |
| PYE 725/31 3R0/56R/27R | 1.19 |
| PYE 725 56R/27R | 1.04 |
| PHILIPS 210/5050 30R/125R/2k85 | 1.75 |
| PHILIPS 210/5051 -/118R/148R | 93 |
| PHILIPS G8/5081 47R Section | 50 |
| PHILIPS G8/5083 2R2/68R | 85 |
| THORN 1400 | 1.15 |
| THORN 1500 | 1.32 |
| THORN 1600 | 1.60 |
| THORN 3500 | 84 |
| THORN 8000 | 98 |
| THORN 8500 | 88 |

## SUNDRIES

| | | |
|---|---|---|
| ANTIFERENCE Super Set Top | | 6.80 |
| ANTIFERENCE Car antenna | | 7.80 |
| Triangular Splitter | | 1.20 |
| Surface Mounting Splitter | | 1.70 |
| Delay Lines DL60 | | 2.20 |
| Delay Lines DL700 | | 2.20 |
| G8 Knobs small/large | | 50 |
| Surface Mounting Aerial Outlets | | 80 |
| Cable Clips | per 100 | 1.18 |
| Transductor 90° | | 2.00 |
| EHT Final Anode Cap | | 53 |
| Delay Line CTAV 82/DL50/50L141 | | 2.20 |
| EHT Cable 30kV | | 25p per metr. |
| Coax Plugs | pack of 10 | 1.80 |
| Focus control GEC/THORN | | 1.83 |
| PVC Tape | | 35 |
| FM Plugs | | 25 |
| PL259 Plugs | | 40 |
| DECCA 30 Series width control | | 50 |
| DECCA 3.9R Modulohm | | 80 |
| DECCA Height Control 2M2 | | 25 |
| THORN 1500 Frame Hold 390K | | 32 |
| THORN 1500 Line Hold 470K | | 32 |
| THORN 1500 Contrast 1K5 | | 32 |
| Line Connectors | | 35 |
| 6.3V CRT boost trans | | 4.35 |
| ANTIFERENCE XG8 High Gain Aerial (State Channel) | | 17.00 |
| Reducers for PL259 | | 18 |
| 13A Plug Tops | box of 12 | 4.80 |
| T.V. Filter 50db rejection 27MHZ | | 2.10 |
| Quick Set Adhesive | | 78 |
| Attenuators 6db, 12db, 18db | each | 1.00 |
| Moulded Plastic Hex 6mm Trim Tools | | 10 |
| Trim Tools Moulded Double Ended 4mm/6mm | | 20 |
| Thorn 1591 Loudspeakers 4¼ × 2¼ | | 3.45 |
| Thorn 1591 Loudspeakers 5¼ × 2¼ | | 3.95 |
| Focus Rod | | 1.25 |
| Holder | | 2.00 |
| Cassette Drive Belts 46mm per pack of 5 | | 1.85 |
| 58mm | | 1.88 |
| 66mm | | 1.71 |
| 77mm | | 1.80 |
| 89mm | | 1.90 |
| Key nector at | | 5.50 |

N B We have a full range of aerials and accessories available from the trade counter.

## SOLDERING EQUIPMENT

| | |
|---|---|
| WELLER Iron 15W | 4.31 |
| WELLER Iron 25W | 4.31 |
| WELLER 3/16" Single Flat Tips | 51 |
| MIN Soldering Iron | 5.00 |
| WELLER Heat Gun Kit | 14.30 |
| (Pair) Tips for Gun | 42 |
| WELLER Cordless Iron | 24.78 |
| ANTEX Soldering Iron 25W | 4.89 |
| Solder Remover Sucker | 6.50 |
| Solda Mop | 72 |
| 500G Reel Solder | 7.00 |
| DIY Type Solder | 43 |
| 250G Solder | 3.50 |

## SERVICE AIDS

| | |
|---|---|
| SERVISOL Freeze-It | 82 plus VAT |
| SUPER SERVISOL | 84 " |
| SERVISOL Foam Cleanser | 82 " |
| SERVISOL Plastic Seal | 85 " |
| SERVISOL Silicone Grease | 98 " |
| SERVISOL Tubes Silicone Grease | 1.58 " |
| SERVISOL Aero Klene | 72 " |
| SERVISOL Aero Duster | 90 " |
| SERVISOL Excel Polish | 74 " |
| Penetrating Fluid | 70 " |
| Fire Extinguisher 840G | 2.60 " |
| Heat Sink Compound 25G | 1.05 " |
| Silicone Rubber Tube 1106 | 2.98 " |
| Solda Mop standard reel | 72 " |

## ELECTROLUBE PRODUCTS

| | |
|---|---|
| Electro-Mech lubricant | 1.39 |
| Elect. cleaning solvent | 1.50 |
| Freezer | 1.39 |
| Foam cleanser | 1.00 |
| Heat transfer compound | 1.07 |
| Silicone compound | 1.81 |
| Special contact fluid (Snorkel) | 2.07 |
| Permagard | 1.43 |
| Elec mech lubricant pen | 89 |

## HOW TO ORDER

**ADD** 15% VAT to **ALL** prices.

All orders **ADD** 65p per order Post/Pecking — U.K. ONLY.

Orders which contain aerosols or degaussing coil **PLEASE ADD** 30p extra per can/coil (these are very heavy!)

**FIRST CLASS** Mail is used whenever possible.

**ALL** enquiries S.A.E. please

VAT Invoice on request.

Goods are despatched on the day we receive your order. If for any reason beyond our control we are out of stock, we will try to inform you as quickly as possible. We try our best to give a speedy, fair, and efficient service.

As our regular customers know, orders telephoned in before 4.0p.m. will be despatched the same day. Give us a ring — we'll give you service.

## TRANSISTORS, ETC.

| Type | Price (£) | Type | Price (£) | Type | Price (£) | Type | Price (£) | Type | Price (£) | Type | Price (£) | Type | Price (£) | Type | Price (£) | Type | Price (£) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AC107 | 0.48 | AU103 | 2.40 | BC192 | 0.56 | BC377 | 0.29 | BD234 | 0.68 | BF222 | 0.51 | 8PX29 | 1.62 | MPSU05 | 0.66 | ZTX500 | 0.18 | 2N3819 | 0.47 |
| AC117 | 0.38 | AU107 | 2.75 | BC204* | 0.39 | BC394 | 0.39 | BD235 | 0.63 | BF224 & J | 0.22 | BR101 | 0.53 | MPSU06 | 0.76 | ZTX502 | 0.22 | 2N3820 | 0.72 |
| AC126 | 0.36 | AU110 | 2.40 | BC205* | 0.39 | BC440 | 0.52 | BD236 | 0.63 | BF240 | 0.32 | BR103 | 0.64 | MPSU55 | 1.26 | ZTX504 | 0.28 | 2N3866 | 1.08 |
| AC127 | 0.54 | AU113 | 2.60 | BC206* | 0.37 | BC441 | 0.59 | BD237 | 0.68 | BF241 | 0.31 | BR303 | 1.06 | MPSU56 | 1.32 | 2N404 | 1.30 | 2N3904 | 0.20 |
| AC128 | 0.46 | BC107* | 0.18 | BC207* | 0.39 | BC461 | 0.78 | BD238 | 0.68 | BF244* | 0.51 | BRC4443 | 1.76 | MPSU60 | 0.82 | 2N696 | 0.46 | 2N3905 | 0.20 |
| AC128K | 0.55 | BC108* | 0.15 | BC208* | 0.37 | BC477 | 0.30 | BD253 | 1.58 | BF245* | 0.43 | 8RY39 | 0.60 | MPU131 | 0.59 | 2N697 | 0.46 | 2N3906 | 0.20 |
| AC141 | 0.85 | BC109* | 0.16 | BC209* | 0.39 | BC478 | 0.25 | BD410 | 1.65 | BF254 | 0.48 | 8RY56 | 0.44 | OC26 | 1.90 | 2N706A | 0.33 | 2N4036 | 0.94 |
| AC141K | 0.70 | BC113 | 0.22 | BC211* | 0.38 | BC479 | 0.65 | BD433 | 0.65 | BF255 | 0.58 | BSS27 | 0.92 | OC28 | 1.49 | 2N708 | 0.29 | 2N4123 | 0.17 |
| AC142 | 0.60 | BC114 | 0.22 | BC212* | 0.17 | BC547* | 0.13 | BD435 | 0.70 | BF256L* | 0.49 | 8T106 | 1.50 | OC29 | 1.60 | 2N914 | 0.32 | 2N4124 | 0.17 |
| AC142K | 0.65 | BC115 | 0.24 | BC212L* | 0.17 | BC548* | 0.13 | BD436 | 0.71 | BF257 | 0.44 | 8T109 | 1.99 | OC35 | 1.25 | 2N916 | 0.46 | 2N4126 | 0.17 |
| AC151 | 0.31 | BC116* | 0.25 | BC213* | 0.16 | BC549* | 0.15 | BD437 | 0.74 | BF258 | 0.52 | 8T116 | 1.45 | OC36 | 1.25 | 2N918 | 0.54 | 2N4236 | 2.20 |
| AC152 | 0.36 | BC117 | 0.30 | BC213L* | 0.16 | BC550 | 0.24 | BD438 | 0.75 | BF259 | 0.54 | 8T119 | 5.18 | OC42 | 0.90 | 2N930 | 0.29 | 2N4289 | 0.32 |
| AC153 | 0.42 | BC118 | 0.24 | BC214* | 0.18 | BC556 | 0.23 | BD519 | 0.88 | BF262 | 0.73 | BU102 | 3.35 | OC44 | 0.68 | 2N1164 | 10.29 | 2N4292 | 0.32 |
| AC153K | 0.52 | BC119 | 0.34 | BC214L* | 0.18 | BC557* | 0.16 | BD520 | 0.88 | BF263 | 0.88 | BU105 | 1.80 | OC45 | 0.63 | 2N1304 | 1.40 | 2N4416 | 0.85 |
| AC154 | 0.41 | BC125* | 0.30 | BC225 | 0.42 | BC558* | 0.16 | BD599 | 0.87 | BF270 | 0.47 | BU105/02 | 1.95 | OC70 | 0.65 | 2N1305 | 1.29 | 2N4444 | 1.90 |
| AC176 | 0.45 | BC126 | 0.30 | BC237* | 0.16 | BC559* | 0.17 | BD600 | 1.23 | BF271 | 0.42 | BU108 | 2.98 | OC71 | 0.73 | 2N1306 | 1.49 | 2N4921 | 0.60 |
| AC178 | 0.51 | BC132 | 0.20 | BC238* | 0.15 | BCY10 | 0.30 | BD663BR | 0.86 | BF272A | 0.80 | BU126 | 2.91 | OC72 | 0.73 | 2N1307 | 1.32 | 2N5042 | 1.65 |
| AC179 | 0.55 | BC134 | 0.22 | BC239* | 0.22 | BCY30A | 1.06 | BDX18 | 1.55 | BF273 | 0.33 | BU204 | 2.50 | OC81 | 0.83 | 2N1308 | 1.53 | 2N5060 | 0.28 |
| AC187 | 0.56 | BC135 | 0.21 | BC251* | 0.25 | BCY32A | 1.19 | BDX32 | 2.95 | BF274 | 0.34 | BU205 | 2.58 | OC81D | 0.95 | 2N1711 | 0.47 | 2N5061 | 0.30 |
| AC187K | 0.65 | BC136 | 0.22 | BC252* | 0.26 | BCY34A | 1.02 | BDY16A | 0.63 | BF336 | 0.63 | BU206 | 2.59 | OC139 | 1.30 | 2N1893 | 0.52 | 2N5064 | 0.63 |
| AC188 | 0.52 | BC137 | 0.30 | BC253* | 0.38 | BCY72 | 0.27 | BDY18 | 1.55 | BF337 | 0.65 | BU208 | 2.75 | OC140 | 1.35 | 2N2102 | 0.71 | 2N5086 | 0.49 |
| AC188K | 0.61 | BC138 | 0.35 | BC261A* | 0.28 | BD115 | 1.35 | BDY20 | 2.29 | BF338 | 0.68 | BU407 | 1.38 | OC170 | 0.80 | 2N2217 | 0.55 | 2N5087 | 0.50 |
| AC193K | 0.70 | BC140 | 0.36 | BC262A* | 0.28 | BD123 | 1.50 | BDY38 | 1.38 | BF365 | 0.72 | BUY77 | 2.50 | OC171 | 0.82 | 2N2218 | 0.38 | 2N5208 | 0.59 |
| AC194K | 0.74 | BC141 | 0.44 | BC263* | 0.26 | BD124 | 1.85 | BF115 | 0.48 | BF382 | 0.49 | C106D | 0.80 | OC200 | 3.90 | 2N2219 | 0.42 | 2N5294 | 0.66 |
| ACY17 | 1.20 | BC142 | 0.35 | BC267* | 0.20 | BD130Y | 1.56 | BF117 | 0.45 | BF383 | 0.49 | C106F | 0.43 | OC201 | 3.95 | 2N2221A | 0.26 | 2N5296 | 0.68 |
| ACY19 | 0.95 | BC143 | 0.38 | BC268* | 0.28 | BD131 | 0.58 | BF120 | 0.55 | BF387 | 0.29 | C111E | 0.46 | OC202 | 2.40 | 2N2222A | 0.41 | 2N5298 | 0.71 |
| ACY28 | 0.98 | BC147* | 0.12 | BC286 | 0.40 | BD132 | 0.68 | BF121 | 0.85 | BF451 | 0.43 | D40N1 | 0.64 | OC205 | 3.95 | 2N2369A | 0.40 | 2N5322 | 1.16 |
| ACY39 | 2.02 | BC148* | 0.12 | BC287 | 0.49 | BD133 | 0.70 | BF123 | 0.48 | BF457 | 0.46 | E300 | 0.42 | OCP71 | 1.98 | 2N2401 | 0.80 | 2N5449 | 0.18 |
| AD140 | 1.79 | BC149* | 0.13 | BC291 | 0.27 | BD135 | 0.37 | BF125 | 0.55 | BF458 | 0.49 | E1222 | 0.47 | ON236A | 0.94 | 2N2484 | 0.35 | 2N5457 | 0.46 |
| AD142 | 1.90 | BC152 | 0.42 | BC294 | 0.37 | BD136 | 0.38 | BF127 | 0.51 | BF459 | 0.52 | E5024 | 0.19 | R2008B | 2.72 | 2N2570 | 0.74 | 2N5458 | 0.40 |
| AD143 | 1.78 | BC153 | 0.38 | BC297 | 0.36 | BD137 | 0.40 | BF137F | 0.78 | BF594 | 0.16 | GET872 | 0.46 | R20108 | 2.79 | 2N2646 | 0.82 | 2N5459 | 0.58 |
| AD149 | 1.42 | BC154 | 0.41 | BC300 | 0.62 | BD138 | 0.42 | BF152 | 0.19 | BF596 | 0.17 | ME0402 | 0.18 | R2322 | 0.75 | 2N2784 | 1.15 | 2N5494 | 0.85 |
| AD161 | 0.66 | BC157* | 0.13 | BC301 | 0.38 | BD139 | 0.46 | BF158 | 0.25 | BF597 | 0.27 | MF0404/02 | 0.18 | R2323 | 0.85 | 2N2869 | 2.08 | 2N5496 | 1.05 |
| AD161/162 | 1.22 | BC158* | 0.12 | BC302 | 0.86 | BD140 | 0.50 | BF159 | 0.27 | BFR39 | 0.30 | ME6001 | 0.18 | ST2110 | 0.49 | 2N2894 | 0.45 | 2N6027 | 0.55 |
| AD162 | 0.71 | BC159* | 0.14 | BC303 | 0.64 | BD144 | 2.24 | BF160 | 0.20 | BFR40 | 0.29 | ME6002 | 0.18 | ST6120 | 0.48 | 2N2904* | 0.40 | 2N6107 | 0.71 |
| AF114 | 1.32 | 6C160 | 0.52 | BC304 | 0.44 | BD145 | 0.75 | BF161 | 0.84 | BFR41 | 0.30 | MJ2955 | 1.30 | TIC44 | 0.25 | 2N2905* | 0.39 | 2N6122 | 0.60 |
| AF115 | 1.26 | BC161 | 0.58 | BC307* | 0.17 | BD150A* | 0.51 | BF163 | 0.65 | BFR50 | 0.29 | MJ3000 | 1.58 | TIC46 | 0.35 | 2N2906* | 0.36 | 2N6178 | 1.07 |
| AF116 | 1.28 | BC167B | 0.15 | BC308* | 0.14 | BD155 | 0.90 | BF164 | 0.95 | BFR52 | 0.33 | MJE340 | 0.68 | TIC47 | 0.45 | 2N2926G | 0.15 | 2N6180 | 1.39 |
| AF117 | 1.32 | BC168B | 0.14 | BC309* | 0.18 | BD157 | 0.51 | BF166 | 0.50 | BFR61 | 0.29 | MJE341 | 0.72 | TIP29A | 0.47 | 2N2926O | 0.14 | 2N6211 | 2.74 |
| AF118 | 0.98 | BC169C | 0.15 | 6C317* | 0.15 | BD158 | 0.75 | BF167 | 0.38 | BFR62 | 0.28 | MJE370 | 0.74 | TIP30A | 0.50 | 2N2926Y | 0.14 | 2SB337BP | 4.28 |
| AF121 | 0.68 | BC170* | 0.15 | BC318* | 0.15 | BD159 | 0.68 | BF173 | 0.35 | BFR79 | 0.30 | MJE371 | 0.79 | TIP31A | 0.51 | 2N2955 | 1.12 | 2SC458C | 0.78 |
| AF124 | 0.38 | BC171* | 0.15 | BC319* | 0.19 | BD160 | 2.69 | BF177 | 0.36 | BFR80 | 0.29 | MJE520 | 0.85 | TIP31C | 0.67 | 2N3053 | 0.48 | 2SC643A | 2.25 |
| AF125 | 0.38 | BC172* | 0.14 | BC320 | 0.17 | BD163 | 0.67 | BF178 | 0.46 | BFR81 | 0.30 | MJE521 | 0.95 | TIP32A | 0.56 | 2N3054 | 0.66 | 2SC930D | 1.50 |
| AF126 | 0.36 | BC173* | 0.22 | BC321A&B | 0.18 | BD165 | 0.66 | BF179 | 0.58 | BFR88 | 0.42 | MJE2955 | 1.20 | TIP32C | 0.72 | 2N3055 | 0.72 | 2SC1061 | 1.45 |
| AF127 | 0.86 | BC174A & B | | BC322 | 0.28 | BD166 | 0.88 | BF180 | 0.53 | BFT41 | 0.48 | MJE3000 | 1.95 | TIP33A | 0.77 | 2N3250 | 0.52 | 2SC1172Y | 3.55 |
| AF139 | 0.58 | | 0.26 | BC323 | 1.15 | BD175 | 0.90 | BF181 | 0.53 | BFT43 | 0.55 | MJE3055 | 1.22 | TIP34A | 0.84 | 2N3254 | 0.58 | 2SD234 | 1.48 |
| AF147 | 0.52 | BC176 | 0.22 | BC327 | 0.16 | BD177 | 0.58 | BF182 | 0.44 | BFW11 | 1.02 | MPF102 | 0.40 | TIP41A | 0.72 | 2N3391A | 0.38 | 3N128 | 1.80 |
| AF149 | 0.45 | BC177* | 0.20 | BC328 | 0.18 | BD178 | 0.92 | BF183 | 0.52 | BFW30 | 2.58 | MPS3702 | 0.33 | TIP42A | 0.80 | 2N3633 | 0.80 | 40250 | 0.98 |
| AF17B | 1.35 | BC178* | 0.22 | BC337 | 0.17 | BD181 | 1.94 | BF184 | 0.44 | BFW59 | 0.19 | MPS3705 | 0.30 | TIP2955 | 0.77 | 2N3703 | 0.17 | 40251 | 1.14 |
| AF179 | 1.36 | BC179* | 0.28 | BC338 | 0.17 | BD182 | 2.10 | BF185 | 0.42 | BFW60 | 0.20 | MPS6521 | 0.36 | TIP3055 | 0.58 | 2N3704 | 0.19 | 40327 | 0.67 |
| AF180 | 1.35 | BC182* | 0.15 | BC340 | 0.19 | BD183 | 1.34 | BF186 | 0.42 | BFW90 | 1.65 | MPS6523 | 0.36 | TIS43 | 0.44 | 2N3705 | 0.17 | 40361 | 0.48 |
| AF181 | 1.33 | BC182L* | 0.15 | BC347* | 0.17 | BD184 | 2.30 | BF194* | 0.14 | BFX29 | 0.38 | MPS6566 | 0.44 | TIS73 | 1.36 | 2N3706 | 0.16 | 40362 | 0.50 |
| AF186 | 1.48 | BC183* | 0.14 | BC348A & B | | BD187 | 1.20 | BF195* | 0.13 | BFX84 | 0.42 | MPSA05 | 0.30 | TIS90 | 0.23 | 2N3707 | 0.18 | 40410 | 0.94 |
| AF202 | 0.27 | BC183L* | 0.14 | | 0.17 | BD188 | 1.25 | BF196 | 0.14 | BFY50 | 0.38 | MPSA06 | 0.32 | TIS91 | 0.28 | 2N3708 | 0.17 | 40429 | 0.88 |
| AF239 | 0.73 | BC184* | 0.15 | BC349B | 0.17 | BD189 | 0.71 | BF197 | 0.15 | BFY51 | 0.37 | MPSA55 | 0.43 | ZTX108 | 0.14 | 2N3715 | 1.70 | 40530 | 0.79 |
| AF240 | 1.40 | BC184L* | 0.15 | BC350* | 0.24 | BD222 | 0.91 | BF198 | 0.29 | BFY52 | 0.36 | MPSA56 | 0.45 | ZTX109 | 0.16 | 2N3771 | 2.09 | 40595 | 1.39 |
| AF279S | 0.91 | BC185 | 0.36 | BC351* | 0.22 | BD225 | 0.91 | BF199 | 0.29 | BFY53 | 0.36 | MPSA93 | 0.56 | ZTX213 | 0.23 | 2N3772 | 2.08 | 40603 | 1.13 |
| AL100 | 1.30 | BC186 | 0.25 | BC352A* | 0.24 | BD232 | 0.91 | BF200 | 0.25 | BFY90 | 1.98 | MPSL01 | 0.33 | ZTX300 | 0.16 | 2N3773 | 2.90 | 40636 | 1.25 |
| AL103 | 1.58 | BC187 | 0.27 | BC360 | 0.59 | BD233 | 0.62 | BF218 | 0.42 | BPX25 | 1.62 | MPSU01 | 0.61 | ZTX304 | 0.26 | 2N3794 | 0.40 | 40654 | 0.89 |

Alternative gain versions available on items marked*. For matched pairs add 20p per pair.

## LINEAR IC's

| Type | Price (£) | Type | Price (£) | Type | Price (£) |
|---|---|---|---|---|---|
| BRC1330 | 0.93 | SN76003N | 3.32 | T8A240A | 3.98 |
| CA810QM | 2.44 | SN76013N | 2.52 | T8A281 | 2.07 |
| CA3005 | 1.85 | SN76023N | 3.02 | T8A395* | 2.58 |
| CA3012 | 1.45 | SN76023ND | 2.52 | T8A396 | 2.40 |
| CA3014 | 2.23 | SN76033N | 3.32 | T8A400 | 2.20 |
| CA3018 | 0.71 | SN76033ND | 1.40 | T8A480Q | 1.84 |
| CA3020 | 1.89 | SN76033N | 2.20 | T8A500* | 2.21 |
| CA3028A | 0.80 | SN76110N | 1.20 | T8A510* | 2.21 |
| CA3028B | 1.09 | SN76115N | 1.62 | T8A520* | 2.98 |
| CA3045 | 3.75 | SN76116N | 1.78 | T8A530P | 2.24 |
| CA3046 | 0.70 | SN76131N | 2.10 | T8A540* | 2.88 |
| CA3065 | 1.74 | SN76226N | 2.60 | T8A550* | 3.13 |
| CA3068 | 1.90 | SN70227N | 1.61 | T8A560C* | 3.18 |
| CA3130S | 1.57 | SN76228N | 1.80 | T8A570* | 1.29 |
| FCH161 | 2.40 | SN76502N | 1.92 | T8A611B | 2.68 |
| FCJ101 | 3.32 | SN76530P | 0.97 | T8A641 | 4.55 |
| LM309K | 1.98 | SN76533N | 1.38 | T8A641A12 | 4.55 |
| LM380N-14 | 1.65 | SN76544N | 1.85 | T8A641BX1 | 4.60 |
| LM1303N | 1.03 | SN76546N | 1.85 | T8A651 | 2.42 |
| MC1307P | 1.82 | SN76570N | 1.81 | T8A673 | 2.31 |
| MC1310P* | 1.84 | SN76620AN | | T8A700* | 2.50 |
| MC1312P | 2.34 | SN76650N | 0.99 | T8A720AQ | 2.38 |
| MC1327P* | 1.88 | SN76660N | 1.48 | T8A720Q | 2.38 |
| MC1330P | 0.83 | SN76666N | 0.64 | T8A750* | 2.18 |
| MC1350P | 1.22 | TA7073P | 0.96 | T8A800 | 2.05 |
| MC1351P | 1.42 | TAA263 | 2.20 | T8A810AS | 2.00 |
| MC1352P | 1.42 | TAA300 | 3.85 | T8A920* | 2.60 |
| MC1357P | 2.92 | TAA320 | 1.10 | T8A940 | 3.52 |
| MC1358P* | 2.30 | TAA350A | 2.48 | T8A950 | 2.08 |
| MC1458G | 1.43 | TAA370A | 3.18 | T8A990* | 2.90 |
| MC1496L | 1.15 | TAA435 | 1.70 | TCA270A* | 3.55 |
| MC3051P | 0.58 | TAA450 | 3.39 | TCA280A | 1.43 |
| MFC4008 | 0.85 | TAA521 | 1.10 | TCA290A | 3.46 |
| MFC4060A | 0.98 | TAA522 | 2.09 | TCA420A | 2.10 |
| MFC6040 | 1.11 | TAA550 | 0.35 | TCA440 | 1.67 |
| MIC1P | 1.10 | TAA560 | 1.93 | TCA640 | 4.26 |
| ML231 | 3.57 | TAA570 | 2.20 | TCA650 | 4.26 |
| ML232 | 3.57 | TAA611A | 1.67 | TCA660 | 4.26 |
| NE555 | 0.72 | TAA611B | 1.89 | TCA730 | 4.10 |
| NE556 | 1.34 | TAA621AXI | 4.75 | TCA740 | 4.04 |
| NE566 | 1.95 | TAA630Q | 3.91 | TCA750 | 2.53 |
| SAA1024 | 5.70 | TAA630S | 4.18 | TCA760 | 1.52 |
| SAA1025 | 10.35 | TAA661A | 2.39 | TCA820 | 3.29 |
| SAS560A | 2.01 | TAA661B | 1.75 | TDA1003 | 1.68 |
| SAS570 | 2.01 | TAA700* | 2.60 | TDA1004 | 3.85 |
| SC9503P | 1.40 | TAA840 | 3.38 | TDA1005 | 3.04 |
| SC9504P | 1.38 | TAA861A | 0.95 | TDA1022 | 6.89 |
| SL414A | 1.91 | TAA930A | 1.43 | TDA1024 | 0.97 |
| SL432A | 2.52 | TAA930B | 1.43 | TDA1034 | 2.98 |
| SL450 | 5.10 | TAA960 | 3.20 | TDA2610 | 2.86 |
| SL901B | 4.75 | TAA970 | 2.81 | TDA2640 | 2.86 |
| SL9178 | 5.60 | TAD100 | 2.66 | ZN414 | 1.45 |
| SL918A | 5.95 | | | | |
| SN72440N | 2.21 | TBA120A | 0.90 | | |
| SN76001N | 1.67 | TBA120S* | 0.99 | * Indicates Q version is also available. | |
| SN76003N | 2.20 | TBA120SA | 1.02 | | |
| | | TBA231 | 1.12 | | |

## DIODES

| Type | Price (£) | Type | Price (£) |
|---|---|---|---|
| AA113 | 0.17 | BY114 | 0.60 |
| AA119 | 0.21 | BY118 | 1.10 |
| AA129 | 0.28 | BY126 | 0.20 |
| AA143 | 0.18 | BY127 | 0.21 |
| AAY30 | 0.28 | BY133 | 0.35 |
| AAZ13 | 0.42 | BY140 | 1.40 |
| AAZ15 | 0.35 | BY164 | 0.75 |
| AAZ17 | 0.28 | BY176 | 2.80 |
| AY102 | 3.85 | BY179 | 0.83 |
| BA100 | 0.24 | BY182 | 1.14 |
| BA102 | 0.36 | BY184 | 0.44 |
| BA104 | 0.19 | BY189 | 5.30 |
| BA110 | 0.80 | BY190 | 4.90 |
| BA111 | 0.70 | BY206 | 0.26 |
| BA115 | 0.17 | BY238 | 0.25 |
| BA116 | 0.56 | BYX10 | 0.30 |
| BA121 | 0.85 | BYX38/600 | 0.70 |
| BA129 | 0.45 | BYX70/500 | 0.53 |
| BA145 | 0.19 | ITT44 | 0.08 |
| BA148 | 0.19 | ITT210 | 0.63 |
| BA154 | 0.06 | ITT827 | 0.80 |
| BA155 | 0.17 | MCR101 | 0.48 |
| BA156 | 0.12 | MR854 | 1.10 |
| BA157 | 0.25 | OA5 | 0.88 |
| BA158 | 0.28 | OA10 | 0.58 |
| BA159 | 0.40 | OA47 | 0.20 |
| BA164 | 0.14 | OA81 | 0.19 |
| BA182 | 0.27 | OA90 | 0.13 |
| BA201 | 0.13 | OA91 | 0.15 |
| BA202 | 0.14 | OA95 | 0.20 |
| BA203 | 0.14 | OA200 | 0.13 |
| BA216 | 0.08 | OA202 | 0.13 |
| BA219 | 0.11 | OA210 | 0.89 |
| BA243 | 0.45 | TIL209 | 0.14 |
| BA317 | 0.06 | TIL211 | 0.18 |
| BA318 | 0.07 | TV20 | 2.25 |
| BAV10 | 0.10 | IN914 | 0.06 |
| BAV21 | 0.18 | IN916 | 0.06 |
| BAW62 | 0.06 | IN4001 | 0.06 |
| BAX13 | 0.07 | IN4002 | 0.07 |
| BAX16 | 0.10 | IN4003 | 0.08 |
| BAX17 | 0.19 | IN4004 | 0.08 |
| BAY72 | 0.16 | IN4005 | 0.09 |
| BB1048 | 0.52 | IN4006 | 0.10 |
| BB1058 | 0.33 | IN4007 | 0.12 |
| BB105G | 0.30 | IN5400 | 0.15 |
| BR100 | 0.40 | IN5401 | 0.17 |
| BY100 | 0.35 | IN5402 | 0.20 |
| BY103 | 0.35 | IS920 | 0.09 |
| | | IS921 | 0.11 |

### ZENER DIODES

| | | |
|---|---|---|
| 400mW plastic | 3.0-75V | 14p each |
| 1/1.3W plastic | 3.3-200V | 18p each |
| 1.5W flange | 4.7-75V | †£1.26 each |
| 2.5W plastic | 7.5-75V | 67p each |
| 20W stud | 7.5-75V | £1.31 each |
| 75W stud | 7.5-75V | £7.95 each |

## VDR's, etc.

| Type | Price (£) | Type | Price (£) |
|---|---|---|---|
| E295ZZ | | VA1074 | 0.20 |
| /01 | 0.28 | VA1077 | 0.31 |
| /02 | 0.28 | VA1091 | 0.29 |
| E298CD | | VA1096/97/98 | |
| /A258 | 0.25 | all | 0.20 |
| E298ED | | VA1103 | 0.32 |
| /A258 | 0.22 | VA1104 | 0.66 |
| /A260 | 0.22 | VA1108/09/10/ | |
| /A262 | 0.22 | 11/12 all | 0.24 |
| /A265 | 0.22 | VA8650 | 1.20 |
| /P268 | 0.22 | 2322 554 | |
| E298ZZ | | 02221 | 0.59 |
| /05 | 0.25 | 2322 662 | |
| /06 | 0.22 | 98003 | 0.88 |
| E299DD/P116- | | | |
| P354 | all 0.23 | | |
| E299DH | | | |
| /P230 | 0.72 | | |
| R53 | 1.75 | | |
| VA1015 | 0.92 | | |
| VA1026 | 0.79 | | |
| VA1033/34/38/ | | | |
| 39/40/53 | | | |
| | all 0.20 | | |
| VA1055a/56a/ | | | |
| 66a/67a | | | |
| | all 0.23 | | |

## VALVES

| Type | Price (£) |
|---|---|
| DY86/87 | 0.75 |
| DY802 | 0.75 |
| ECC81 | 0.78 |
| ECC82 | 0.95 |
| ECC83 | 0.78 |
| ECH81 | 0.83 |
| ECL80 | 0.82 |
| EF80 | 0.80 |
| EF183 | 0.75 |
| EF184 | 0.75 |
| EH90 | 0.94 |
| EL34 | 3.08 |
| EY51 | 1.20 |
| EY86/87 | 0.67 |
| PCC84 | 0.61 |
| PCC85 | 0.79 |
| PCC89 | 0.74 |
| PCC189 | 0.94 |
| PCF80 | 1.20 |
| PCF86 | 0.87 |
| PCF200 | 2.32 |
| PCF801 | 0.74 |
| PCF802 | 1.20 |
| PCF805 | 3.37 |
| PCF808 | 3.80 |
| PCL82 | 0.93 |
| PCL83 | 5.25 |
| PCL84 | 0.65 |
| PCL86 | 1.27 |
| PCL805/85 | 1.00 |
| PD500 | 3.75 |
| PFL200 | 1.40 |
| PL36 | 1.20 |
| PL81 | 0.94 |
| PL84 | 0.79 |
| PL504 | 1.50 |
| PL508 | 1.85 |
| PL509 | 4.75 |
| PL519 | 4.75 |
| PL802 | 5.60 |
| PY81/P810 | 0.60 |

### BRIDGES

| Rating | Price (£) | Rating | Price (£) |
|---|---|---|---|
| 1½A 50V | 0.27 | 2A 100V | 0.36 |
| 100V | 0.28 | 200V | 0.40 |
| 200V | 0.32 | 400V | 0.47 |
| 400V | 0.40 | 600V | 0.53 |
| 600V | 0.50 | 800V | 0.60 |
| 800V | 0.58 | 1000V | 0.87 |
| 3A 100V | 0.52 | 6A 100V | 0.66 |
| 200V | 0.55 | 200V | 0.68 |
| 400V | 0.61 | 400V | 0.74 |
| 600V | 0.67 | 600V | 0.80 |
| 800V | 0.80 | 800V | 0.86 |
| 1000V | 1.20 | 1000V | 0.95 |

10A and 25A ranges also stocked.

## RESISTORS

**Carbon Film (5%)** — *Mixes of a minimum of 10 of one value / 10pcs of any value:*

| | Ea | 50pc | 100pc | 500pc |
|---|---|---|---|---|
| ¼W 5.6Ω-330kΩ (E12) | 3p | 25p | 95p | £1.49 | £6.40 |
| ¼W 10Ω-10MΩ (E24) | 3p | 25p | 95p | £1.49 | £6.40 |
| 1W 10Ω-10MΩ (E12) | 5p | 45p | £1.95 | £3.40 | £15.25 |
| 2W 10Ω-10MΩ (E6) | 9p | 80p | £3.80 | £6.40 | £28.90 |

**Wirewound (5%)**

| | |
|---|---|
| 2½W 0.22Ω-270Ω | 18p |
| 4W 1.00Ω-10kΩ | 22p |
| 7W 0.68Ω-22kΩ | 24p |
| 11W 1.00Ω-22kΩ | 28p |
| 17W 1.00Ω-22kΩ | 33p |
| Vertical mounting pillars | 3p |

**Presets (†)**

0.1W (Vertical and Horizontal)
100, 220, 470Ω, 1, 2·2, 4·7, 10, 22, 47, 100, 220, 470kΩ, 1, 2·5, 5MΩ
all 14p each

0·2W (Vertical and Horizontal)
Values as 0·1W all 14p each

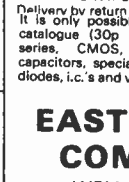
## FUSES (all packs of 10)

| 20mm Time Delay (BEAB) | | 20mm quick-blow (BEAB) | |
|---|---|---|---|
| 40mA | £3.68 | 100mA | 68p |
| 50, 63mA | £2.55 | 200, 250, 315, 500, 630, | |
| 100mA | £1.86 | 800mA, 1, 1.25, 1.6, 2, 2.5, | |
| 160, 200, 250mA | £1.44 | 3.15, 5A | all 56p |
| 315, 500, 800mA, 1, 1.25, | | 2A circuit breakers | |
| 1.6, 2, 2.5, 3.15, 5A | | metal | £1.52 |
| | all £1.19 | plastic | £1.48 |

**LABGEAR** (Details of full range on request)

**TELETEXT ADAPTOR 7056.** An amazing box which can be used with any UHF Receiver. **£223** + £2.25 P&P + VAT. – ask us for a fully descriptive brochure.
**VIEWDATA ADAPTOR 7050.** Prices and details on request.

**COLOUR BAR GENERATOR**
CM6052/DB. VHF/UHF gives standard 8 band colour bars + variable tuning + front panel on/off switch + sync trigger output + blank raster + red raster + crosshatch + greyscale stepwedge + colour bar + centre cross + dot pattern + centre dot. **£243.37**



**MULTIMETER SPECIAL**
Russian type U4324
DC Voltage: 0.6, 1.2, 3, 12, 30, 60, 120, 600, 1200.
AC Voltage: 3, 6, 15, 60, 150, 300, 600, 900.
DC Intensity M/A: 0.06, 0.6, 6, 60, 600 3000.
AC Intensity M/A: 0.3, 3, 30, 300, 3000.
DC Resistance: 0.2, 5, 50, 500, 5000K.
ge level dB: –10 to +12.
**Special Price £12.** including p/p and VAT.

**P. & P.** UK: £0.20 per order. **Overseas:** At cost.
Please add VAT at 15%.
Delivery by return of mail on all stock items.
It is only possible to show part of our range here. Our catalogue (30p refundable) shows Service Aids, 7400 series, CMOS, op amps, SCRs etc., hardware, capacitors, special TV items and many more transistors, diodes, i.c.'s and valves.

*A/c facilities available*

## CAPACITORS

**Metallised Paper**

| | | | | | |
|---|---|---|---|---|---|
| 2n2F | 1500V DC | 60p | 10nF | 500V AC | 80p |
| 2n2F | 600V AC | 24p | 15nF | 300V AC | 30p |
| 3n6F | 1700V DC | 60p | 22nF | 300V AC | 32p |
| 4n7F | 1500V DC | 60p | 100nF | 1000V DC | 46p |
| 10nF | 1000V DC | 22p | 470nF | 1000V DC | 60p |

**H.V. Disc Ceramic (†)**

| | | |
|---|---|---|
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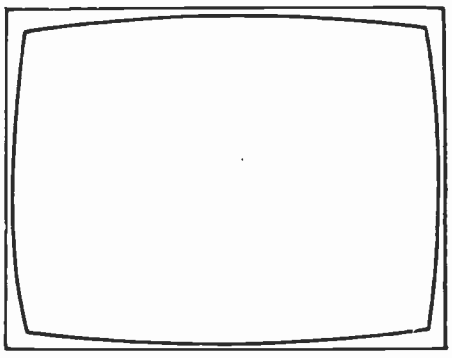

# TELEVISION


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**COVER PHOTO**

Our thanks to Philips who provided the photograph of their VR2021 VCR shown on our cover this month. The VR2021 superseded the original VR2020 V2000 format machine late last year.

## You and Us

Late last year a bit of research was carried out with the aim of finding out something about our readers and their main interests in television, also whether we as a magazine are catering for these interests as effectively as we might. At the time I promised to report back to you, so here goes.

The method adopted was to include a questionnaire in 5,000 copies of our September 1981 issue. That's slightly less than one in every six issues sold (our circulation is about 32,000 a month at present). Just over a thousand readers filled the questionnaire in and returned it (our thanks to them for the trouble they took – we asked quite a lot of questions, and got quite a lot of comments). You might ask how valid the replies of about one in thirty readers can be, but we are assured that statistically such a sample is reasonably representative. It's obvious however that the results have to be treated with caution: those who replied would tend to be the more committed of our readers.

You might also ask why a magazine that's been published regularly for over thirty years should need to carry out an enquiry amongst its readers? The fact is that it's in our interests and yours that we publish what you want. If you're all satisfied customers, you'll probably continue to buy the magazine without telling us what you think of it. If you're dissatisfied, you'll just stop taking it. The only way we can get to know a bit more, to provide us with some general guidelines, is to ask.

The first thing we discovered, and this was rather heartening, was that those who replied were indeed committed readers. Over 93% purchased their own copy of the magazine, 82% claimed to read every issue, and 78% had been readers for over four years (37% for over ten years). The next thing we discovered was that 80% of our respondents are employed in one or another branch of electronics, 46% specifically in the TV trade/industry. 49% have a City and Guilds qualification, and a further 27% some other qualification (so we'll have to watch it!). Rather surprising was the finding that for nearly 70% of readers electronics is both a job and a hobby: 10% thought of electronics as a job only and 22% as a hobby only.

It should not perhaps be any great surprise to anyone that for 96% of those who replied TV servicing was a major interest. This is after all the subject to which we have for many years devoted the greater part of our attention. What did surprise us a bit, though the video boom should perhaps have alerted us to it, was the great interest shown in VCR servicing – 82% of respondents expressed interest in this subject. Other subjects that rated highly were trade news (83%) and constructional projects (72%).

So much for subject matter, what about treatment? The vast majority (88%) of respondents felt that the contents of the magazine were technically "about right". Exactly the same proportion felt that the layout and presentation were appropriate. The main suggestion for improving our service was the inclusion of an annual index of servicing articles and the sets covered. This would help us too! The problem, apart from the time it would take to compile such an index, is that we often deal with parts of chassis and with particular faults in different sets. An index of faults as well as sets would be ideal of course but would be quite a task.

We also asked about readers' feelings on widening the scope of the magazine to include other topics. Greatest interest was shown in providing detailed information on circuit operation and design. The trouble here is that so much circuitry has nowadays disappeared into i.c.s which – correct me if you disagree – are best considered in block diagram form (one needs to know what's going on behind each pin rather than what each of the fifty to a hundred or more transistors in the device is doing). The main discrete component departments are the traditional power handling ones – the power supply itself, and the line and field output stages. I'd say we've covered most aspects of these subjects in some detail in the past, but maybe we ought to provide some brief summaries for more recent readers, at the same time incorporating latest developments – we're considering a series on "circuit action". More information on new components, servicing equipment reviews, video equipment and trade news also came high on readers' lists. Little interest was expressed in the broadcast side of television – professional studio equipment, programme production and that sort of thing.

Our thanks once again to those who helped with information and views. The completed forms went to a computer which produced some startlingly detailed analyses of the replies. The forms then came back to us so that we could browse through them and draw our own conclusions.

You've kindly told us about yourselves. Perhaps we should return the compliment and tell you a bit about us. The editorial staff consists of just the two of us, but between us we've some forty years' experience in technical editing on the electronics side. Our regular contributors are nearly all engaged in the radio/TV trade in one way or another. Between us, we hope to be able to continue to provide the sort of service our readers appear to find helpful.

## Satellite TV

I'd hoped to be able to comment in this issue on the Government's proposals for a UK satellite TV service. There's been some delay over making the announcement however, due it's understood to problems in reaching agreement over how such a service should be distributed to viewers.

# Teletopics

### A SUCCESSFUL YEAR

The video boom along with the successful promotion of teletext combined to make 1981 a good one for the UK radio and TV trade. VCR sales/rentals exceeded all forecasts at some 820,000, and the expectation is of a further increase of 50-70 per cent in the present year. It seems incidentally that the overwhelming majority of pre-recorded cassettes are rented rather than bought outright.

Total sales/rentals of teletext equipped TV sets in 1981 rose to some 200,000, bringing the total number of such sets in use to around 300,000. There was a considerable build up during the course of the year, deliveries of 20,000 during the first three months rising to 85,000 in the final quarter, reflecting the success of National Teletext Month last October. The rental chains did particularly well with teletext promotion: DER's marketing service manager Ken Smith says that a large slice of his promotional budget this year will be devoted to teletext, while he expects 60 per cent of his new rental stock to be teletext equipped. Estimates for teletext receiver deliveries during 1982 range over the 400-500,000 range.

Deliveries of large-screen colour sets during 1981 showed a modest increase at 1·65 million. A further slight increase is expected this year.

### MINIATURE TV

Sony have introduced a "pocket" TV set, Model FD200, in Japan. The set measures approximately 8 × 3½ × 1¼in. and is intended to sell at around £130. Consumption is said to be 300mA from a 6V battery, and the set uses a c.r.t. of the "flat" variety, i.e. the electron gun is mounted parallel with the screen, at one side.

Clive Sinclair, whose Microvision pocket TV set is due to be launched towards the end of the year, claims that Sony's set has been launched simply to give them a "first". He says the set employs an "antediluvian design" and consumes ten times the power the Microvision will – in addition, it's still intended to sell the Sinclair set (size 6 × 4 × 1in.) at around £50, and f.m. radio facilities will be included (for further details see *Teletopics,* April 1981).

The claim to have the smallest colour set in production is made by Matsushita, whose 3in. Model TH3-W3V was introduced on the Japanese market last December, at around £200, and is expected to be available in the UK in mid-1983. The set measures approximately 4½ × 3½ × 9¼in., weighs 1·5kg without the batteries and consumes 9·5W at 12V d.c. The set can be used as a colour monitor with a VCR and as a tuner. Operation is from the mains, a car battery or an optional rechargeable battery pack.

### NATIONAL TELETEXT MONTH AGAIN

The success of the October 1981 National Teletext Month has prompted a second go this year which, after all, is Information Technology Year. The decision was taken at a recent Mullard hosted industry/government conference whose aim was to follow up and sustain the sales impetus. This time however it's hoped that the Prestel service will be a major beneficiary. The target agreed to last time was for 46,000 Prestel installations by the end of 1981: in the event, the total reached was around 15,000. New connections are running at the rate of 400-500 a month – at which rate it will take seven years to reach a total of 50,000 subscribers, the number at which the system will, according to some observers, become economically viable. Since business users have declined to take to Prestel in the numbers hoped for, renewed efforts are to be made to interest private subscribers.

### ICs FOR SATELLITE TV RECEPTION

A paper on the design of i.c.s for use in head-end converters for satellite TV reception was presented by the Hughes Aircraft Co. at the 12th Montreux International Television Symposium last May. The aim is to integrate a complete head-end receiver unit comprising a two-stage low-noise preamplifier, a mixer with separate 10·75GHz local oscillator, and a three-stage i.f. amplifier (output at 0·95-1·45GHz) on a gallium-arsenide substrate – the only external component would be a resonant cavity for local oscillator tuning. F.E.T. technology would be used throughout. It's hoped that the following performance figures will be achieved: preamplifier gain 16dB, noise figure 3dB; mixer conversion gain 4dB, noise figure 5dB; mixer filter 2·1dB insertion loss, 17dB image rejection; i.f. amplifier gain 20dB, noise figure 4dB; overall noise figure 3·5-4dB.

One hundred i.c.s could be produced on a 5cm wafer, and on the basis of the yields obtained with discrete f.e.t.s using similar technology a manufacturing cost of $25-40 per chip is envisaged initially.

### WILLOW VALE CONVERSION KIT

Willow Vale have introduced a new conversion kit that should solve quite a few problems – a pushbutton tuning head for use with the ITT CVC8 and CVC9 chassis. The unit cures certain tuning difficulties and has an extra button to provide a VCR position. The order code is 17.038 and the price £12·88 (with discounts for quantity purchase). Details from Willow Vale Electronics Ltd., Old Hall Works, Arborfield Road, Shinfield, Reading – orders can be telephoned to the sales desk on 0734 884444. The original ITT unit is now available on a repair basis only.

### VIDEODISC SETBACK

The failure of videodiscs to catch on so far in the US has led MCA (Music Corporation of America) and IBM to withdraw from their joint videodisc manufacturing venture with DiscoVision Associates – their stakes have been sold to the third partner, the Japanese company Pioneer. The DVA venture was set up in 1979 to produce LaserVision discs: the plant, which has now closed, produced over two million discs. North American Philips comment that the plant was using obsolete technology and couldn't meet the latest quality and cost requirements. The LaserVision system will continue to be marketed in the USA by Philips and Pioneer.

### TRANSMITTER NEWS

The following relay transmitters are now in operation:
**Ballantrae** (Ayrshire) TV4 (future) ch. 54, BBC-1 ch. 58, Border Television ch. 61, BBC-2 ch. 64.
**Llanharan** (Glamorgan) BBC-Wales ch. 21, HTV-Wales ch. 24, BBC-2 ch. 27, Sianel 4 Cymru (future) ch. 31.
**Newry South** (Co. Down) BBC-1 ch. 39, TV4 (future) ch. 42, BBC-2 ch. 45, Ulster Television ch. 49.

**Pinwherry** (Ayrshire) BBC-1 ch. 22, Border Television ch. 25, BBC-2 ch. 28, TV4 (future) ch. 32.

The above transmissions are all vertically polarised.

The IBA has published a new (January 1982) edition of its *Pocket Guide to Transmitting Stations*. The new 20-page issue includes the changes that have stemmed from the new ITV contracts, and guidance on which main and relay stations will carry the new TV4/S4C programmes from November and the four-channel relays due for completion in the earlier part of the year. Details of the expanding number of ILR transmitters and planned extensions are also given.

## NEXT VIDEO COURSE

Steve Beeching's next VCR servicing course will be held on April 24th and 25th at Newark – details from the Newark Video Centre, 108 London Road, Balderton, Newark, Notts NG24 3AQ. We've had several letters from readers who say they've found the courses very helpful.

## COMPACT CASSETTE SYSTEMS

The basic specification for the compact cassette system for camcorder use (see *Teletopics* last month) has now been released. Details are as follows: video recording using two slant-azimuth rotary heads mounted in a drum of approximately 40mm diameter, with f.m. luminance recording and the colour signal on a converted carrier; tape either metal powder or metal evaporated, 7-8mm width (i.e. just over ¼in.), in a cassette of approximately 9 × 6 × 1·4cm, with the two reels in parallel; recording time one hour; audio recording by means of fixed and/or rotary heads. In other words, most of the video technology will remain much as with the standard cassette systems, the problems being to scale everything down to get a worthwhile playing time from the small cassette. One can't help but feel that there's still a fair amount of room for dissension as the various firms working on camcorder systems come up with ideas to obtain improved performance. The system is now officially known as "8mm video".

Meanwhile Sulkin (UK) Ltd. have introduced on the UK market the Technicolor 8mm Microvideo system. This is a sort of half-way house, using a small, lightweight VCR and a standard video camera. Sulkin exhibited it at the trade shows last year, when the equipment displayed was manufactured by Funai who originally developed the system – it's since been taken up by Technicolor and Grundig, who demonstrated CVC (another name for this system) equipment at the last Berlin Audio/Video Fair.

The Technicolor VCR weighs 7lb (3·3kg) including the battery, and uses ¼in. tape in cassettes only slightly larger than a standard audio cassette. The current cassettes have a playing time of 30 minutes, but 45 minute and one hour versions are to be introduced soon – it's stated that two-hour prerecorded cassettes will follow. The tapes can be played back through a conventional domestic TV set and can be simply transferred on to VHS, Betamax or other video cassettes.

The VCR has a shoulder carrying strap and simple piano-key controls for rewind, fast forward, stop/eject, play and record. A panel at the side carries the d.c. power socket, the camera socket and jack points for an external microphone and earphone, plus controls for tracking, audio dub and still frame (also allowing slow motion and almost twice times speed). It can be operated from the mains, an internal rechargeable nickel-cadmium battery or, via an adaptor, a 12V d.c. car battery. The internal battery provides a camera recording time of approximately 40 minutes and a playback time of an hour.

*The Technicolor Microvideo system.*

The Technicolor camera has a times six zoom lens and an electronic viewfinder and weighs 4·2lb (1·9kg). Features include a built-in microphone with boom and illuminated indicators for light intensity, video start, battery life and white balance. Other cameras can be used via a simple adaptor. The accessories comprise an a.c. adaptor/battery charger, power leads, an earphone and cassette: optional extras include a tuner for off-air recording. The VCR is expected to retail at around £600, with the camera slightly less and thirty minute blank tapes at approximately £6 each. Servicing of all the products in the range will be undertaken by Technicolor.

## VCR PRODUCTION

Till now, VCRs have tended to be in short supply. Will 1982 see a move to over production? According to Matsushita, Japanese VCR production in 1982 is likely to exceed 14 million units. Matsushita's own production capacity is already 1·7 million machines per year, and their view is that sales worldwide will grow at a modest rate of some 22 per cent this year, taking into account the difficult economic conditions. Sanyo's production last year reached 950,000 machines and is expected to increase significantly this year. In a move to establish themselves in the European market, Matsushita have announced a joint venture with Bosch to set up a VCR plant in W. Germany: production is expected to start next year.

## TV PRODUCTION

Despite excess capacity worldwide, TV plants continue to spring up all over the place. Sharp have set up their sixth overseas TV plant, in the Philippines, while to establish a foothold in the EEC the Korean TV manufacturer Samsung is to start production in Portugal – both these plants will be operated as joint ventures with local concerns. In the UK, Zanussi have expressed an interest in establishing a TV assembly plant in the north country – to supply the UK and Scandinavian markets.

The European Community Commission is to ask Japan

to restrict the export of TV sets with screen sizes of 20in. and below to the EEC for the next two-four years, on a voluntary basis. The EEC is now almost as large a market as the USA for Japanese colour receivers, and is the largest c.r.t. market.

### END OF AN ERA

Mullard Ltd. have ceased the production of valves for domestic receiving equipment. During the past forty years over 1,000 million valves have been produced at their Blackburn plant, which is now being used for the production of a wide range of other components including capacitors, delay lines, electronic assemblies, fine wire and LaserVision discs.

### NEW VIDEO EQUIPMENT

Panasonic's new WV3030 colour video camera is interesting in having an enclosed pistol-handgrip with the in-built microphone mounted at its base – to prevent the microphone picking up the noise when the zoom lens is operated.

New VCRs have been introduced by Pye, Telefunken and Sharp. The Pye 20VR22 is a V2000 system machine with a five-programme, sixteen day timer and a still frame facility. The Telefunken VR520 is a VHS machine distributed by Paul Spring Electronics. The Sharp VC7750H is a front-loading, microprocessor-controlled machine with infra-red remote control, expected to sell at around £620. Also introduced by Sharp is a new colour camera, Model XC40H, with infra-red automatic focusing.

### VIDEO BOOK

Butterworths have published a useful and up-to-date introductory book on video, written by Steve Money. The book, entitled *Questions and Answers on Video,* runs to 128 pages and is priced at £1·95. It's certainly a comprehensive guide to the present video scene, including TV topics such as frequency-synthesis tuning, teletext, etc.

### GERMAN VCR TEST

The West German consumer magazine *DM* has carried out VCR tests and user surveys recently. The former has given a boost to the V2000 system, with the Grundig and Philips machines taking the first and second places respectively out of ten VCRs tested by a jury of 20 during a three and a half hour session. Grundig comment that one of the main findings was that the development of new video heads has improved the picture quality with all systems, especially with the V2000 system. The survey of nearly 9,500 readers (40 per cent VCR owners) revealed that picture and sound quality is the first consideration in choosing a machine, ease of operation second and the provision of extra features third. 51·4 per cent of owners used their machines more than five times a week, 12·2 per cent using them only once or twice a week. Two out of three owners used their machines mainly for off-air recording, with very little use of prerecorded material – less than one in twelve made their own "films".

### CBI

Several manufacturers have introduced filters to counter the problem of interference from CB equipment. Both Wolsey and Antiference have small, in-line units available for connection between the aerial and the set's aerial input socket. Of particular interest is the Isherwood-Leeming filter which incorporates a 1:1 ferrite transformer as a braid breaker and a printed circuit filter comprising four capacitors and three coils. The price is £2·99 including postage (quantity discounts for four or more). Details can be obtained from Mrs. B. Leeming, 87 Durham Road, Wilpshire, Blackburn, Lancs. BB1 9NH.

### SOLID-STATE CAMERA FROM EEV

The English Electric Valve Co. have announced a charge-coupled, solid-state image sensor for monochrome use. The sensor, type P8600, is interesting in having a high resolution – it's a frame transfer type with a 576 × 385 picture element format. The silicon array is controlled by circuits providing clock and sync drive pulses that can be used in a variety of ways – for example for slow-scan readout from a cooled sensor chip. The sensor has been designed to give optimum performance at a scan rate of 625 lines/50Hz. The sensor and drive circuitry are packaged together as the P4300 hand-held camera, which can be powered from its own internal battery (in the hand grip) or an external 6V source. The price of the camera is £1,100: the chip is an extra £400-£2,000 depending on the blemish specification.

### JVC VIDEODISC LATEST

*David K. Matthewson, B.Sc., Ph.D. writes:* JVC had their VHD videodisc system on display at the recent "Professional Video Show" (the successor to Video Tradex). It's been going through various stages of development and is now capable of some very clever tricks. For example, when you load an NTSC disc into a PAL/Secam player the machine recognises the type of disc and adjusts the speed accordingly – PAL discs revolve at 750 r.p.m. whilst NTSC discs revolve at 900 r.p.m. In addition to replaying the disc at the right speed, there's some signal processing that results in a pseudo-PAL 525-line 4·43MHz colour picture. A PAL disc likewise gives a pseudo-NTSC 625-line 3·58MHz picture. The net result is that a disc purchased in the USA can be replayed satisfactorily on a PAL player coupled to a PAL TV set and vice versa, though the geometry will not be quite right.

In addition, there are three types of discs offering different features. The Type I disc is intended for normal movies etc. and gives an hour's playing time per side, with a limited range of special effects – stills, fast motion etc. The Type II disc has a reduced playing time – half an hour per side – but has a whole range of special effects, including perfect stills. The Type I-II disc is a Type I disc with sections of material on it recorded to the Type II specification. The player automatically recognises these different types of discs and sections of disc and adjusts itself as necessary. All these discs rotate at the same speed, the tricks being produced by track "jumping" and recording the signals on the disc in different ways – the Type I disc has two complete frames (four fields) per rotation while the Type II disc has a single frame repeated twice per rotation.

The disc size has been finalised at 26cm (10·2in.), with two audio channels having a crosstalk figure just good enough for bilingual material. A wanted section of the programme on the disc can be quickly reached via a chapter search or a time-code facility as well as by a ×64 high-speed manual search.

The show itself was a considerable improvement over 1980, but for the serious user of video hardware it would be more convenient to get the thing together with IBC.

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*Axial. All others are Radial.

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| 2,200µf 63v | 70p |
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| 10 of one value | 80p |
| 10 of each | £6.60 |

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| | |
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| 10 of each | £2.50 |

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| 10 × SKE 4F2/06 (600v 2a fast switching) | £1.00 |
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| Convergence Panel for above. Brand new leads and plug. | £3.00 each |
| GEC 2010 Transistor Rotary Tuner with AE, SKT, and leads | £1.95 each, 3 for £5.00 |
| Bush CTV 25 Quadrupler type Q25B equivalent to ITT TU25 3QK | £3.00 each, 2 for £5.00 |
| PYE 697 Line and power Panel, damaged with some components missing but ideal for spares | £2.20 each, 3 for £6.00 |
| Grundig UHF/VHF Varicap Tuner for 1500 GB, 3010 GB | £12.50 each, 3 for £30.00 |
| EHT Lead with Anode cap (CTV) suitable for split Diodes sets 1m long | 60p each, 3 for £1.50 |
| EHT Cable | 30p per metre, 10 metres £2.50 |
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| Cassette Mains Leads. 7ft with fig 8 plug | 60p each, 3 for £1.50 |
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| 2k2 Screenfeed Resistors. White ceramic, 9 watt, with fusible link. | 8 for £1.00 |
| Phillips G8 Transductor. | £1.20 each. 3 for £3.00 |
| Mullard LP1173, 10 watt. Amplifier module with circuit diagram. | £3.50 each. 2 for £6.00 |
| E.H.T. Discharge probe, with heavily insulated handle, with lead and chassis connector. | 60p each. 3 for £1.50 |

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# Saga of a Saba

**Steve Knowles**

TWO words are guaranteed to turn any rational engineer into a quivering wreck – intermittent fault. There can't be many of us who've not had a real stinker at one time or another. If the trouble is due to a dry-joint or a poor plug/socket connection on a panel, gentle probing and panel flexing will usually reveal the cause of the fault. Alternatively, if the fault is heat sensitive a can of freezer can be used to cool suspect components in turn. There's a third type of intermittent fault however – the type that comes and goes at random, no action from the engineer goading it to put in an appearance if it doesn't want to. In this case test equipment can be used to advantage, by hooking it into the circuit at strategic points to see whether any voltages change when the fault occurs. But just how far can you go with deploying equipment in this way, especially in those cases where the fault puts in an appearance for say five minutes every fortnight or so?

### Intermittent Loss of Signals

We had such a fault recently on a Saba Model T6716 (H chassis). The complaint was intermittent failure of the sound and vision – the screen would black out completely and a rushing noise would come from the speaker. It was as if the aerial had been disconnected, though very faint sound was often present. The owner reported that the set would sometimes come on normally, going off half an hour or so later: on other occasions the fault would be present at switch on, the set suddenly bursting into life some twenty minutes later. A previous engineer had apparently made several attempts to cure the fault, and had replaced a number of components on spec without success. We decided to adopt a more scientific approach – that was the idea, anyway!

We were fortunate enough to see the fault when the set was first brought in. The symptoms were exactly as described, so we started off with an experimental probe around the panels. This revealed nothing. Our next move was to feel the temperature (gently!) of the power resistors on the power supply panel. All were hot, so the trouble was unlikely to be here. Next we got out the circuit to study it.

### A Diversion

All of a sudden there was an almighty bang and a flash and the whole thing went dead. Check around and find the 4A mains fuse shattered and one of the mains filter capacitors short-circuit. This little diversion was put right and we switched on again – only to find that the original fault had cleared. The set was run on soak every day for the next fortnight and behaved impeccably. We thought that perhaps the blown filter capacitor had resulted in some sort of voltage surge that had sealed the faulty component, and as there was no point in keeping the set any longer we returned it, explaining to the owner what had happened and telling him to be sure to contact us in the event of further trouble – we somehow knew we'd see it back eventually.

Three weeks later the owner got in touch and explained that the set was back to playing its old tricks. He said he'd not got in touch immediately, hoping that the fault would become permanent (the owner was himself an engineer, albeit in a totally different field, and was well aware of the difficulties caused by intermittent faults).

### Back it Bounces

When the set was brought in it had refused to work for three days on the trot. As soon as we removed the back and plugged it in it worked perfectly of course – and continued to do so for the next three weeks! We also tried it out with the back on in case the cause of the fault was heat, but this made no difference. I was getting well and truly cheesed off when all of a sudden, five minutes after switching on, the fault was back again. We were over like a shot and just managed to make some voltage checks on the i.f./luminance panel before the fault once again cleared. We now knew that the trouble lay over on the right side timebase panel however: a fault in the line output stage will mute the a.g.c. gating pulses that go to the TBA500 luminance/a.g.c. chip, shutting down the signal circuits.

Our first suspect was the tripler, though we'd not known one do this sort of thing before. It had to be eliminated from the search however. We didn't have long to wait for the fault to occur again, and hurriedly switched off so that we could unsolder the tripler's input lead from the line output transformer. As we did so, we noticed that at the instant of switching off a bright horizontal line appeared across the centre of the screen. We were so hell bent on eliminating the tripler that the significance of this didn't occur to us. With the tripler disconnected, the fault was still present. The tripler was cleared of suspicion therefore and we switched off to reconnect it. Switch on and the fault had cleared. Switch off and on a few times to see if we can instigate the fault in this way. Nothing doing. We did however notice that on switching off the raster faded to a decreasing square at the centre of the screen.

We then remembered the horizontal white line we'd seen. "Means the field timebase is inoperative when the fault is present" we said to no one in particular. Now the 38V supply for the field driver and output stages is obtained from a rectifier (D734) which is fed from a winding on the line output transformer. Probing around this area failed to reveal anything amiss, and the rectifier's 1Ω surge limiting resistor R757 was found to be running at the right sort of temperature. Playing a hunch, I hooked a meter to the rectifier's output. It read 38V, so I left it there. Two days later the fault put in another appearance and when I rushed over to the set the meter was reading only 3V. I gently felt the surge limiter – it was hot, very hot!

We were now very close! Bring the cutters around and snip one of the rectifier's leadouts: sound returns immediately, white line appears on the screen. So that

was it! The rectifier (type BYX55-600) was going short-circuit intermittently. What I couldn't understand was why the surge limiter resistor hadn't burnt out as one would expect – I can only assume that the diode still presented a certain amount of resistance in its fault condition, thus limiting the current to some extent.

Since that original saga we've had another of these sets in with exactly the same intermittent fault. This time we went straight to the diode of course. It would seem then that the original type of red-bodied rectifier used in this position is prone to this trouble – a BY299 is a suitable replacement.

# VCR Clinic

***Reports from Steve Beeching, T.Eng. (C.E.I.) and Derek Snelling***

A couple of weeks ago my friend Ian Pawson invaded the Newark Video Centre mumbling about the state of health of his poorly HR7700. It seemed to record all right, but the playback was erratic – the picture broke up into horizontal lines and the sound had a speed variation on it. The symptoms indicated that the capstan servo was playing up at least.

Investigation with an oscilloscope revealed that the ramp waveform in both the drum and capstan servos was missing. Ian helped our investigation with comments such as "what's up?", "what sloping bit?", "can I take it back with me today?" and "doesn't that panel come off well – what oscillations?" This last remark related to the fact that there were no oscillations present at the crystal oscillator that provides (after counting down) the playback 50Hz servo reference signal. The crystal is mounted on the inside PCB of a pair: it's necessary to hinge one panel down to get at the other, then to loosen the second one and hinge it down in order to get at the component side with the 4·433619MHz crystal and the oscillator circuit (in IC1) – see Fig. 1. The two boards are spaced apart in this position by a device called a "movement displacement and insulation spacorial support unit" – or, as Ian put it, a bog roll. This device allows safe handling of the boards without the danger of short-circuits. It was the crystal that was faulty.

As an aside, JVC use one of their wonderful digital counters in this circuit – it divides by 88,672 to enable a standard 4·433MHz colour subcarrier crystal to be used. A good job it wasn't a rarer component. Ian went home clutching his recorder and saying what a wonderful thing guarantees are for saving money. Next time mate, next time . . . **S.B.**

## Beware the Pilot Burst

Another fault this month gave us problems and involved a crystal oscillator. The machine was a Sanyo VTC9300, the fault reported to us being that it wouldn't record in colour. Well, most of the circuitry used for colour signal processing is used in both the record and playback modes, so that generally if a machine won't record in colour it won't play back in colour either. This particular machine would play back in colour however, as we found by using a test tape. The machine's own recordings played back in monochrome – as a cross-check we tried one out in a Toshiba Beta machine and got a monochrome display. This proved that the Sanyo machine was in fact recording in monochrome – or was it?

A check around the colour recording circuits indicated that all was well and that the 4·433MHz chroma signal was being down-converted to 685kHz and recorded. On playback the 685kHz off-tape colour signal signal was being up-converted to 4·433MHz – but the playback colour-killer was working. So why wouldn't it replay its tapes in colour, and why were its recordings being replayed in monochrome by other machines?

In the Betamax system a pilot burst signal is recorded on the tape during colour recording – the burst occurs during the line sync pulse period and is used on playback as a phase error indicator. In this particular machine the pilot burst was present, but was at too low a level – too low for correct operation. During recording, the pilot burst is gated from an a.p.c. loop. The basic signal is produced by a 4·433MHz crystal (X201) in conjunction with circuits in the colour sync i.c. (Q205, type CX137A), and on checking the buffered output was found to be only 200mV instead of 700mV.

In 90 per cent of such cases a low signal level is due to the crystal – assuming in this case that the buffer transistor (Q244) is not at fault. So after checking around the other relevant components without finding anything amiss we pronounced the crystal faulty. After a couple of weeks a replacement crystal arrived and was fitted. Still a low level pilot burst. By a stroke of genius we deduced that the i.c. was defective – it was the only thing left to blame. So a new i.c. was sent for. When this turned up and was fitted the oscillator signal level came back up to, but only just up to, the correct level. There's a preset (VR213) to control the pilot burst level, and adjusting this gave us the right pilot burst level – just. **S.B.**

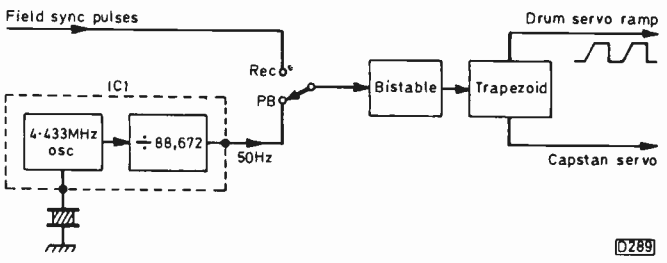



*Fig. 1: Method of obtaining the playback servo reference ramp waveforms in the JVC Model HR7700 — from a 4·433MHz colour crystal after division by 88,672.*

## Ferguson 3V29/3V30

As most of you probably know, the "standard" Ferguson 3V22 VCR was replaced a few months ago by Models 3V29 and 3V30. These incorporate logic control in place of the mechanical piano-key type arrangement used in the earlier machine and separate motors for load/unload, wind/rewind and play instead of a single motor. We're gaining a lot of experience of these new machines. The changes have overcome (so far) the mechanical problems that beset the later version of the 3V22. Also the ability of the new machines to match recordings made on other machines, i.e. rented tapes, is vastly improved (this

is particularly important in our area, which has a large immigrant population). There are nevertheless one or two common faults, and it must be said that the quality control doesn't seem to be all that it should be.

One common trouble is "buzzing". This occurs with the machine in the E-to-E mode, and is usually confined to BBC-1 (it used to be a problem with the early 3V00 machine). If switching the a.f.c. off and slightly adjusting the VCR's tuning clears the fault, adjust T2 on the tuner/i.f. board – this sets the point to which the a.f.c. locks. Unfortunately this can result in the picture being slightly off tune. If the buzzing still can't be tuned out, try adjusting the sound rejector T1. Take care, as T1 and T2 have cores with square holes, and I've yet to find a suitable trimmer – we file a plastic hexagonal trimmer down to a square cross-section.

To reach T1 and T2 it's necessary to unplug the r.f. lead from the tuner and the two-pin plug adjacent to it so that the panel can be removed from its guides – it may be necessary to ease some of the wires from under the presetter board. When the board has been removed from its guides, reconnect the two leads and adjust T1 and T2 as necessary.

If these adjustments fail to solve the problem, Ferguson suggest trying an attenuator or adjusting the vision detector circuit in the set. Be warned however that it's virtually impossible to eliminate the buzz, especially on captions, with some TV sets – e.g. older Philips models and the Toshiba C81B.

Another common problem is minor but irritating since it usually needs a call to the house. The problem is tuner drift after the first week or two. You correctly tune the VCR on installation – by tuning in with the a.f.c. off, then switching the a.f.c. on – but after a week or so the customer will phone to say that they have no sound or no colour on their recordings. The trouble is always due to the tuning having drifted – easily spotted by switching the a.f.c. off. Retuning will clear the problem, and there's then no further drift. It seems that a component in the tuning circuit has to "burn in".

An unusual associated problem occurs when the tuning has drifted but not sufficiently for the a.f.c. to lose lock. Until, that is, the timer is used for an unattended recording. The a.f.c. then for some reason fails, giving the rather misleading symptoms of the machine apparently working perfectly except on a timed recording, when there's no sound or no colour. Retuning cures the trouble.

One or the other of the faults mentioned above has occurred on at least half the machines we've rented out to date, and I suspect that the faults may have been present on many of the other machines, with the customer either putting up with the buzz (it's amazing what some people will put up with, as any TV engineer will tell you) or sorting out the tuning themselves.

Now to some other faults we've had on these machines. Dry-joints seem to be a general problem. Several machines have suffered from a dry-joint on the presetter board (the one on the top of the machine, containing the channel presets). The symptom has been inability to change channels – sometimes intermittently. We had one machine with no sound on playback or in the E-to-E mode due to a dry-joint in the u.h.f. modulator. On another there was no colour due to a dry-joint in the subcarrier oscillator circuit on the audio/video board (the one underneath).

A silly one to watch out for is no signals in the E-to-E mode, with no channel lights on – the tuner/camera switch is in the camera position.

We've also had two cases of squeaking. On the first the cause was the wiring harness rubbing on the capstan flywheel. On the second the earth spring on the top of the head was off-centre, rubbing on the side of the little depression it runs in.

Finally we had a 3V30 that wouldn't play. When we examined it we found that the head wasn't rotating. The cause was finally traced to a wire in a plug from the MDA board (at the front, behind the switches) to the servo board (the outer of the two vertical panels on the left-hand side). It hadn't even got a pin on the end – it had just been inserted into the plug body. Once we'd got the head rotating we found that the capstan speed was incorrect and couldn't be set correctly with the capstan discriminator potentiometer R10. Scoping the waveforms around IC1 showed that the pulses were coming out of the capstan frequency generator and being amplified and fed correctly to the frequency/voltage converter, but instead of the pulses being converted to a voltage proportional to frequency and hence to the speed of the motor they were coming back out unchanged. Replacing IC1 and resetting R10 cured this one. **D.S.**

## Hitachi VT8500

The fault we had with a Hitachi VT8500 was a line about a quarter of an inch wide across the centre of the picture. Cleaning the heads had no effect, so we thought that perhaps the head switching was occurring at the wrong point. Reducing the height of the display on the TV set and adjusting the Ch.1 and Ch.2 switching potentiometers showed that they were working correctly however, with the switching taking place in the blanking interval. Next a new head drum was tried, again to no avail. Scoping the video signal showed that the fault was occurring in the head preamplifiers, or before, but the scope was not sufficiently sensitive to narrow things down any further. Hitachi suggested changing the head motor: this was tried, though it seemed unlikely, and cured the fault. Unfortunately this involves replacing the entire lower drum assembly, including the rotary transformer. I suspect that the fault was in fact in this latter area, and would welcome any ideas. **D.S.**

## Toshiba V5470

A Toshiba machine wouldn't play after rewind or on timer, the keys going straight back to the off position. Naturally it performed perfectly at the house, so we had to take it back to the workshop for a prolonged test. The timer problem was simply a matter of changing R619 on the servo panel to 330kΩ, a recommended modification, but it was two days before the other fault showed up. Fortunately it then came on permanently. It turned out to be due to failure of the head to rotate, and we soon established that the drive was not reaching the drum motor board though it was leaving IC503 on the servo board. This meant that either R581 was open-circuit or the drive was being lost between the two boards. The drive goes via the stop microswitch, which shorts the drive to chassis when the stop solenoid operates. Checks showed that all three terminals of the switch were permanently shorted together, a new switch curing the problem. **D.S.**

# Long-distance Television

**Roger Bunney**

JANUARY 1982 was relatively active for the time of year. On New Year's eve Sporadic E signals were present at up to Band II (f.m.) from south east Europe/Hungary. There was then a lull until the 3rd, when the Quadrantids meteor shower produced good Band I signal pings during the day. Tropospheric propagation also improved on the 3rd, with signals mainly from the south/south east (France) and Belgium/Holland to the east. The 3rd/4th produced strong F2 reception as well, on ch. R1 from the USSR. There was further SpE reception on the 5th/8th-10th, with signals from TSS (USSR), JRT (Yugoslavia), RAI (Italy) and RTVE (Spain), i.e. from the east through to the south: the openings were of medium strength and duration.

The main event of the month was the good tropospheric opening on the 13th/14th. This produced quite exceptional reception all over the UK. On the 13th there were improved French u.h.f. signals, conditions peaking on the 14th with reception from SR1/2 (Sweden) on chs. E9/30, NRK (Norway) chs. E6/9, DR (Denmark) chs. E5/7/10 and various W. German stations. Even here at Romsey several W. German stations throughout the group A/B channels were received. On the 14th SR2 ch. E30 was so strong that Brian Renforth (Chippenham) was able to lock the PM5544 test pattern from Goteborg using a hand-rotated Fuba XC343d aerial. Intense signals from Belgium/Holland were present at the time. The signals faded at around 1700 local time. Many u.h.f. signals were logged in Holland, including various AFN (AFRTS) stations – one of these signals, on ch. E26, had the EBU test pattern. Other signals received in Holland came from SR/NRK/DR/DFF (E. Germany). Amateur TV activity was also at a high level.

Conditions since the 13th/14th have been quiet – the usual mid-winter meteor scatter signals and, with an increasing MUF on the 28th, ch. R1 again at lunchtime via F2.

My thanks to Ryn Muntjewerff (Holland), Hugh Cocks (E. Sussex), Brian Renforth (Chippenham), John Tellick (Surbiton), Don Bassnett (Glasgow), Arthur Milliken (Wigan) and Cyril Willis (Ely) for their contributions to this reception report.

The u.h.f. bands have been more cluttered in the UK in recent weeks due to various IBA TV4 transmitters being on test. Just for the record, T. Boorman (Swansea) reports that Wenvoe ch. 47 has been radiating the ETP1 electronic test pattern with the identification "S4C" (Sianel 4 Cymru).

The SpE season in Australia has been described as "very good lately". Let's hope that this is a pointer to a good UK season in the months ahead.

## 49MHz Walkie-talkies

Last month I discussed the 49MHz walkie-talkie problem and mentioned that I'd written to the Home Office (Queen Anne's Gate, London) seeking the official view on this encroachment of illegal signals into the Band I broadcast band. The reply I've received states:

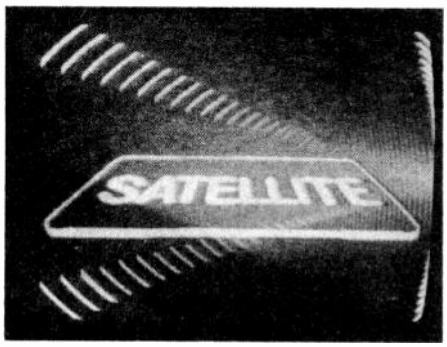
"We are concerned about the growing illicit use of these sets which, as you say, were originally designed for the North American market. They cannot be licensed for use in this country because of the interference such use is likely to cause to authorised radio services. Unlicensed use is an offence under the Wireless Telegraphy Acts and users are therefore liable to prosecution. The Radio Interference Service of British Telecom acts as our agent for the investigation of illicit use of radio, and within the limitations on available resources, and their commitment to investigate other forms of illegal use, they are doing all they can to trace users of these sets with a view to taking them to court.

The Government recognises that the only effective answer to this problem is to prohibit the sale of these walkie-talkie sets and that the present position wherein it is legal to sell the equipment but illegal to use it is anomalous. Ministers are therefore currently considering measures to strengthen the enforcement provisions of the Wireless Telegraphy Acts, including a power to prohibit the sale of equipment, and they will be submitting proposals to Parliament as soon as legislative time permits."

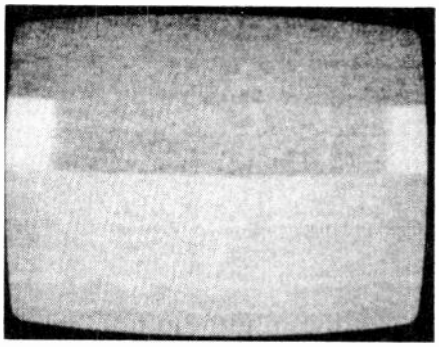
So there you have it. Any readers who have purchased such 49MHz units would be well advised to return them to the shop and request a refund – particularly if no warning about their use being illegal was given. Action if necessary under the Sale of Goods Act would probably ensure such a refund.

## News Items

**UK:** There's been little further information to date on the forthcoming Satellite Television Ltd. service of

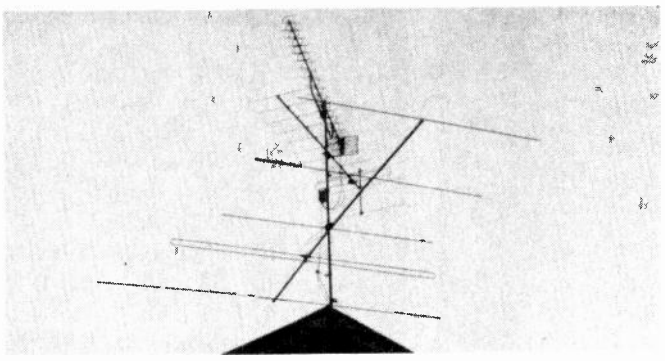



*Satellite TV Ltd. test transmission received by Steve Birkill, at 11·6GHz from the OTS satellite.*



*RTM (Morocco) test pattern received by Michel Dubernat (S. France) via SpE on ch. E4.*


*TSS-1 (USSR) transmission received by Steve Birkill from the Gorizent satellite at 3·875GHz.*



*Petri Pöppönen's DX-TV aerials at Lahti, Finland. The Band I array features a 1:1 300Ω/75Ω balun transformer.*

direct satellite TV transmissions to Europe via the OTS craft, at 11·6GHz. A few advertisements for jobs on the programme control side have appeared, and programme origination will be from a London facility house, Molinaire Ltd., at Marshall Street, London W1. The large L-Sat craft for direct broadcasting is scheduled to come into operation in 1986: the BBC and RAI (Italy) are both understood to be considering the use of the craft.

**Spain:** We learn with regret that the RTVE-2 Santiago ch. E2 transmitter is to close on July 1st, 1983. Fortunately other Band I transmitters are to be modernised.

**In brief:** Colour transmissions (PAL) have started in Bangladesh... Mongolian TV commenced Secam colour transmissions on November 5th, 1981... A correspondent in the Saudi Arabian area reports reception of a system M (525-line) AFRTS transmission on ch. A3, thought to be from a military base in the Straits of Hormuz region... Mauritania is to start TV transmissions in the capital (Nouakchott) this month... In the USA a new record for multiple-hop 2GHz ENG (electronic news gathering) has been established – a 232 mile path using eight hops was used by KRON-TV, San Francisco in covering anti-nuclear demonstrations at San Luis Obispo.

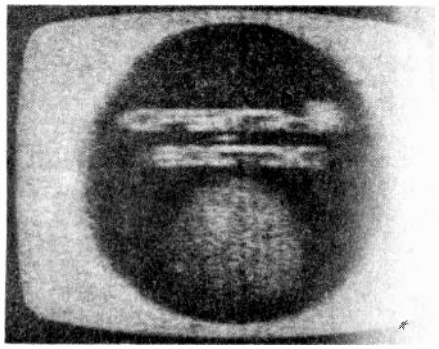
## USSR UHF Satellite

Bindu Padaki (Madras) reports that the Russian Stat-T direct broadcasting satellite at 99°E has changed channel from ch. 51 (714MHz) to ch. 56 (754MHz) with increased power. Programme times are 0715-1600 GMT with a fifteen minute break at 1115. The TSS circular identification has been modified and now has "ORBITA III" and underneath "VOSTOK" – Petri Pöppönen (Lahti, Finland) received the new identification on December 15th, via F2 on ch. R1. Orbita III is the satellite number, Vostok standing for east. It would seem that the signal received by Petri came from a ground station which receives the signals from the satellite and re-radiates them on ch. R1.

## From our Correspondents

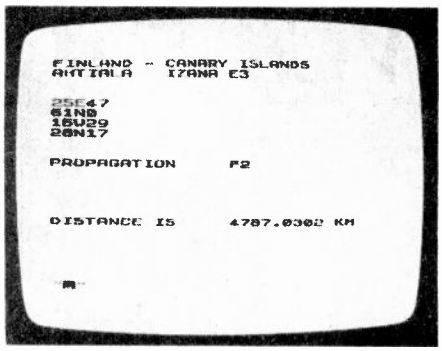
Petri Pöppönen has provided us with an exclusive programme for Sinclair ZX81 computer users to enable them to calculate distances and other information between a DX reception site and the transmitter. The programme is unique and will be featured next month, with an example of reception in Finland from the Canary Islands. Stay tuned!

Clive Budden (Berri, South Australia) reports having received signals from virtually all the Australian states. His aerial system consists of two phased-together dipoles

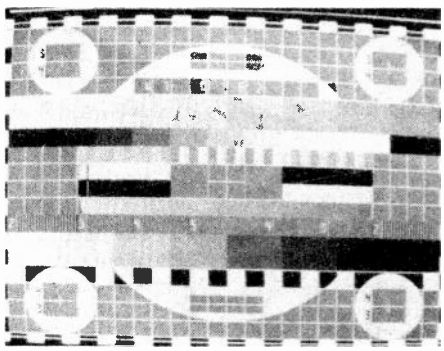


*The Orbita III identification received by Petri Pöppönen in Lahti, Finland via F2.*

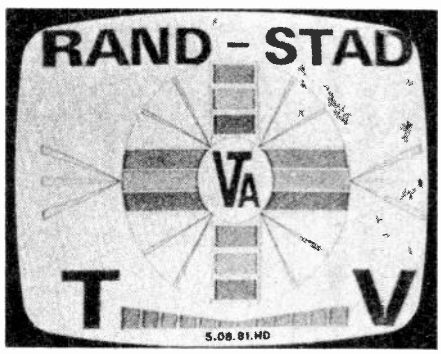
*JTV (Jordan) received in Holland by Ryn Muntjewerff via SpE. Transmission on ch. E3.*



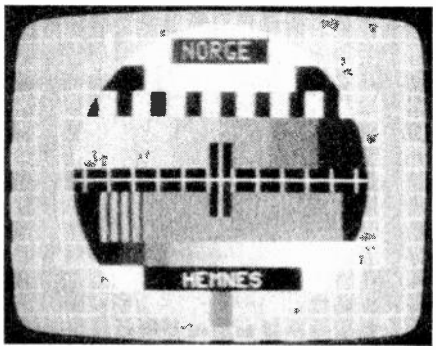

*Example of Sinclair ZX81 programmed for DX-TV calculations by Petri Pöppönen.*



*The Leningrad type 0167 test pattern, received by Steve Birkill via the Gorizent satellite.*




*A Dutch pirate, Rand-stad TV, on Amsterdam ch. E48. Photograph from Henny Demming.*




*The Norge (Norway) PM5544 test pattern, received by Nicholas Brown in Rugby on ch. E2 via SpE.*

giving wideband coverage of Band III and a log-periodic array for Band I. A 25dB head amplifier is also used for Band III reception. He'd like to hear from other Australian DXers – the address is 1 Aitken Street, Berri 5343, S. Australia.

W. Homann (Transvaal, South Africa) reports that new identifications are now in use for the TV2 and TV3 networks – AUK/BCH, standing for Aukland Park and Broadcasting House.

Gosta van der Linden (Holland) reports that the BRT (Belgian) VTV1 and VTV2 identifications on the PM5544 test pattern have been replaced by TV1 and TV2. The Egem mast has been increased in height, giving a general improvement in u.h.f. reception. ZDF (W. Germany) is continuing with stereo sound tests and NOS (Holland) hopes to follow by early 1985.

Alexander Wiese (Munich) has sent us a photocopy of the Milan TV1 "free" TV station's programmes, the unusual point being that the transmissions (on ch. E55) are all in English – from 1900-2300 nightly. The Italian "free" TV network continues to expand, with chaos in the u.h.f. spectrum – powers range from 0·5W to 5kW e.r.p.

## Charles Hopkinson

It is with regret that I record the death of veteran TV-DXer and radio enthusiast Charlie Hopkinson of Malton, Yorkshire. He had a lifetime interest in long-range TV, MW and FM reception, also 70cm amateur reception, and was one of the first to receive the ATF-S satellite at 860MHz in 1976. A particular interest of his was the reception of Lille ch. F8a/21 in the days of RTF/ORTF. He was a close friend of both Ian Beckett and Charles Rafarel.

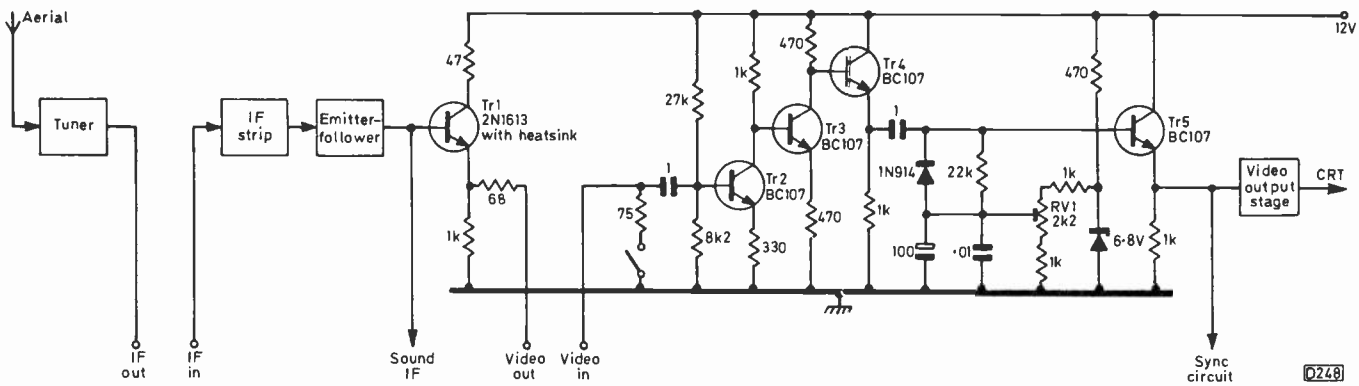



*Fig. 1: Circuit enabling a TV set with an isolated chassis to be adapted for receiver/monitor use. Of W. German origin, the circuit was sent from S. Africa by Jim Maden/Ian Roberts. RV1 should be adjusted so that the voltages at the base of Tr1 and the emitter of Tr5 are equal. For normal receiver use, link the i.f. and video input/output connections. The output from an external tuner can be fed to the i.f. input or, via a gain-controlled i.f. strip, to the video input. It may be better to use BC109 transistors in positions Tr2-5.*

# VCR Servicing

**Part 7**

**Mike Phelan**

THIS month we start to take a look at some typical VCR faults. First however a few general comments.

### Servicing Equipment

It may not be too obvious that in addition to recording and playing back tapes a VCR, whilst the viewer is watching an off-air transmission, acts as an aerial amplifier – albeit one with a gain of only about unity. When trouble is experienced, the first thing that has to be ascertained is whether the fault occurs in the record or playback mode or both. It's essential therefore to have a known good prerecorded tape, i.e. one recorded on a known good machine. A test card makes a good subject, but moving pictures are also required for when we progress (hopefully) to repairing machines with still frame, slow motion and other features – a test card in still frame has a great resemblance to one at normal speed or even twice normal speed! A good oscilloscope is also essential, preferably a double-beam one. It's assumed that you would already have a multimeter: we don't propose to enter into the digital versus analogue controversy here – they both have their pros and cons. It's nice to be able to measure the voltage at the tuning pin of a tuner without putting it off station, but we have a great respect for the AVO 8 (not the version with printed boards in it).

It's also necessary to pay attention to the toolbox. Chewed up screwdrivers, pliers and cutters more suited to power station maintenance will not do. A magnetic screwdriver is very useful – Woolworths do one with an assortment of bits for about a fiver. Next on the list comes a couple of good pairs of pliers and either a stout pair of tweezers or artery forceps. Finally we need grease, light oil and something like methylated spirit or isopropanol for cleaning heads etc. So much for equipment.

We'll look first at faults in the r.f. and i.f. sections, i.e. the tuner and i.f. strip, the u.h.f. modulator and aerial amplifier.

### Aerial Amplifier, Tuner and IF Troubles

A common complaint is a snowy picture. Try the machine with a prerecorded tape: it will probably be found that the picture is normal when playing this back but snowy when an off-air picture is being viewed (via the machine's aerial amplifier) or when the machine is being operated in the E-to-E mode (recording, with the signal being recorded fed to the TV set via the machine's tuner, i.f. strip and u.h.f. modulator). If the picture is noisy in the E-to-E mode it follows that the noise will be recorded on the tape and the playback will be snowy. The cause of this fault is usually the first transistor in the aerial amplifier, since it's the first thing in line in the event of static charges on the aerial, thunderstorms, etc.

It's not too bad a job to change this transistor on the JVC HR3330. Remove the top, base and right-hand side of the cabinet. Then remove the back and the trim over the socket panel. Two screws hold the rear frame in place: after removing them, draw the frame to the rear. Disconnect the two phono plugs from the aerial amplifier, unsolder the supply and earth leads, take out three screws and remove the unit. The suspect transistor is the one nearest the aerial socket, and must be replaced with the correct type (2SC2570). Earlier machines (Ferguson 3292/JVC HR3300) had an i.c. in the aerial amplifier, and there were two types (MC5156 and MC5192). Reassembly is straightforward – make sure that the clear plastic shield round the mains wiring is in place and that the correct screws are used in each location. The latter point should always be uppermost in one's mind when servicing VCRs.

If the picture is snowy in the E-to-E mode and when the machine is playing back its own recording but there's no snow when simply viewing an off-air picture via the VCR's aerial amplifier, the tuner unit in the VCR is suspect. This is unlikely as the tuner and i.f. strip in these machines are very reliable. Any such fault symptoms would be similar to those produced by the same parts of a TV set, and would not be present when playing back a prerecorded tape. We have had occasional complaints of slight tuner drift due to leaky varicap diodes in the tuner.

### UHF Modulator Defects

The machine's u.h.f. modulator (r.f. converter) can also cause problems. If the TV display is blank and even the test signal can't be obtained, a u.h.f. carrier is being generated (hence the blank display) but it's not receiving any modulation. Check the supply at the edge connector, then change the unit – easy, as it plugs in. Other modulator faults can cause severe patterning or a very snowy picture in the E-to-E mode and on playback. There are a few situations where adjustment is all that's required however.

When one of these machines leaves the factory the modulator's output is set at about channel 37. If one of the local channels is somewhere near this, there'll be severe patterning. All machines have an adjustment for the modulator, allowing it to be tuned up or down by a few channels – the adjustment is usually accessible from outside the machine. It will also need adjusting if radar interference is being picked up: this appears on the screen as random white dashes, and may or may not be accompanied by a bleeping sound.

The only other adjustment that may be attempted is for the video modulation depth. If this is set too high, there'll be caption buzz and limiting of highlights (these will be observed on playback and in the E-to-E mode of course). We strongly advise trying another modulator before attempting to adjust this, but the potentiometer concerned is at the opposite end to the little square coil (two or three layouts have been used). Reducing the setting too far will cause low contrast. The potentiometer sometimes develops a noisy track, with the result that the picture goes negative at intervals.

Except for those in the latest machines and the portables, all the modulators used in the JVC/Ferguson

machines are interchangeable. When adjusting the tuning in the 3292/HR3300, don't screw the core in too far otherwise it will fall inside: as the u.h.f. modulator box is soldered up, that will be the end of that! Newer modulators are about the size of a matchbox but still have an adjustment for depth. In passing, some TV sets are more prone to caption buzz when used with VCRs than others – the ITT CVC5-9 hybrids and the Philips G8, G11 and KT3 chassis spring to mind. Adjusting the set's a.f.c. sometimes helps.

### *Coming Next Month*

Next month we'll be taking a look at the video heads and the preamplifier circuits, also the f.m. processing circuitry.

# *Routine TV Receiver Tests: Rank A823 and T20 Chassis*

***S. Simon***

WHEN a TV set is received for service, the action taken by the engineer depends not upon a basic set routine but upon the engineer's experience of the particular chassis (not make). What we are getting at is that if you know the habits of a particular chassis, various fault conditions will lead you to check certain components without further ado. The habits of different chassis, even of the same make, vary drastically. Some chassis have few set behaviour patterns, particularly if they are of the more reliable type: fault tracing on these can be a very tedious business. It's a great help on the other hand to know the habits of chassis with established fault patterns, and the aim of the notes provided in this and following articles is to summarise some of these patterns and the action required. Previous articles have gone into most of these chassis in depth and should be referred to when less common faults arise: our purpose here is to deal with the more common defects that regularly occur.

## RANK A823 CHASSIS

We'll start off with the earlier Rank-Bush-Murphy (and Co-op) solid-state colour chassis, the A823 etc. – see Fig. 1.

### No Results

If the fault is no results, the first thing to check is whether the c.r.t. heaters are glowing. If not, check the mains fuses in the plug and at the bottom of the power panel – left side rear, as viewed from the back of the set. If the mains fuse has blown, don't suspect the mains filter capacitor (8C5) at first: it rarely shorts in these sets. Instead, check the mains rectifier thyristor 8THY1 (half way up the panel) which could well be short-circuit. If not, remove the panel and inspect the print around the thermistors for signs of flashover. This is often promoted by a faulty thermistor – the VA1104 (8TH2) which acts as a surge limiter in the h.t. circuit.

More often however the tube heaters will be glowing and the drill then is to check for the presence of h.t. voltage at the top 630mA fuse (8F3) on the panel. Some 200V is to be expected, and if this is present the next check is on the l.t. fuse (8F1-2A) half way down the rear edge – it feeds the bridge rectifier (8BR1) which is just above it. The voltage on this fuse is a.c. If the l.t. fuse has failed, it's usually because the bridge rectifier has an internal short. The BY164 is not really man enough for the job, and a BY225 should be fitted. Quite often you'll find that the bridge is made up of four separate diodes, one of which may be short-circuit. BY126 diodes can be used in this case, but more beefy types such as the 1N5408 will provide greater reliability.

If there's no h.t. at the top 630mA fuse, first check the condition of the previously mentioned VA1104 thermistor – it may have come apart. If it's intact, check for h.t. at the cathode of the thyristor: if this is a BT106, the long arm is the cathode. If h.t. is present here but not at the fuse, suspect that the h.t. smoothing resistor 8R15 is open-circuit: it's the left-hand section (68Ω) of the "dropper" resistor at the front of the centre section beneath the tube. Whilst looking in this area it's prudent to check the condition of the two large h.t. electrolytics (8C9/10) which often leak, also the condition of the 47kΩ resistors across these capacitors as they often deteriorate.

The "no raster" symptom should also direct attention to the right-hand section (56Ω) of the "dropper" – if this (8R17) is open-circuit, there will be h.t. at the 630mA fuse but no supply to the line output stage.

It's worth bearing in mind that in this chassis the line driver transistor (BD131 or similar) is not fed from the h.t. line, its supply coming instead from the l.t. supply via 8R2 (6·8Ω) – this is just below the left side of the 630mA fuse and often goes open-circuit to stop the line timebase working. If this wirewound resistor is open-circuit, it's as well to check the driver transistor which may have suffered an internal short. While you're about it, check the damping network in this transistor's collector circuit (22Ω resistor and 0·22μF capacitor).

### Field Collapse

The aforementioned BD131 transistor is at the bottom right of the timebase panel. At the top of this panel are the field output transistors and the various associated preset controls. In the event of complete field collapse (white line across the centre of the screen), first check that the 40V supply is reaching the field timebase: it's obtained from a pair of series-connected diodes (usually – just a single BY207 in late production) which are fed from a winding on the line output transformer and charge a 750μF electrolytic capacitor. It's not easy to be too specific with this chassis, since numerous minor alt-

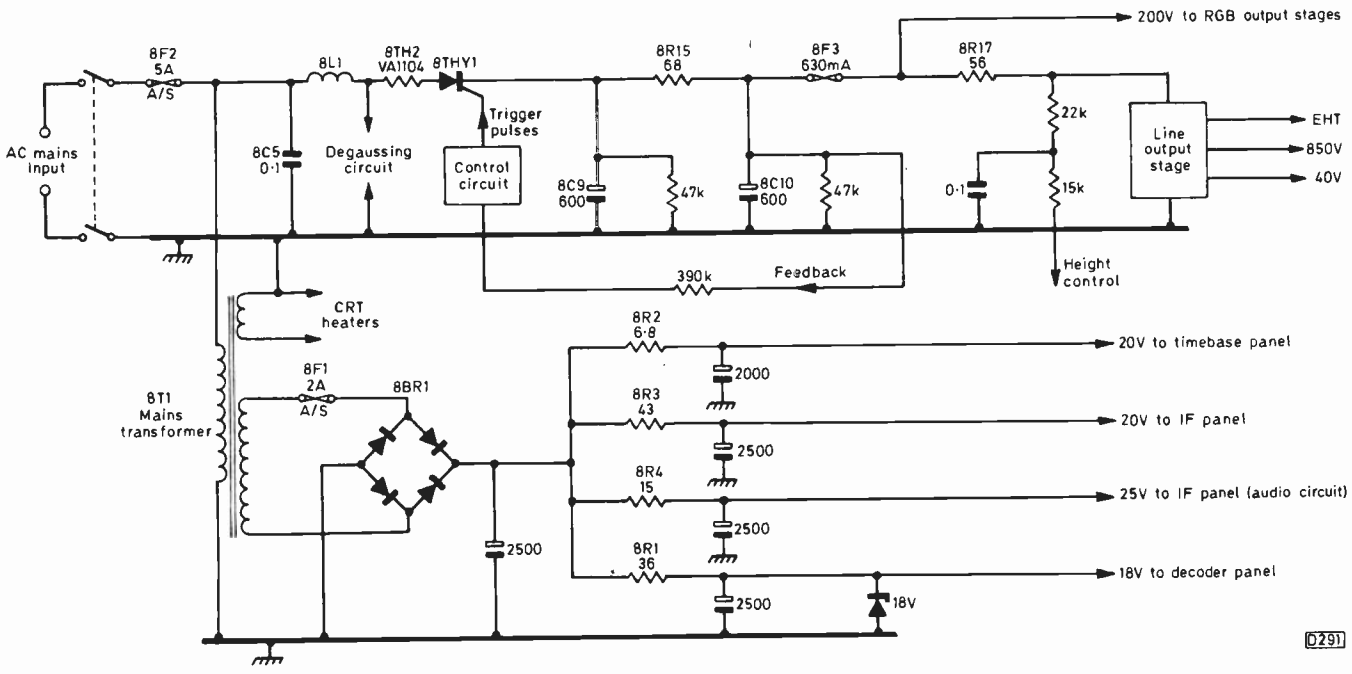



*Fig. 1: Power supply arrangements in the Rank A823 chassis.*

erations were introduced during its long production run and the component reference numbers used on some panels differ between earlier and later versions. A couple more diodes are used in the field output stage – they are there to play a part in the flyback action, and if either goes open-circuit the result is field collapse. It's a matter of moments to check that both have the 40V supply at each side. The other quick check to make in the event of field collapse is that voltage is present at the height control – the supply comes from the h.t. rail rather than the 40V line. It's essential to check this supply back to its source (the previously mentioned 56Ω h.t. "dropper" resistor), as it's possible for corrosion to occur in this area. If these points check out o.k., the fault is probably on the timebase panel and routine checks upon the output transistors and back as necessary should speedily reveal the cause.

Field collapse can also be caused by a fault on the scan control panel. The usual problem here is a dry-joint on the connections to the pincushion phase coil 6L20. If necessary, check potentiometers 6RV2 and 6RV4.

## Probable Line Output Stage Faults

The line output transformer is rarely troublesome in these sets. This is something to be glad about. The line output transistors often give trouble however, and when they have to be replaced it's prudent to change the flyback tuning capacitors 6C5/6 at the same time. These have the value of 4,700pF and are of a special type for use in this position – only those specified as suitable for this application should be used. Failure of one output transistor can produce a poor picture with excessive width.

The tripler is a frequent source of breakdown, and if the 630mA h.t. fuse has failed it's advisable to unplug the input to the tripler from the line output transformer and monitor the h.t. current, using a meter connected across the fuseholder. The reading should not exceed 500mA – more like 400mA is normal. Another reading taken with the tripler connected will show whether it is the cause of any excessive h.t. current.

A word of caution here. With the tripler disconnected, check the c.r.t. cathode voltages – if there's an h.t. fault or any other fault that results in the loss of the c.r.t. cathode voltages, the heavy current drawn by the tube will mean that the tripler has to pass a heavier than normal current.

## No Colour

Loss of colour possibly gives rise to more head scratching than any other fault condition on these sets. A couple of hints may be of help therefore. It should be realised first that the chroma amplifier is not on the decoder board: it's towards the top of the i.f. unit, on the left-hand side, in the can between the red and white plugs. Speaking very generally, the small round type of transistor (there are three in the can) is less reliable than the more traditional "rectangular" type.

There are two types of decoder panel, the earlier with one i.c. (SL901) and the later with two (the lower i.c. is an SL917, which took over most of the jobs undertaken by separate transistors on the earlier panel). It cannot be said that either of these i.c.s is above suspicion in the event of no colour. They are pretty expensive however as chips go, and a couple of checks may save a red face.

If the decoder uses an SL917, there will be a BC148 transistor (3VT2) to the right of it. This provides a stable 11V supply for pins 7 and 19 of the i.c. and the ident control. It is common for this transistor to become open-circuit, with consequent loss of colour. It can be checked cold with an ohmmeter – this may save coupling up extension leads for a more thorough voltage check on the i.c.s etc.

To remove the decoder panel, it's often necessary to unplug the lead between the tube base and the degaussing circuit – it crosses over to the power supply panel. If you forget to replace this plug when testing the set, something it's easy enough to do, the result will be a cloud of smoke from 8R5 on the power supply panel. So

don't forget to replace the black plug when reassembling everything.

## RANK T20 CHASSIS

As a contrast, let's consider a more recent Rank chassis – the T20. This calls for a completely different fault-finding routine. For a start, the tube's heaters are fed from a winding on the line output transformer. So the fact that they are not alight means only that the line output stage is not working, it doesn't mean that the h.t. supply (200V – there are higher voltages in the power supply unit) is not present. Most often these high voltages will be present in the power supply unit, and unless one is aware of the general circuit arrangement (see Fig. 2) progress will be very difficult indeed. The following is a rough idea of the writer's approach and the reasons for it.

With the rear cover off, note the insulating card covering the BU208A line output transistor. Remove the card and with the set switched on take a voltage reading from the body of the transistor to chassis, with the meter switched to the 250V or a higher range. A reading of over 200V indicates that the chopper power supply unit is in order and that the line output transistor is not short-circuit. A low reading accompanied by a subdued noise from the centre section power supply unit on the other hand indicates that some sort of stress is present, and it's quite possible that the line output transistor is either leaky or under severe load. Both these conditions could be present, i.e. the severe load has resulted in the transistor breaking down.

To test the transistor, disconnect the collector (body) lead either at the transistor tag or at the panel on the right side. With the collector free and the set switched off, check the transistor with an ohmmeter switched to a high resistance range. With the black probe (positive lead) connected to the body and the red probe (negative lead) to the base or emitter, no reading should be obtained. Any sort of reading means fitting a new transistor. With the black probe applied to the base and the red one to the collector or emitter a low reading should be obtained (in each case) to prove that the transistor is capable of working.

If the transistor is not at fault, leave its collector disconnected and switch the set on again. The h.t. voltage should this time be high, since the principal source of loading (the line output stage) has been disconnected. If the reading is still low, check the power supply output with all the loads removed from it, i.e. disconnect 5Z2. If by any chance the voltage is still low (measured across 7R1), suspect that the h.t. reservoir capacitor 7C2 is either open-circuit or poorly connected, then if necessary make a general check on the power supply unit. This would require a separate article of its own, and as it's not often at fault we'll pass it by for the present.

We mentioned 5Z2 which is a plug and socket connector at the top of the right side vertical panel. Really this is one of the first things to check, since in most T20s the first contact will be found to be blackened – the pin and socket are apparently unable to cope with the current that passes. Remove the wire from the plug, pass it through and solder it securely to the socket contact to prevent further deterioration.

The cause of excessive loading on the line output stage could well be a faulty tripler (easily unsoldered from the

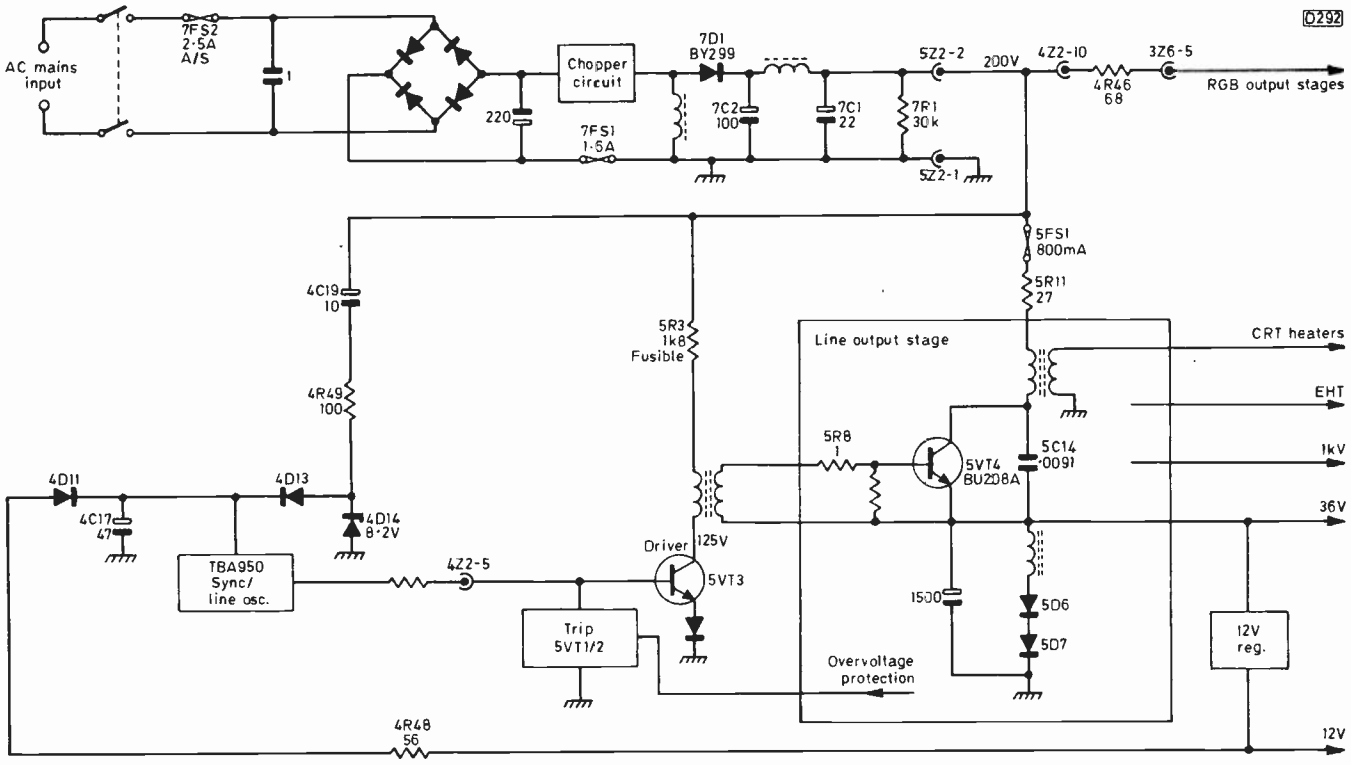



*Fig. 2: Power supply arrangements used in the Rank T20 chassis — skeleton circuit showing the main supply lines. EW drive is applied to the junction of the modulator diodes 5D6/7. The trip circuit (5VT1/2) short-circuits the base of the line driver transistor 5VT3 in the event of excessive h.t., an open-circuit flyback tuning capacitor (5C14), a short-circuit within the e.h.t. tripler or excessive voltage on the 36V line due to reduced loading.*

line output transformer) or the transformer itself: these are two items that regularly give trouble in the T20 chassis. Two other items are the line output transistor and the two diodes 5D6/7 in the EW modulator circuit.

## HT Present, Nothing Working

We now come to the tricky bit we all meet regularly. First a word of explanation. The line oscillator is in the TBA950 chip, along with the sync circuitry. This chip receives its 12V supply from the line output stage – via the 12V regulator, 4R48 and 4D11. So something has to be done to get it going when the set is first switched on. For this purpose a kick-start supply is provided – by means of capacitor 4C19, which is connected to the h.t. supply. The kick-start gets things going only if there's no fault along the line, i.e. in the oscillator, driver or output stage circuits. If there is a fault in one of these stages, the whole show will come to a stop. The writer has his own pet method of sorting this kind of thing out, and it seems to work.

One has to appreciate first how the kick-start system works, then keep the line oscillator working whilst carrying out various simple checks. The line oscillator is on the front left of the swing-down centre panel. If it's working, the line driver stage will operate (if it's capable of this of course) and the driver transistor's collector voltage will fall from the non-working figure of 200V to 125V. So by providing the line oscillator with a supply that's independent of the line output stage, the driver transistor's collector voltage should fall to 125V. If this is the case and there are still no results, the fault has been proved to lie in the line output stage. It's useful to be confident about this, since it narrows the search area considerably.

It's simple to keep the line oscillator working without help from the line output stage. The kick-start capacitor 4C19 is on the same panel as the TBA950 i.c., but is on the right side of the board, in series with 4R49. The voltage at the "earthy" end of this resistor is clamped at 8·2V by zener diode 4D14. This gives one a little leeway in the choice of a resistor to shunt across 4C19 – about 10kΩ is enough to load the zener diode without damaging it. In short, connect a suitable resistor across 4C19 and the line oscillator will continue to operate (again, if capable): the driver transistor's collector voltage should then be at its correct 125V or so, and we can be reasonably sure that the line output stage is receiving its drive.

If the line output stage remains inactive, it's quite likely that the drive is not being applied fully between the base and emitter of the line output transistor – this is an extremely common fault in fact. There's a 1Ω resistor (5R8) in series with the drive path to the base, and one quite often finds that this small wirewound resistor is open-circuit. So often in fact that the writer now makes a check on this resistor one of the first he performs when the line output stage is inactive – before going to the trouble of starting up the line oscillator.

The other quick check to make in this area is on the line driver transistor's collector feed resistor 5R3 (fusible). If this has sprung open, the line driver transistor could be faulty – but solder the resistor up first just in case it's sprung open "naturally" due to poor soldering originally. It's worth checking the plug/socket earth connection between the timebase and line output panels.

When using the "resistor across 4C19" dodge, if the voltage at the collector of the driver transistor remains high it could well mean that the TBA950 line oscillator chip is in need of replacement.

These few notes should help in removing some of the uncertainty when handling one of these sets for the first time. In the next few issues we'll be dealing similarly with other common chassis.

# Inside the Philips VR2020

**Part 1**

**Brian Dempster**

THE VR2020 was the initial "basic" Philips VCR using the V2000 system. The system itself, which was developed jointly by Philips and Grundig and first announced in late 1979, brought with it two important new features on the domestic VCR market. These are dynamic track following, which amongst other things ensures complete compatibility between all machines using the standard, and a turnover cassette which provides the longest playing time per cassette and the lowest tape cost per hour. In addition, the machine features straightforward non-mechanical single key operation, with microprocessor control ensuring freedom from user abuse.

## Main Features

The use of dynamic track following much simplifies the operation of the machine. Instead of the user having to adjust a tracking control to obtain optimum picture quality on playback, the machine automatically compensates for any mistracking by moving the video heads so that they are continuously aligned with the recorded tracks.

The turnover cassette uses half-inch tape and gives up to eight hours recording/playing time – four hours per side. The cassette can be protected against accidental erasure on either side (independently) by sliding over a small plastic tab at the rear of the cassette: when record protection is no longer required, the tab is returned to the normal position.

The keypad type buttons operate microswitches, greatly easing use of the machine. The "heavy" tasks, such as cassette lift, pressure roller operation etc., are carried out by solenoids, removing the need for mechanical linkages to the user controls. Single key operation means only one key action per machine function: for example, with the VCR switched off (but still connected to the mains supply) recording is selected simply by pressing the record key – in most machines the record and play buttons have to be operated simultaneously.

The microprocessor ensures that regardless of which key is pressed the machine's conditions are rendered correct for any operation before that operation starts. If for example the machine is in the record position and the eject key is pressed, the tape transport will first disengage, the tape will then unthread, and only when this has been completed will the cassette lift be raised to the eject position. The idea is to protect the machine and the tape from accidental damage due to misuse, i.e. an inexperienced user pressing the wrong thing at the wrong time.

Other features of the machine include:

(1) Dual-mode wind/rewind. If the wind or rewind key is held down whilst the VCR is in the play or record mode, fast tape motion is initiated without unthreading: the wind/rewind speed in this mode is as fast as some other VCRs. When the wind/rewind key is released, the VCR automatically returns to the play mode. If on the other hand the stop key is depressed before wind or rewind, the tape unthreads and fast tape motion then continues until the stop key is pressed again or the end

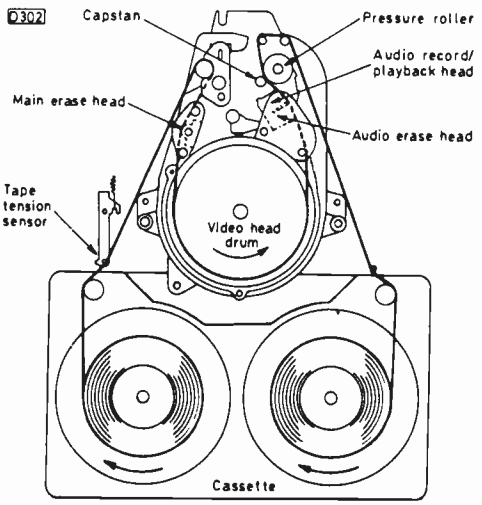



*Fig. 1: Cassette/deck layout.*

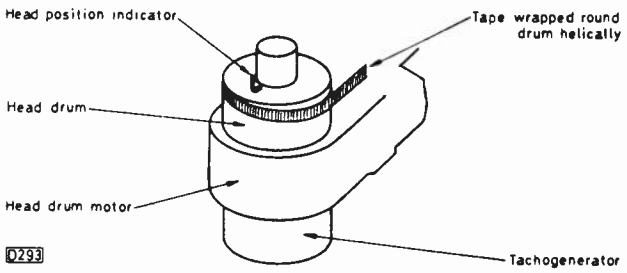



*Fig. 2: Simplified view of the video drum/motor assembly.*

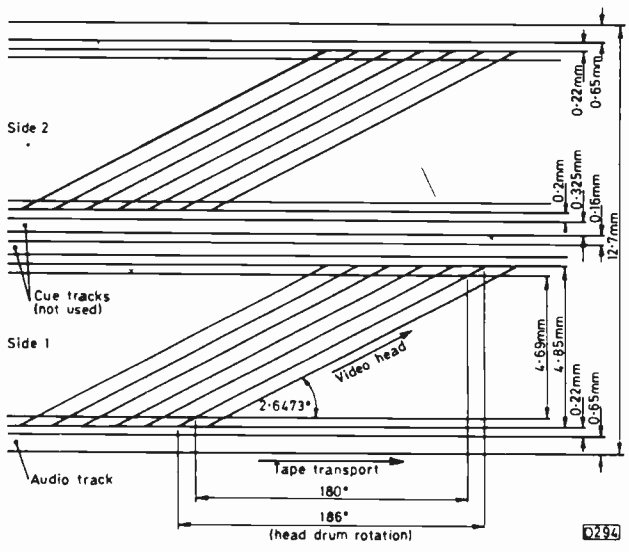



*Fig. 3: Track layout on the tape.*

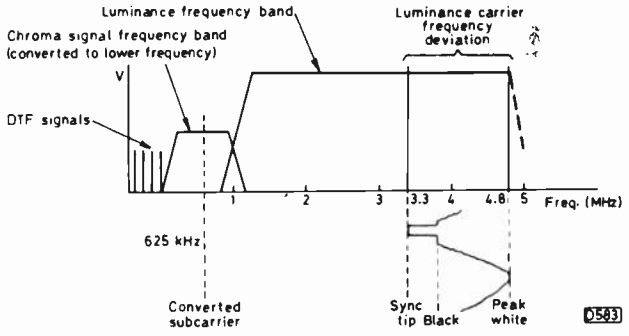



*Fig. 4: Signal spectrum.*

of the tape is reached: in this mode a very fast wind-rewind time is obtained – one hour of tape is rewound in about thirty seconds. The use of this dual wind/rewind mode gives much increased video head life expectancy compared with the earlier N1700 series machines.

(2) The "go to" facility. When the "go to" key is pressed, the clock display goes blank and a four digit number can be entered via the keyboard. When the last digit has been keyed in, the machine unthreads and the tape advances to a counter reading equal to the number entered.

(3) Search tuning. The VCR will automatically search the TV bands (Bands IV/V), locking to any transmission whose signal strength exceeds 250$\mu$V. This channel can then be given a two digit number via the key pad and will be stored by the VCR..

(4) Unattended recording. A programme of up to five different recordings on any of the stored channels, on any day(s) up to fifteen days in advance, can be preset by means of the timer. If required, the machine will also rewind the tape after the last recording.

## The Mechanics

As with other VCRs, the h.f. response required is obtained by using specially designed video record-playback heads and a fast head-to-tape speed. The familiar helical scan arrangement is used. In this system two video heads are mounted 180° apart in a cylindrical drum that rotates at 1,500 r.p.m. The tape is wrapped at a slight angle around 180° or so of the drum, moving comparatively slowly in the same direction as the rotation of the heads. In this way a fast head-to-tape speed is obtained though the linear tape speed is slow – in fact the head-to-tape speed is 5·08m/sec, the tape speed being only 2·44cm/sec. Figs. 1 and 2 show the arrangements used in the VR2020.

Following conventional practice, the tape is first erased (half track only with the V2000 system of course)

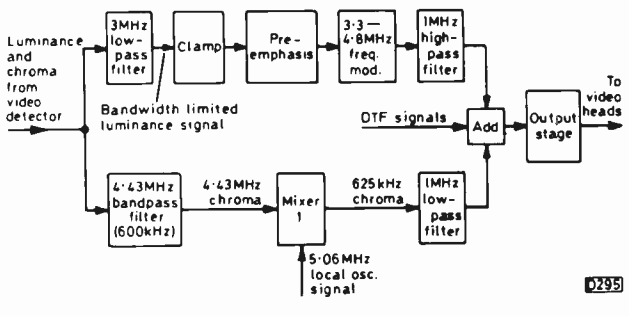



*Fig. 5: Signal path on record.*

before recording. The separate luminance and chrominance signals are then recorded by the rotating video heads, whilst the accompanying sound signal is recorded by a separate audio record/playback head, using a linear track at the bottom of the tape. A separate audio erase head is provided. The tape distance between the main erase head and the audio record/playback head is about 19cm: with a linear tape speed of 2·44cm/sec, this would mean that when recording over old material some 7·5sec or so of sound from the previous recording would precede the required sound. The separate sound erase head immediately before the record/playback head overcomes the problem.

The angle at which the tape is wrapped around the head drum results in the recordings being laid down as shown in Fig. 3. As can be seen, there is no space between the helical video tracks. Even if a head was scanning the exact centre of a track on playback, some crosstalk from adjacent tracks would take place. The usual precautions are taken therefore. To cancel crosstalk at the higher (luminance) frequencies, the slant azimuth technique is used – the heads are mounted with an azimuth angle of ±15°, so that the angle between the heads is 30°. Phase shifting and error cancelling by means of a comb filter (128$\mu$sec delay line plus an adder network) are used to cancel crosstalk at the lower (chrominance) frequencies.

To maintain a good signal-to-noise ratio on playback it's essential that the video heads accurately follow the recorded tracks: this is ensured by the dynamic track following system which we'll return to later.

## Recording

The recorded signal spectrum is shown in Fig. 4 – excluding the sound signal which is recorded on its own track. A frequency range of 25Hz to over 5MHz would be required to record the full luminance and chrominance bandwidth. The response of the video heads falls to zero above 4·8MHz however, so signal processing is required. On record, the luminance channel incorporates a low-pass filter tuned to 3MHz. This removes the chrominance signal and also the higher order luminance signal components. The latter means that some fine detail is lost: this is hardly noticeable to the eye on playback, and is compensated for by the use of crispening in the luminance playback channel. The bandwidth limited luminance signal is then passed to a frequency modulator whose centre frequency is 4·05MHz. A deviation of ±750kHz records the signal amplitude from the sync tips to peak white. The upper sideband of the f.m. signal is removed by the falling response of the video heads, while to provide room for the chrominance and dynamic track following signals at the lower end of the spectrum the lower sideband of the luminance f.m. signal is clipped at 1MHz by a high-pass filter.

The a.m. chrominance signal is bandwidth limited to about 600kHz and is then frequency converted down to 625kHz. The five dynamic track following signals slot in just below the chrominance signal.

Since the f.m. luminance signal is of more or less constant amplitude, it can be used as the recording bias for the chrominance signal. Fig. 5 shows the signal path in the record mode.

A 5·06MHz local oscillator signal is used to frequency convert the 4·43MHz chrominance signal to 625kHz. It's derived from two sources, both phase locked to the

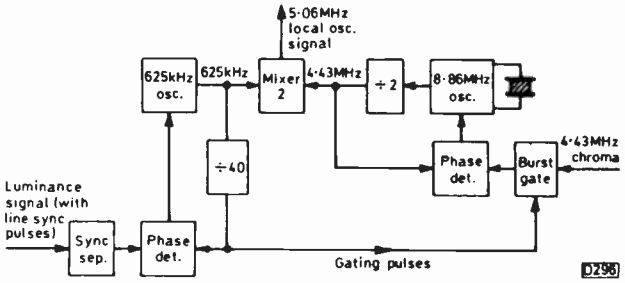



*Fig. 6: Method of generating the 5·06MHz local oscillator signal for the chroma channel.*

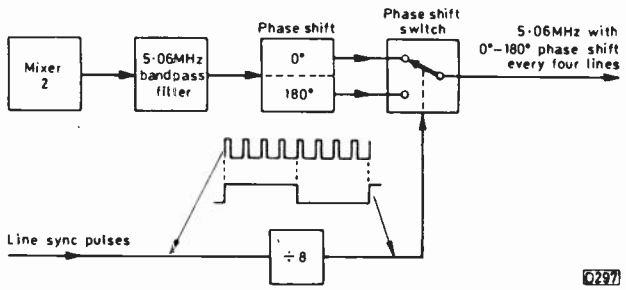



*Fig. 7: Chroma phase switching on record.*

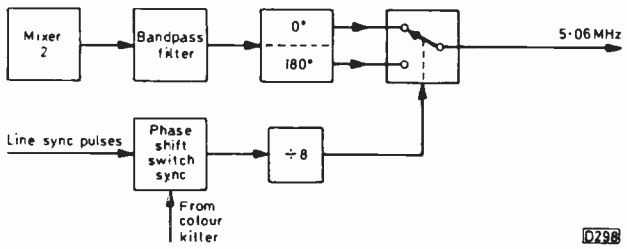



*Fig. 8: Chroma phase switching on playback.*

incoming signal. One, at 4·43MHz, is locked to the colour burst; the other, at 625kHz, is locked to the line sync pulses (obtained from the luminance signal). The arrangement is shown in Fig. 6.

### *Chroma Crosstalk Protection*

As mentioned above, the azimuth tilt of the video heads does not eliminate crosstalk from adjacent tracks at the lower (i.e. chrominance) frequencies. So chroma crosstalk protection is employed. This entails phase shifting the chroma signal by 180° at four-line intervals when recording and reversing the process during playback. The system works on similar lines to the basic PAL technique.

On playback, a two-line (128$\mu$sec) delay line is used to add the chroma signals two lines removed from each other, i.e. 1 and 3, 2 and 4, 3 and 5 etc. Provided the record and playback phase-shift switching is synchronised, cancellation of chroma crosstalk between adjacent tracks occurs. Figs. 7 and 8 show the switching arrangements on record and playback – the switching is done to the 5·06MHz local oscillator signal rather than to the chroma signal itself to minimize disturbance to the chroma signal. The system results in some loss of vertical

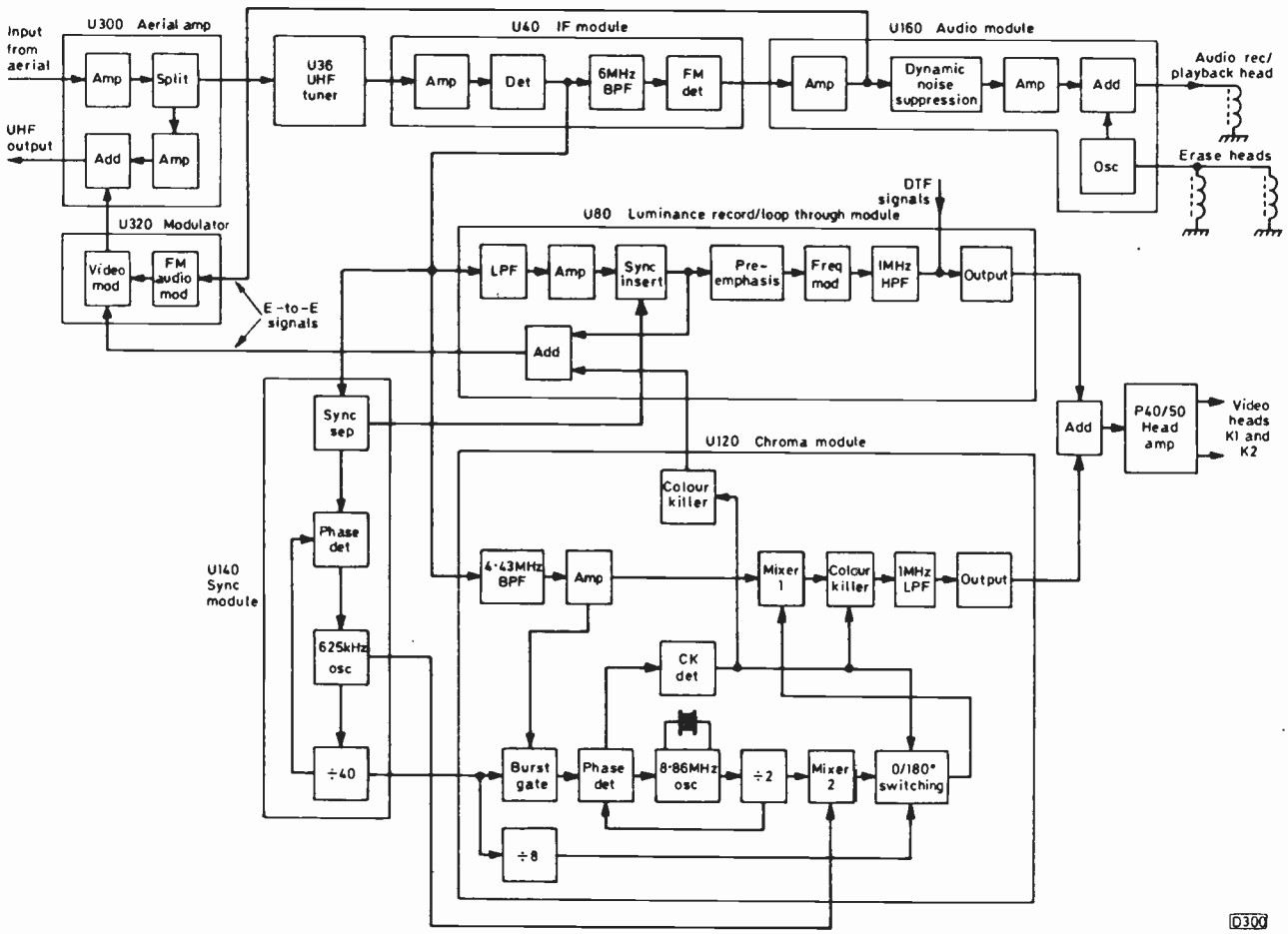



*Fig. 9: Simplified block diagram of the signal circuits in the record mode.*

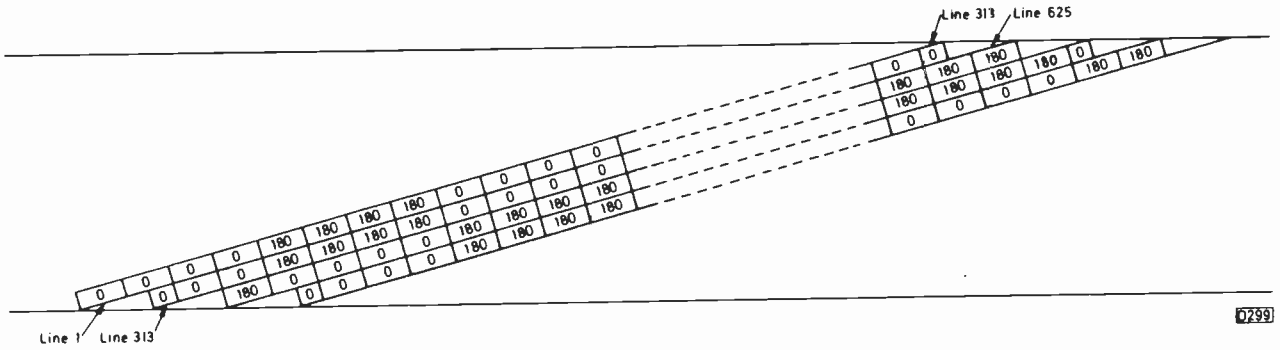



*Fig. 10: Chroma signal phase shift pattern on the tape.*

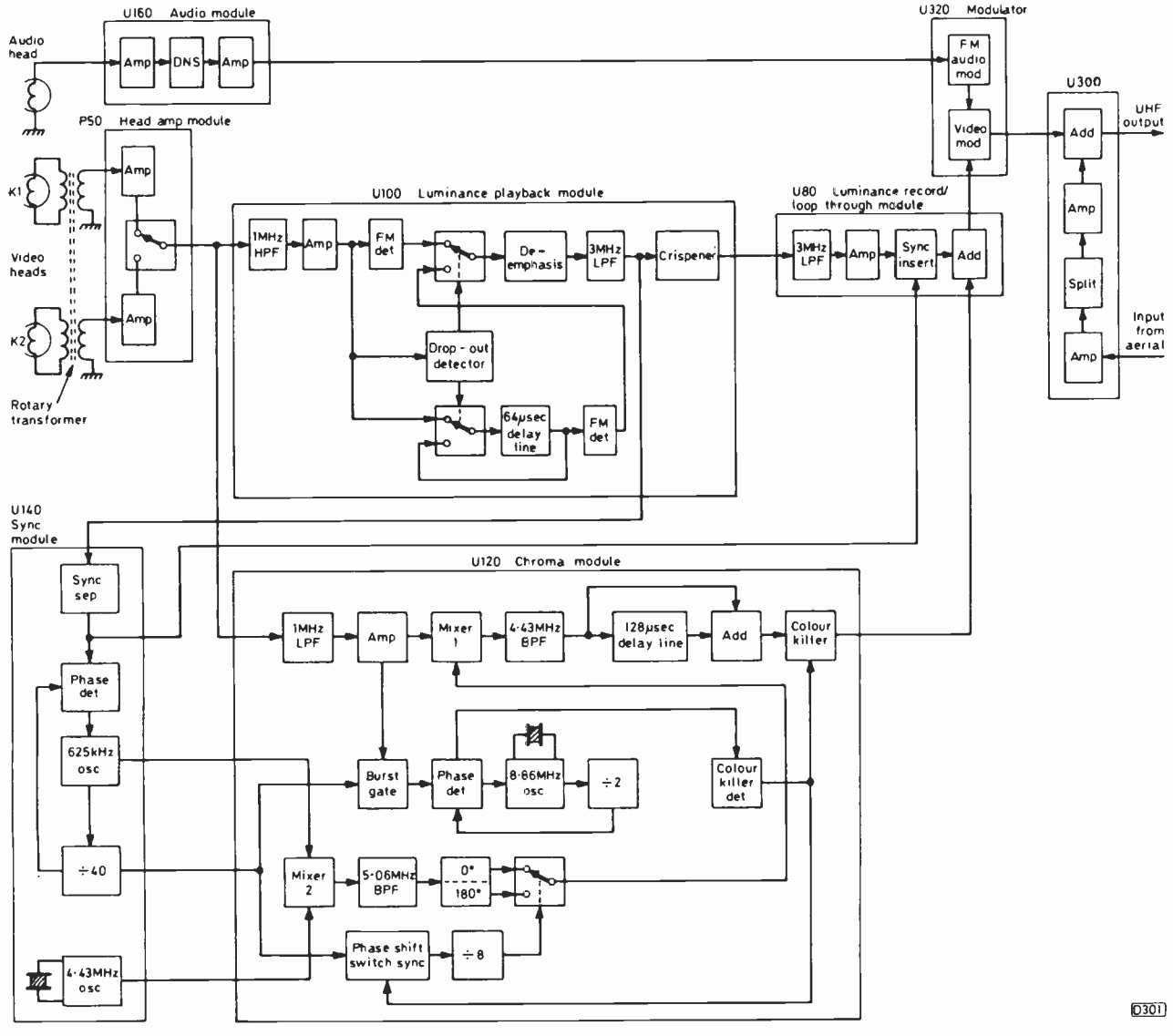



*Fig. 11: Simplified block diagram of the signal circuits in the playback mode.*

chrominance resolution, but this is not noticeable.

Fig. 10 shows the way in which the signal phase shifts are laid down on the tape. From this it will be seen that adjacent track signals delayed by two lines are in opposite phase and thus cancel.

If the phase shifting on playback differs from that on record, the chroma signal itself gets cancelled. As a result, the colour killer operates. The colour killer voltage is then used to delay the switching until correct synchronisation is restored. At this point the colour killer reverts to normal, the switching continuing in the correct phase.

## *Block diagrams*

Figs. 9 and 11 show more detailed block diagrams of the signal circuits, in the record and playback modes respectively.

# Sanyo Models CTP7118/CTP8118

*John Bourne*

ONE of the more recent TV chassis to arrive in our workshops is that used in the Sanyo Models CTP7118 (22in.) and CTP8118 (26in.). The sets are manufactured in Spain and use mainly European components, with eight-channel touch tuning and sockets at the front for headphones and a tape recorder, the sound output being a respectable (by TV standards) 4W. The sets are supplied with a stand that has a shelf near floor level intended for a Sanyo VTC9300 VCR.

## Technical Details

The chassis drives a 30AX tube and has a U-shaped frame similar to that of the Rank T26 chassis. Viewed from the rear, the signals board and the power supply board are on the left-hand side, mounted back to back, the timebase board being on the right-hand side. The touch tuning/customer control unit is mounted on the plastic cabinet near the front. The whole chassis pulls out on two plastic rails. Unfortunately the interconnections between the various boards are of the wire-wrap type, which makes panel swapping very difficult indeed. The terminations are prefixed by a different letter number for each panel as follows: B touch tune, F signals, G power supply, H timebase.

The switch-mode power supply is of the Siemens self-oscillating chopper type which has been described in these pages on a number of occasions in recent months – the chopper transformer in this version provides mains isolation. There are four outputs: 208V at pin G6 for the RGB output stages; 150V at pin G7 for the line output stage and the tuning potentiometers; 26V at pin G8 for the field timebase, the line driver stage and the EW amplifier and driver stages; and 17V at pin G9 for the audio chip. The 12V supply for the signal circuits is obtained from the 17V line via an L7812 regulator i.c. The power supplies are set up by adjusting VR801 on the power supply panel – for 150V at pin G7 with the brightness and contrast controls at minimum (note that some circuits show the voltage as 117V).

The i.c.s used are as follows:

| | |
|---|---|
| TDA2541N6 | i.f., a.f.c. etc. |
| TBA120U | intercarrier sound channel. |
| TDA1037 | audio output. |
| TDA2560 | luminance/chrominance signal processing. |
| TDA2522 | colour reference oscillator/demodulator etc. |
| TDA2530 | RGB matrixing and preamplifiers. |
| TDA2591 | sync separator/line oscillator. |
| TDA1170H | field timbase. |
| SAS580/590 | touch tuning. |

The RGB output stages are of the complementary-symmetry type and are mounted on the signals panel rather than the tube base. A separate tripler (type TVK196/17) is used instead of a diode-split transformer arrangement. Vertical shift is adjusted as follows: if the picture is too high, disconnect R718/9; if too low, disconnect R716/7.

## Faults

We've had two common faults during the comparatively short time we've handled these sets. The first is in the EW modulator circuit (see Fig. 1), the symptom being that the width, EW amplitude and trapezium controls have no effect. The usual cause is R626 going open-circuit. When this happens, the EW output transistor Q752 is overrun and you may find that its emitter resistor R764 is burnt. The transistor itself has a fifty-fifty chance of surviving – a TIP41 works well as a substitute. The basic problem seems to be that R626 is slightly under-rated. Although it's marked as a ½W type, the resistor fitted is smaller than you'd expect: fitting a standard ½W type clears the trouble.

EW problems have also been caused by failure of one or other of the EW modulator diodes D601 (PFR15T) and D602 (BY298). It's best to replace the diodes as a pair – a BY228 can be used in the D601 position.

Fault-finding in the EW correction circuit is not helped by the voltage readings shown on the circuit, some of which are clearly wrong. The following readings were noted after checks on several working sets:

| *Transistor* | *Collector* | *Base* | *Emitter* |
|---|---|---|---|
| Q750 | 8·5V | 4·9V | 4·3V |
| Q751 | 2·6V | 8·5V | 9·1V |
| Q752 | 25V | 2·6V | 2·1V |

The other common fault we've had is sound but no raster due to R628, the anti-breathing resistor in the h.t. feed to the line output stage, going open-circuit (it's a fusible resistor). Soldering the contacts often appears to clear the trouble, but the fault reappears two-three hours later. Replace the line output transistor Q602 to clear the fault completely.

We've also had one or two faults in the field timebase

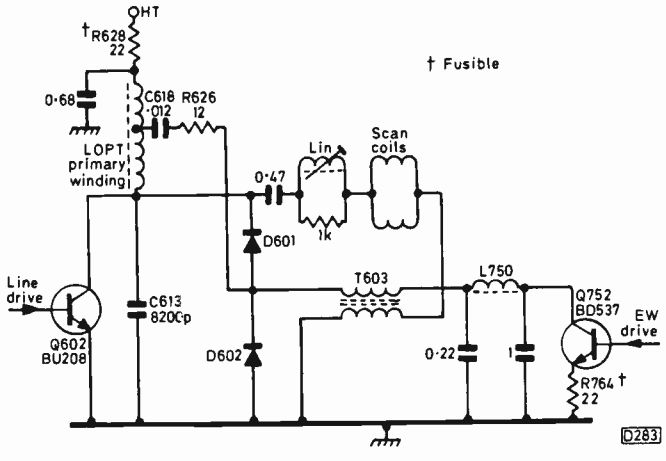



*Fig. 1: The EW modulator circuit.*

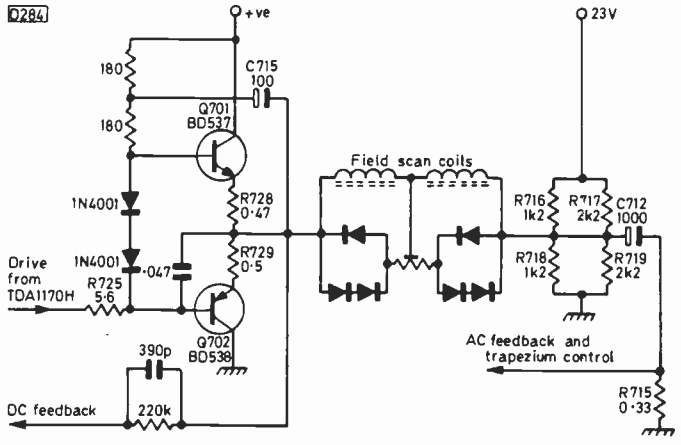



*Fig. 2: The Field output stage.*

– the TDA1170H i.c. is followed by a BD537/BD538 output stage (see Fig. 2). In cases of field collapse, check whether the 23V supply is present at pin 2 of the chip. If it's absent, the fusible feed resistor R720 is almost certainly open-circuit, due either to the i.c. or one of the output transistors being defective. In the latter case check the emitter resistors R728 (0·47Ω, 0·5W safety) and R729 (0·5Ω, 0·35W), also R725 (5·6Ω, 0·45W safety) in the feed from the i.c. to the base of the BD538 transistor. In one set field collapse was traced to R715 (0·33Ω, 0·35W) in the field scan circuit being open-circuit – fitting an 0·5Ω resistor (the nearest we had at the time) resulted in insufficient scan even with the height control at maximum, so the correct value must be used.

### Purity Problem

One final complaint: we've sometimes found that new sets straight from the box have purity errors due to the scan coil assembly slipping back along the tube neck by a quarter of an inch or so – we've had this problem with all makes of TV set using the 30AX tube.

# Letters

### N1700 IN/OUT MODIFICATION

I have just completed the video/audio input modification for the Philips N1700 VCR described in the March 1981 issue and feel that the following notes may be of help to others.

The small inductors used are difficult to obtain in New Zealand, so I wound my own, using standard miniature 5mm diameter formers, 34 s.w.g. enamelled copper wire and F25 dust cores. L1 (10$\mu$H) required 50 turns, L2 and L3 (both 1$\mu$H) five turns and L4 (2·2$\mu$H) twelve turns – closewound in each case. To get the maximum rejection (−20dB) from the chroma notch filter I found it necessary to increase the values of C3 and C4 from 0·0012$\mu$F to 0·0047$\mu$F.

This input modification was combined with the output arrangements described in the November 1979 issue on a single PCB which fits neatly into one of the spare holders in the base of the cabinet. The additions have made the N1700 a much more versatile machine.

*B. A. Wright,*
*Christchurch, N.Z.*

### TAPE TROUBLE

We'd noticed that a lot of prerecorded tapes were being damaged when used with Sony VCRs and decided to carry out an investigation. The first thing that came to light was that the problem was not confined to Sony Betamax machines. The damage was being caused by failure of the cassette's take-up spool to rotate in both the play and the eject modes, due to the internal spool brake catch not being released.

When the cassette compartment is closed, an internal leverage system releases the take-up and supply spools – by virtue of the cassette's lid being lifted. Thought was first given to the VCR actuator brackets that lift the cassette lid, but this was discounted because the problem was experienced with only certain types of cassettes – they can be identified by small triangles in the patterning on top. Attention was turned to the cassettes therefore, and it was found that the lid hinge on the right-hand side, next to the take-up spool, was not in the same position as on other Betamax cassettes. The position of the hinge on the lower case moulding is slightly farther towards the rear of the cassette, the result being that the lid has to be lifted higher on the right-hand side to clear the take-up spool than on the left to clear the supply spool.

Our conclusion therefore is that the cassettes are the cause of the trouble. This has since been confirmed by others, including Sony. It seems that the cassettes should be returned via the distributor through whom they were obtained, but this can cause problems where you order from more than one distributor.

Be warned, therefore. There is undoubtedly a large quantity of such prerecorded cassettes on the market. As to who is going to accept the responsibility for the situation, this remains to be seen. My own feeling is that the production companies should be held responsible initially, since it was they who released the non-standard cassette packages on the market.

*Steve Beeching, T.Eng. (C.E.I.),*
*Newark, Notts.*

### LUXOR 6664

With regard to the Luxor Model 6664 mentioned in your December 1981 letters column, we apologise for the fact that the audio module is incorrectly marked as far as the connections to the Darlington output transistors TL24 and TL25 are concerned – they should of course read E-C-B from left to right. It would be rather difficult to fit replacement transistors incorrectly however, bearing in mind that they are TO126 types.

*Paul England,*
*Service Manager, Luxor (UK) Ltd.*

### PROBLEMS AND SPARES

I had a similar problem to Robin Smith (*Fault Report,* January) on an ITT hybrid set fitted with the CVC9 chassis. In this case the complaint was that the field would jitter, then collapse and open up again, rolling. Many fruitless hours were spent trying to solve the problem, and the set also received attention from ITT. We were all fooled by the fact that the fault was of an intermittent nature: changing components would seem to

clear the fault, which would return after the set had been left running for some time.

Whilst writing I'd like to sympathize with Chris Avis (*Letters,* February). I too have experienced much frustration in dealing with manufacturers spares departments. Some years ago for example I purchased a number of ex-rental monochrome sets for sale or re-renting. The sets were overhauled and ready for use except for the absence of the u.h.f. tuning knobs. These were ordered, but the COD parcel we received contained knobs bearing no resemblance whatever to the ones ordered. This happened repeatedly, so I sent off the one and only correct knob I had as a sample, with a large label attached saying "please don't lose". The return parcel contained the knob with a note saying "sample returned, order to follow." You'll by now know what the next parcel contained. By this time the sets were so old I decided to scrap them.

*Peter Nutkins,*
*Charmouth, Dorset.*

## REPAIR HINTS

It's an unfortunate fact that much time is wasted through things that go wrong whilst carrying out repairs themselves rather than in fault diagnosis. Here are some simple tips that may help others with their repairwork.

(1) A minute bit of Plasticine applied to the head of a self-tapping screw or bolt will hold it to a screwdriver long enough to get it started and driven home.

(2) A bit of Plasticine stuck to the end of a piece of stiff plastic tubing is helpful in retrieving screws, bolts, nuts, washers etc. that have fallen into the innards.



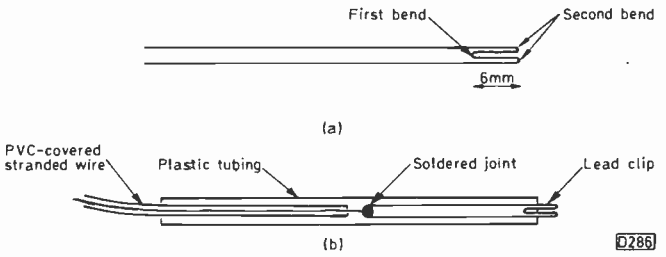



*Fig. 1: Transistor lead clip.*

(3) A piece of Sellotape applied to printed circuit tracks adjacent to one to be soldered prevents solder bridges forming.

(4) Long, thin wooden sticks of suitable thickness make excellent starters for screws and bolts with Phillips heads.

(5) Small transparent plastic boxes with lids enable you to keep screws, nuts etc. from a set being repaired together so that they are not mislaid.

(6) A short length of guitar string wire makes an effective transistor lead clip for small-signal transistors so that one has only two leads to cope with. Make the clip as follows (see Fig. 1). Take a length of "B" guitar string, about 5cm long, and cold bend it in two until the sides touch. Make a second bend at a point some 6mm from the first one – the sides must again touch and be parallel. Roughen the two free ends and solder them to a length of PVC-covered stranded wire. Lastly, cover all but about 3mm of the clip with a length of stiff plastic tubing some 2-3cm long. It's important that the clip is held tightly within the tubing, with no slipping. In use, press the clip against the transistor lead until it is gripped.

*Victor Rizzo,*
*Msida, Malta.*

## PURPLE TELETEXT

Here's one that may be of interest. I'd been away for some months on the "ocean waves" only to be told on my return that the trusty Thorn 3000 had given some trouble – it had "gone crack, then dark". Apparently someone had subsequently "tweaked it up a bit". The picture looked all right when I switched the set on, with only the preset brightness control slightly advanced, but my heart sank when I switched over to teletext – a purple page 100! I'd stitched on a Tifax module rather Heath-Robinson style, and feared the worst for its ROM.

First however I made some checks in the green channel. The driver transistor turned out to be duff, so with a sigh of relief I replaced this and switched on. No change! Oh dear. A short-circuit f.e.t. was then discovered in the brightness control circuit on the Tifax interface panel: replacing this restored the normal brightness level, but the text was still purple. By now I was becoming convinced that the initial flashover had found its way through to the text ROM, but as a final straw I decided to try a new green output transistor – I was hoping that it had sustained some sort of damage that left it able to respond to drive at its base (luminance) and emitter (colour-difference) but not at its emitter only. Fortunately this turned out to be the case, a new BF337 restoring everything to normal.

*Dave Kirby,*
*Brighton, Sussex.*

# IF Pre-processor Unit

**Roger Bunney**

IN the last two issues I've described the construction of a modern varicap tuning system for DX use, with a stabilised power supply and integral i.c. i.f. amplifier, and an i.f. processor which provides switched selectivity (wide or narrow bandwidth) and includes an upconverter so that the output can be fed to the aerial socket of a standard u.h.f. receiver. The final unit in the overall system I've adopted, described in the present article, is for insertion between the DX tuning system and the i.f. processor – you could call it an i.f. pre-processor. Its purpose is to increase the versatility of the overall system by providing further, switched bandwidth limiting (down to 2MHz) and control of the i.f. gain to prevent saturation of the r.f. amplifier stage in the upconverter.

As with the units previously described, the details given apply to the system used in my own DX-TV installation and can be modified to suit other readers/operators' needs. The circuitry is simple and basic (see Fig. 1). The input is routed via either D1 or D2/3 depending on the setting of switch S1 which provides forward bias for these diodes. In the wideband position diodes D1 and D4 are non-conductive whilst D2 and D3 are on. The signal appears at the anode of D5 attenuated by some 3dB. In the narrow-band position the signal is routed through the U800 module via diodes D1 and D4, D2/3 then being non-conductive. The U800 unit is the well-known i.f. selectivity module used in the Philips G8 chassis (for the circuit, see Fig. 8, page 488, in the July 1978 issue). The module contains a BF196 transistor plus four tuned circuits for bandpass shaping/filtering. Diodes D5/6 provide 3-30dB attenuation, variable by means of the attenuation level control. D1-D6 are all pin diodes (type BA379, available from Ambit).

The transistor in the U800 module contributes a certain amount of gain which can be adjusted by means of the gain preset – the gain is maximum with 3·5V applied to pin 4 of the module. The preset should enable the gain of the two signal paths, i.e. the input to the anode of D5, to be balanced.

The power supply arrangements are conventional, with LEDs to show "power on" and "narrow-band setting".

Alignment is simple. Switch the previously described i.f. processor unit to the narrow-band position and the pre-processor to wideband. Tune the DX tuner to a weak but stable signal. At the optimum signal setting, switch the pre-processor to the narrow-band position and adjust the four cores in the U800 module. The tuning of two of the cores is relatively sharp, the other two having a shallow response. Provided the input signal is weak, adjustment of the cores will lift the signal out of the noise: adjustment is complete when no further improvement can be obtained. Switching S1 to the wide position should then push the signal into the noise. Alignment has thus reduced the i.f. bandwidth, increasing the gain and reducing the noise.

Reducing the bandwidth increases the selectivity at the expense of picture quality, but for DX purposes

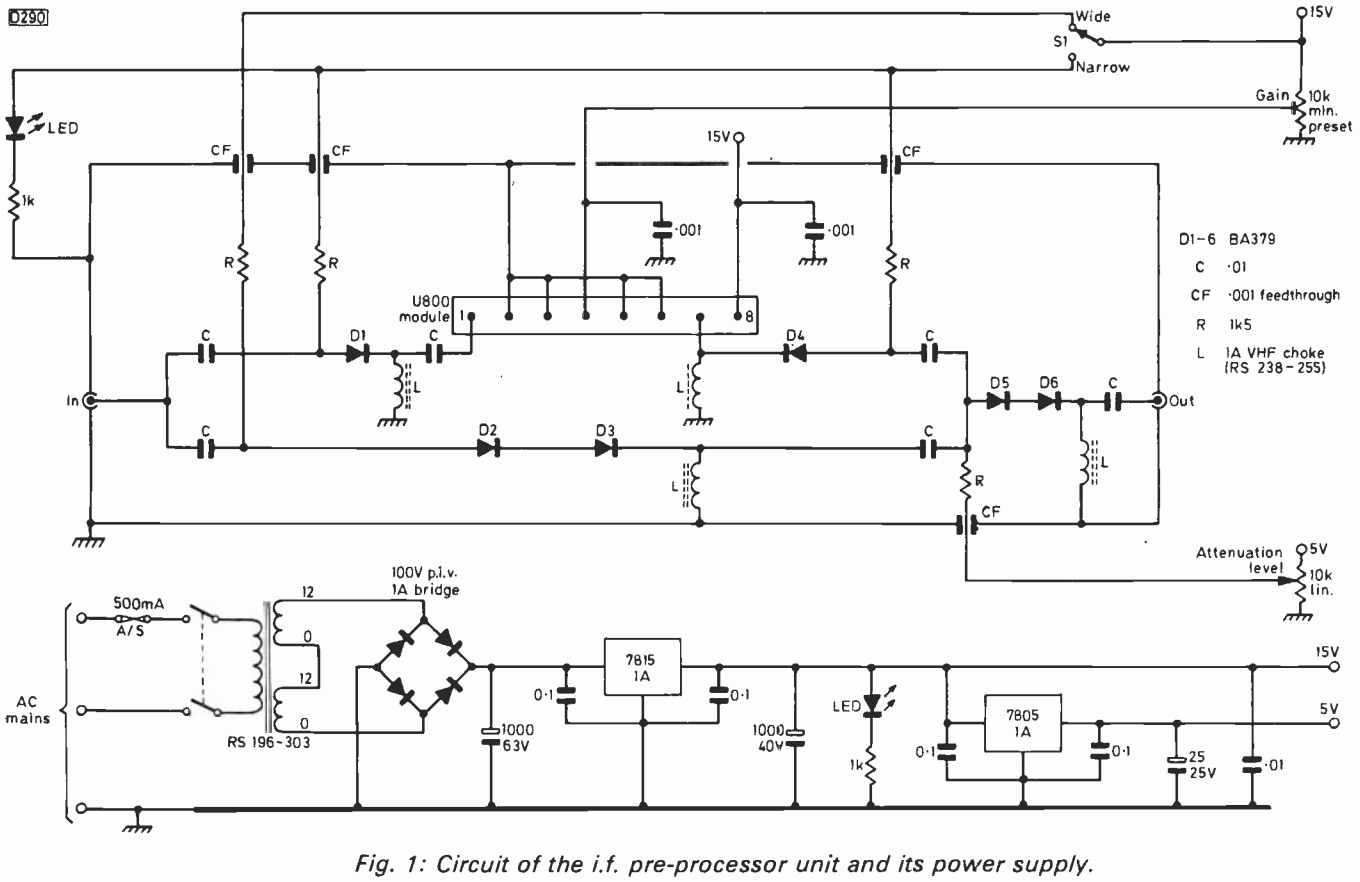



*Fig. 1: Circuit of the i.f. pre-processor unit and its power supply.*

where one is attempting to resolve a signal of only a few $\mu$V – often adjacent to the signal from a local 500kW e.r.p. transmitter – this bandwidth reduction is essential.

Once the alignment of the U800 module has been completed, the gain preset can be readjusted to get the correct i.f. levels with the two settings of S1. It is essential to avoid any retuning of the tuner unit during alignment.

The use of the i.f. processor and pre-processor gives three i.f. bandwidths – 6MHz, 3MHz and 2MHz. We thus have a system that will receive the weakest signals at reduced bandwidth and strong signals at the full bandwidth, i.e. at optimum picture quality. The processor and pre-processor can be housed in matching diecast boxes (three of each in my own installation, with three preset gain, attenuation level and wide/narrow controls, feeding three Thorn portables).

Some final notes. First, respect the 240V a.c. mains input! Secondly, depending on the tuner in use it may be found that patterning occurs when both tuners – the one in the DX unit and the one in the receiver – are operating at the same frequency. In this event, first check the continuity of all coaxial screens. If the problem persists, insert an in-line notch filter at the output from the DX tuner. U800 selectivity modules can be obtained from Hugh Cocks Television Services, Cripps Corner, Staplecross, Robertsbridge, E. Sussex TN32 5RY at £1·80 each including VAT and postage.

# No Mend NordMende

***Les Lawry-Johns***

IT all started innocently enough. A middle aged man came in and asked us whether we would repair his daughter's Ferguson colour portable. It had been going all right, but now there was only a white line across the centre of the screen.

"Certainly sir. Just pop it in and pop back later. No trouble."

So off he went and about an hour later a young fellow came in to enquire whether we would handle a Ferguson colour portable which had a white line across the centre.

"Certainly sir. Just pop it in. By the way, are you any relation of the chappie who came in a while ago and asked about servicing his daughter's Ferguson colour portable?"

"Probably my father-in-law. He's going to buy the set from us when we go to Australia in the spring."

It was the young chap who brought the set in later, and my heart sank just a little when I noticed that it was a 3787 – the 14in. colour portable made in W. Germany by NordMende. We'd had heartaches with these before, but after all the trouble was only field collapse, and a new i.c. and a fuse were probably all that was needed. So we put on a cheerful face and asked him to collect it later in the day.

A little later we turned our attention to the 3787. The rear cover was removed, the wing nuts slackened, and the chassis let down. The far right side fuse (there's one nearer) had gone open-circuit, and sure enough it was VU09 (630mA) in the 22V supply line (U3) to the TDA1170 field timebase chip and a couple of other circuits. Not wishing to waste time, we removed the bottom centre field timebase panel and set about removing the TDA1170 chip with its screening heatsink. A new chip was speedily fitted and the heatsink soldered in place. The blown fuse was replaced with an 800mA one, which we understand is the correct and proper thing to do. Switching the set on produced a lovely picture, and we left it on for about an hour just to be sure.

The owners collected it later, and were quite pleased that the job hadn't been a complicated one. Some time later however they phoned to say that the set had worked for about half an hour and had then gone off with a display of coloured splashes and noises. The net result was a white line across the screen again. They brought it in next morning, and said they'd leave it for a couple of days so that I could make sure.

Investigation showed that the fuse had failed again, so as a start I thought I'd better check out the other lines supplied from the 22V source. Everything o.k., so the next step was a check on the current, which was not at all excessive. Another fuse was fitted (reverting to 630mA just in case) and the set was kept running while I got on with another awkward job that had been bugging me for some time – an amplifier which kept blowing its output transistors every few hours or so.

Whilst engrossed in taking voltage readings in the amplifier, I heard a funny noise coming from the portable – sort of plasticy clicks, as though the line output transformer was breaking down. Before I could do anything there was a shower of colours on the screen, with drastic picture size variations – both width and height. It then went off with a dying croak.

Sure enough the same fuse had failed, but this time the difference was that the set was completely out of action and my attention was caught by the rearmost thermal wirewound resistor which had "thermalled". This was RU05 (680Ω, 11W) in the soft-start circuit (see Fig. 1). Resoldering this resistor's contacts brought it back into circuit, but it was overheating and would have opened again had I left the set on.

My ice cold logical mind told me that something was wrong. It didn't suggest a solution however. So I checked across the output from the resistor, and there didn't appear to be any shorts. I then started to think. Painfully. The 22V supply is obtained from a winding on the line output transformer. The line output stage had probably suffered when the short (blowing the fuse) had occurred. It was probably still suffering. It's a thyristor line output stage, with the usual flyback and scan thyristors. Hmmm. We disconnected the h.t. feed to the nearest thyristor, the flyback one, and the start-up feed resistor RU05 no longer overheated. Ha we thought, these thyristors are not as tough as they're reputed to be. So I put another one in and switched on. Bang! The mains fuse had blown. I stared at the set and it stared back. With a blank look on its face.

"Now what are you doing?" I asked it desperately. The only difference this time, apart from any accidental wrong connections or maybe another fault developing, was the new thyristor. For want of other inspiration I

refitted the original thyristor and another mains fuse. It didn't go bang, which was something anyway, but the set remained dead and RU05 got hotter and hotter. Here I committed my first error, which was to move on in the search for the fault with the original thyristor still fitted. It was to prove costly in time.

To cut a long story short, it was not until both line output stage thyristors had been replaced, with a different type and encapsulation, that we returned to something approaching sanity. The original conditions were then restored, which meant that we were no nearer to solving the field collapse problem, or rather the firework display which preceded it and could happen at any moment.

I decided to check the voltage rails. I'd already checked the 22V supply, just to make sure that it was there, but a more careful check revealed that it was over 22V. In fact all the rails were high. So I looked around for a preset voltage control and the only one I could find was the e.h.t. control RZ13 on the line oscillator panel. Adjusting this reduced the voltages to those specified, and I was glad to note that the intermittent plasticy ticking or stress noise had now stopped.

Three days on test seemed to prove that the problems were over, so the set was returned to its owners. I still feel that it could bounce back at any time though – Not-Mended?

## No Colour

Then on to the afternoon's outside calls. The first one

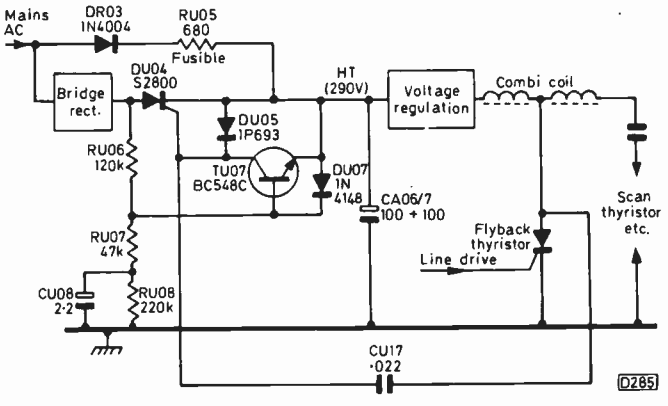



*Fig. 1: Soft-start system used ih the Ferguson Model 3787 colour portable. When the set is switched on, the reservoir capacitors CA06/7 are charged slowly via DR03 and RU05. As the h.t. voltage rises, the line timebase will come into operation, the pulses at the anode of the flyback thyristor being fed back to the gate of DU04 via CU17. During the soft-start period the voltage at the base of transistor TU07 will exceed that at its emitter: as a result, the pulses are shorted out by TU07 and do not fire DU04. Once the h.t. line has risen to its normal voltage, TU07 will be cut off and DU04 will be triggered, passing the 100Hz pulses from the bridge rectifier to CA06/7. Diodes DU05 and DU07 provide junction protection for TU07. CU08/RU08 ensure that the soft-start action occurs when the set is switched off and on quickly.*

*The circuit also provides protection in the event of a short-circuit across the h.t. line — say the flyback thyristor going short-circuit. In this event TU07's emitter voltage will fall below its base voltage and thyristor DU04 will switch off — as during the soft-start cycle. DR03 will try to supply the h.t., but the fusible resistor RU05 will go open-circuit.*

was to a 26in. Bush colour set fitted with the A823 chassis. It lived in a flat over a bank in a neighbouring town, so the journey involved several miles and much lugging from the van to the flat once we'd got there. I eventually managed to puff up to the front door to be admitted to the colourless set.

I'd brought a decoder panel with me just in case I got into trouble, but it was the early one (as I'd thought the set was) with no provision for the flyleads. I'd no alternative to repairing the set's own panel therefore – assuming that the fault was not in the chroma amplifier section on the i.f. panel. We managed to fit some extension leads to enable the panel to work outside the set, and a couple of checks brought us to the fact that there was no voltage at the emitter of the 11V regulator transistor 3VT2 (BC148). A cold check on this showed that it was open-circuit. It didn't take long to fit a new BC148, when back came the colour and my confidence. The panel was back in a jiffy, and we didn't forget to put the black plug back in to complete the degaussing circuit (we still forget now and again, producing clouds of smoke from 8R5 on the power supply panel). So the job had been wrapped up and the young man came over to enquire how much he owed us.

"Twelve please."

He was gone for a few minutes and returned with a pound note. "Keep the change" he said.

I looked at him carefully and decided to laugh and join in the fun. "My fault I suppose. Should have said twelve pounds. That'll teach me to be more explicit."

The young man apologised and said he'd thought twelve pence was a call out charge since the repair had been done so quickly. . . .

## Femme Fatale

Sneezing and coughing, I made my way to the next call. The young lady who opened the door was passing fair in more ways than one. Her blonde hair was plaited and piled up on top, and her smile was welcoming as she lead me to the lounge where the set lived. It was a Thorn 9000 which didn't appear to do anything.

I immediately got to work and found that there was plenty of h.t. up to the chopper/line output transistor but not much else. Tapping the panel caused the set to burst into life, and it didn't take long to find a dry-joint which was speedily put right. Panic over, I put the set back on its frame, replaced the back cover, and suddenly became aware that the young lady was reclining on the settee with her long blonde hair released, flowing down to her waist. . . .

"Some people are troubled by conscience" she was saying, and I was also aware that she'd been talking for some time though I'd not been listening. "Conscience has never bothered me" she continued. "I always do what I want when I want and it seems to work out all right."

"Quite so" I stammered, blowing my nose violently. "This dose of flu I've got is deadly."

"What you need is a large scotch and some sympathy. Would you like me to get you a drink?"

"No thanks" I said, "I really must get back to the shop. Must take a powder." In fact I didn't have the flu, it was a cold. Plus cold feet. After all, what if there'd been some of those video cameras hidden? We've read about these things, haven't we? And anyway I don't like drinking scotch during the day.

# Test Report: Willow Vale Colour Pattern Generator

*Eugene Trundle*

WILLOW Vale Electronics have long been known to the TV service trade as suppliers and distributors of TV components and spares. Innovation is not new to the company, and they've now started to manufacture test equipment. So it was that a little colour-bar generator arrived for review, via the editorial office. Things have been rather hectic here of late, and as a result we found plenty of use for the generator but little time to write our review! We did however get to know the instrument quite well.

The instrument, Model 12-008, is a small, mains-powered colour-bar/crosshatch generator with a u.h.f. output. A sound signal is also provided. It's housed in a tough plastic case which fits easily into a toolbox. The controls are mounted on a metal front panel and consist of two small toggle switches for power and sound and two rotary switches for pattern selection. There's a LED power indicator, and the output is fixed at about channel 30. We found a neat layout inside, consisting of a large fibreglass printed circuit board on which are mounted the mains transformer, nine i.c.s (six CMOS types and three TTL chips), nine transistors, a crystal plus assorted resistors and capacitors etc. – a total component count of around 150.

The patterns available are crosshatch, white raster, grey-scale step wedge, standard colour bars and a red raster. The sound signal can be used with any of the patterns and consists of a 1kHz sinewave. The r.f. output is about 2mV, via a flying coaxial lead. Although there's a three-core mains lead, we decided not to ground the earth wire as this can be hazardous when dealing with live chassis receivers: on checking, no significant leakage could be found between mains live and the instrument's metal output socket.

## On Test

The first pattern is the ubiquitous white crosshatch for convergence appraisal. We say appraisal rather than adjustment since with modern tubes many sets nowadays have no facilities for the twiddle-and-squint brigade, though millions of older sets with delta-gun tubes will keep us twiddling for many years to come. We found that the crosshatch was a little "open", consisting of 12 × 8 lines, and we'd have preferred a "tighter" pattern consisting of say 15 × 11 lines (particularly helpful when converging a large-screen set with a 110° delta-gun tube). In the absence of frequency gratings (multiburst seems to be the "in" term nowadays) the crosshatch pattern is often used for focus adjustment: the narrow, horizontal lines are fine, but the vertical lines are rather wide – 2·5mm with a 20in. tube compared with about 1·5mm from the Philips PM5509 generator and other instruments.

We have no reservations about any of the other patterns provided. The peak white raster and grey-scale step wedge were o.k. subjectively, and an oscilloscope check proved that they were correct. The red raster, like the colour bars, is at 100 per cent saturation, giving an easy check on purity. The bars are stable and accurate, indicating careful setting up at the factory.

A game we like to play when checking pattern generators is to adjust a non-PAL receiver such as a Sony KV1800UB for good colour bars using an off-air broadcast transmission, then examine the locally-generated bars for correct reproduction at the same control settings (by non-PAL we mean with a non-standard decoder). The Willow Vale generator came through this test with flying colours!

## Sound

The sound facility is sometimes a stumbling block with instruments of this type, as we've reported in the past. The Willow Vale generator has as good a sound performance as any we've reviewed – better in fact than one instrument costing four times as much! The reproduced sound comes through clean and undistorted, with no pattern breakthrough to cause rasp or vision-on-sound – this applied even to the "busiest" pattern, the crosshatch.

Provided the correct sideband (upper sideband) is selected when tuning the receiver, there's very little sign of sound-on-vision either. We found that this depends on the age and condition of the set under test, but with a new receiver in good order only the smallest ripple of horizontal bars (due to the 1kHz modulating tone) could be made out at the optimum tuning position.

## UHF Modulator

There was no tendency to overloading or crushing in the u.h.f. modulator, whose output is sufficient to enable several sets to be driven via a splitting arrangement. The modulator is a little over generous as to outputs however: the review instrument produced a noise-free output on channel 23, a slightly noisy output on about channel 41, and several spurious outputs spread through Band IV and the lower part of Band V. Most of these were eliminated by connecting a suitable attenuator in series with the output, and they present no problem when the instrument is plugged into a single receiver.

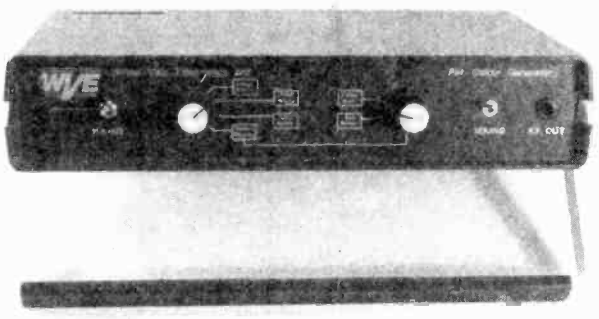
### Brief Specification

| | |
|---|---|
| **System:** | PAL, 625/50 lines/fields. |
| **Vision modulation:** | Negative, a.m. |
| **Sound modulation:** | 1kHz, f.m. |
| **Patterns:** | Crosshatch, white raster, grey scale, colour bars, red raster. |
| **Colour bars:** | Standard white/yellow/cyan/green/magenta/red/blue/black. |
| **Saturation:** | 100 per cent. |
| **UHF output:** | 1-5mV adjustable, at approximately channel 30. |
| **Mains input:** | 240V, 50Hz. |
| **Size:** | 25 × 16·5 × 5cm plus handle. |

When we tried piping the instrument's output into the workshop distribution system however we found that a simple filter was necessary to prevent the spurious outputs upsetting reception of the local broadcast channels.

### *In a Nutshell*

In conclusion, we liked the instrument and have no hesitation in recommending it to readers. The price of about £120 plus VAT is about right for the facilities offered – a substantial discount is available to Willow Vale account holders. The instrument is well made and should prove reliable – technical advice and repair facilities are available from the manufacturers. And it's designed and made in the UK. Available from Willow



Vale Electronics Ltd., Arborfield Road, Shinfield, Reading (0734 884444) and agents.

# Miller's Miscellany

**Chas E. Miller**

HAD a Thorn hybrid transportable (1580 chassis) in recently from a trade customer, the complaint being field collapse. It was soon apparent that the timebase itself was working correctly and that the fault was due to a disconnection on the secondary side of the output transformer. Having had trouble in this area before, I resoldered all the joints between the transformer and the scan coils, whereupon the full raster appeared. No doubt you can guess what happened as soon as I put everything back together again? That's right, field collapse.

This time it was a bad joint on the primary that was to blame. Once again it was quickly found and put right. The raster lasted a little longer after that – it was half an hour before the single white line returned to mock me. It was the start of one of those little episodes where everything you touch provokes the fault but when you want to provoke it deliberately nothing will make it happen. I did manage to discover that none of the voltages around the PCL805 changed sharply during the field collapse, ruling out some parts of the printed circuit. Eventually I became so impatient I began to flex the board quite brutally, with the aid of a nut driver – until the field scan finally went for good.

It was then fairly easy to trace the waveform from the triode to the pentode section of the valve, using an oscilloscope, and to discover that the signal disappeared somewhere between the height control and the pentode's control grid (in case you're wondering how, in this case, oscillation continued, the field sync pulses are applied to the control grid of the pentode rather than to the triode section of the valve). Even with matters narrowed down this far, the print break couldn't be found until the appropriate section was scraped clean and metered along its length. The fault turned out to be due to a smaller-than-hairline crack around a component joint – it was virtually impossible to see even with the aid of a magnifying glass.

It always puzzles me how a set of this age (some ten years) can work for such a long period before something like this shows up, especially as the set would have travelled around a fair bit during this time. Oh yes, and also why it is that I always seem to get them . . .

### Even on Holiday?

Here's another one of a similar type. Last winter my wife and I decided to take a few days off in a new acquisition, a motor caravan based on a retired ambulance. The mainly fibreglass body is fully insulated, so the cold weather wasn't a problem. Now we normally never take a television set away with us, but in view of the long winter evenings we decided to break the rule. The set, which I've had for a number of years, is an old Teleton one that's suffered some really rough treatment in its time, including being thrown across a vehicle on more than a few occasions as a result of it being left in an unsafe position.

Anyway, having reached the camping site and settled in we decided to watch the Saturday night feature film on ITV. Reception was excellent – we were only a few miles from a relay transmitter. But just as the final credits were rolling through the picture disappeared and up came loads of grain and sound hiss. It seemed to me that the local station had gone off the air, so I had a quick tune round to try to find another. Knowing that this set will produce a picture on virtually any signal going, I was puzzled at getting precisely nothing. It was late however so I gave up.

Next evening I had another try. Still nothing but grain. It seemed that something must have come adrift from the tuner unit – but why, since the set hadn't so much as been breathed on when it had packed up? I ended up with the tuner unit apart, and then discovered that the mixer transistor's base connection had never been soldered into position from new! How on earth it had avoided coming apart over the years, with all the banging about the set had had, failing only when the set was sitting quietly working, is strange indeed. But at least it waited till the end of the film.

I suppose I could tell you how I tried to repair it with a 12V soldering iron but succeeded only in ruining the transistor, and how the extended load on the battery made it go flat. How I had to get a jump lead start from the RAC man next day and how he then got his van stuck solid in the mud. How I had to tow him out – but I don't think I'll bother. Apart from all this we enjoyed ourselves no end!

### A Guide to Coarse Servicing (continued)

As I made my way into Ike Hodge's workshop I was met by a venerable female who was just leaving the sanctum. She fixed me with a rheumy eye and in a wavering voice said "Such a nice man that Mr. Hodge, such a very nice man!"

Well . . . When I reached Ike I found him seated at his desk gazing abjectly at a bunch of pound notes he was grasping firmly in his left hand. Now one thing I happen to know is that nothing is more calculated to bring joy to my friend Ike than the sight of money, so his obvious dejection was all the more hard to understand. In answer to my question he muttered "she paid me!"

"Then why so downcast?"

"You don't understand. She's been on my back for years. Had me running around to her house time and time again for the most footling things. I was sorry for her to start with and used to charge her little or nothing. Then I began to get fed up and started to pile it on, hoping she'd go elsewhere. But it didn't have the slightest effect. Finally I decided I'd have to sacrifice my principles and soak her."

"You took that defenceless old battleaxe to the cleaners?" I gasped.

"All the way. And here's the result. Paid me without a murmur and thanked me for being so good and hoped I'd always give such good and prompt service." He screwed his face up miserably. "It's enough to make me loose my faith in human nature."

"Strange" I pondered aloud. "I'd come to ask you about charges."

"What kind" he asked, returning slightly to his usual jocular manner, "cavalry or battery?"

"Customer. What do you charge for small jobs now – especially when the customer is a friend of yours?"

"Friends" he muttered. "With customers for friends who

needs enemies? It's the worst thing you can do in this trade, to be matey with them. The best thing is to hate them all. When you like them you tend to feel sorry for them, just like I used to with that old trout, so you don't charge enough. When you hate them you can screw them without a second thought." He paused and gazed into the bench mirror reflectively. "Yes, it's been my down fall being such a good natured, generous chap." His lip trembled and I fancied I detected a tear in his eye. "These new underpants are devilishly tight" he complained. "Where was I?"

"You were saying what a noble nature you have."

"That's right. And where's it got me? Stuck in this mouldy workshop while guys like the proprietor of Perfidious TV Service Ltd. ride around in expensive motor cars with nothing to do but watch their bank balances grow."

"You mean Roderick Teste-Prodde I suppose?"

"That's what he calls himself nowadays. He's had businesses in every town for miles around. They usually last for a couple of years at most."

Interested despite myself I asked "how come?"

"He pays half a dozen housewives to take telephone messages for him in different districts. That way he can put all the numbers in his newspaper ads and make it look as if he's real big. So he gets lots of customers whom he takes for as much as he can on the first call. Freely admits he's not interested in building up a clientele as a bona fide tradesman, like what you and I are. If the sets go wrong again, no *when* they go wrong, he just ignores the calls. When the housewives get fed up they pack it in. He's got this telephone answering machine too. So no one can ever speak to him directly, but if anyone still wants him to call he doesn't miss out."

"You're joking."

"Never been more serious. There are blokes up and down the country who'd give their eye teeth to get the Bodger on his own by the canal side one dark night. It's a good job there are some of us left giving good, honest service. Here, do you mind giving me a lift out with this set while you're here? And Willy, if the phone rings while I'm out tell them I can't do anything till next week. Can't be at their beck and call just because they've been coming here for a long time."

### *Sizing Things Up*

I had to devote some time recently to writing about SI (System International) units. Consequently I've been discovering the standards of accuracy in force at the National Physical Laboratory. Next time you have to measure say ten metres of coax and chop it off roughly to length, you might like to bear in mind that the NPL measures its metres so accurately it could give the earth's circumference to a millimetre. And when you set your watch, think that the NPL works to the equivalent of one second in 166,000 years. I wonder how the staff carry on when they're making their time sheets out . . .?

# *Figuring It Out*

***George Wilding***

FIGURING out how the voltages in a circuit are developed can give you more insight into circuit operation than reading through reams of circuit description. Furthermore, once you've figured out how it's done, you tend to remember it!

Take for example the simple i.f. amplifier circuit shown in Fig. 1. Unlike many such stages, the base is not biased by a potential divider across the supply. Instead it receives its base bias via R2 from the junction of R1/C2, which provide collector circuit decoupling. This bias arrangement gives d.c. stabilisation, since if the transistor's collector voltage tends to fall as a result of increased collector current, the base bias voltage will also fall, partially offsetting the initial change. The degree of stabilisation is determined by the transistor's current gain and the value of R1.

Anyway, assuming that the transistor is a silicon type with a current gain of 100, and that the base bias current is 50μA, can you figure out the voltages in the stage? The component values have been chosen to give round voltage figures to simplify matters. See whether you can figure it out for yourself before reading on!

Starting with the base bias current, since this sets the operating conditions of the stage, we can calculate the transistor's emitter current. The transistor's current gain is 100, so the emitter current will be 100 times greater than the base current, i.e. $100 \times 50\mu A = 5mA$. The transistor's emitter resistor R3 is 280Ω, so its emitter voltage will be $280 \times 0{\cdot}005 = 1{\cdot}4V$. This is simply Ohm's Law. Since the stage is an i.f. amplifier, it will be biased to operate under class A conditions. We can assume therefore that the base voltage will be 0·6V (the silicon junction barrier potential) higher than the emitter voltage, i.e. 2V.

When a transistor is biased by a potential divider across the supply, the current flowing in its collector circuit will be the emitter current minus the base current. In our example however the collector current and the base current, which together equal the emitter current, both flow through R1. So 5mA flowing via 200Ω will produce 1V across R1, making the transistor's collector voltage 1V less than the supply line voltage, which is the last item we set out to find.

The 50μA base current flows via the 180kΩ resistor R2, so the voltage developed across this resistor will be 9V. Add this to the 2V base voltage and the 1V across R1 and you get the supply line voltage −12V. The transistor's collector voltage is 11V of course. So we've figured everything out!

R2, which carries the base current, is 900 times the value of R1 but develops only 9 times the voltage across R1, which carries the effective emitter current. Dividing 900 by 9 gives us the transistor's current gain, 100.

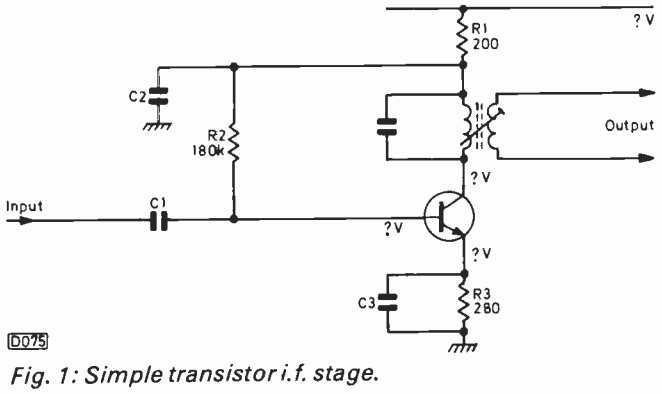



*Fig. 1: Simple transistor i.f. stage.*

# Is It the Aerial?

**Malcolm Burrell**

PROVIDED the signal from the aerial is of adequate strength and free from distortion, satisfactory sound and vision should be obtained from a TV set in good working order. Unfortunately a certain amount of distortion is almost inevitable, due to refraction, reflection or obstruction of the signal. Reception quality depends therefore on the condition of the receiver, the aerial installation and the geographical situation.

### Causes of Poor Reception

Refracted signals, i.e. those whose direction is changed by variations in atmospheric conditions, often travel some distance beyond the radio horizon. This is known as tropospheric propagation: most fringe area reception is affected by this, and of course it's one of the modes of DX reception. Weather conditions often improve or impair fringe reception.

An aerial will often receive reflected signals in addition to the main one coming directly from the transmitting aerial. Where the receiving site is close to a hill, high buildings or trees for example a direct and a reflected signal will be received (or maybe several reflected signals), giving rise to dual images on the screen displaced in accordance with the time difference between the arrival of the signals. In most cases the "ghost" signal takes longer to travel to the receiving aerial since its path is fractionally longer. Cases do occur however where the best reception at a difficult site is obtained from a reflected signal and anything that makes the direct signal the stronger of the two, such as aerial movement or exceptional weather conditions, produces a ghost image to the *left* of the stronger image.

These effects can impair the chrominance signal, by addition or cancellation of the subcarrier, affecting the colour strength and in some cases removing the colour completely. The same effects can distort the accompanying f.m. sound signal, and also cause problems with teletext reception.

A weak signal produces a snowy ("noisy") picture. This symptom may be due to a noisy transmission (occasionally) or a defective aerial amplifier, but by and large an inadequate or defective aerial or a receiver fault is responsible. How do you tell which?

Most engineers have at one time or another encountered the problem of convincing a suspicious customer that his aerial is either defective or not good enough. If you make a mistake with your diagnosis the word can spread alarmingly while the customer may refuse to pay the cost of aerial work he considers to have been unnecessary.

Problems with ghosts are relatively easy to diagnose, though there are cases where the offending image is faint and careful examination is required. The possibility of front-end misalignment should also be considered – it's quite possible to confuse overshoot or ringing with ghosting, though in this case adjusting the tuning will cause the effect to vary considerably.

The biggest problem is a weak signal due to lack of gain. Engineers rely on four methods of proving whether or not the aerial is responsible. First, experience. This is in many cases sufficient, where you know the local conditions, but is not conclusive and may be a bit of a gamble if you don't know the conditions all that well. There's no way of demonstrating the fact that the aerial is inadequate unless the signal strength is high enough to produce a reasonable picture by touching the aerial socket with a screwdriver. Secondly, another tuner/i.f. assembly can be used if by chance one is available. The third method is the conventional test using another receiver. This is a good method where a second set is to hand and the aerial fault is very definite. Even receivers of the same type differ slightly however, so you might find that your demonstration is not as convincing as you thought it would be.

The best approach is undoubtedly to use equipment. A field strength meter provides a convenient and reliable evaluation of the signal strength available, though the technician should be aware of the possibility of false readings due to effects such as ghosting. A pattern generator can be used to show the customer the clarity of the pictures his set is capable of resolving.

### Poor Reception Survey

Probably no two service areas are wholly alike. A couple of years ago however I decided to gather some facts about reception problems in my local area – Chelmsford, Essex. The help of seven other technicians was obtained, and questionnaires on problems dealt with over a period of three months were completed. Some interesting facts emerged.

Chelmsford lies just within the service area of the Sudbury high-power transmitter (250kW e.r.p.), the distance being about 25 miles. The transmitter uses group B channels. Reception is also possible from Crystal Palace (1,000kW e.r.p., group A channels) at a distance of some 35 miles. Ghosting is not prevalent in the area, but problems do arise due to preferences for reception from London (Crystal Palace) or Anglia TV (Sudbury). Further complications arise when reception of both is desired but only a single receiving aerial is used.

It was not uncommon to be called to attend to poor reception from Crystal Palace and find that the aerial in use was directed towards Sudbury, i.e. the opposite direction! Often satisfactory results had previously been obtained. Provided the reception from Sudbury was all right, one had to explain that reception from Crystal Palace was unusual without an aerial of the correct type pointing in the right direction, and that it was highly likely that the aerial system had deteriorated sufficiently to mar reception from Crystal Palace without affecting reception from Sudbury.

With the correct aerial, good pictures were available in most locations with signal strengths of between 500$\mu$V and 1mV. More modern sets produced reasonable pictures with only a 300$\mu$V signal. Elaborate arrays are rare in the area, and few locations produced a signal

of greater than 1·5mV – usually on the lowest channel of the particular group. Receiving aerials were generally mounted outside.

Table 1 summarises the results of the three-month survey. It will be seen that of a total of 105 calls, in only 13 cases were set faults the cause of the poor reception. We found the use of a signal strength meter helpful in 89 cases. Here are one or two cases I came across myself.

The complaint with an 18in. Decca colour set was a noisy picture. The signal strengths at the receiver's aerial input were 500$\mu$V on ch. 41, 350$\mu$V on ch. 44 and 200$\mu$V on ch. 51. It was noticed that eight yards of standard coaxial cable were in use between the set and a low-loss termination. Readings at the termination were 800$\mu$V ch. 41, 550$\mu$V ch. 44 and 350$\mu$V ch. 51. Low-loss extension cable improved matters considerably.

A noisy picture with a measured signal strength of 600$\mu$V was cured by replacing the tuner.

In a case of very noisy pictures it turned out that the maximum signal available was 150$\mu$V on ch. 23 (Crystal Palace).

We had two cases where the readings from a field strength meter were misleading. In the first the reading was 550$\mu$V on ch. 26, though the picture was inferior to ch. 23 which produced a reading of 330$\mu$V. A loft aerial was in use. In the second case a reading of 1mV was obtained on ch. 23 with an aerial directed towards Sudbury: the picture was very noisy and a prominent ghost was present.

In about ninety per cent of the cases investigated poor reception was found to be due to causes other than the set itself. Apart from sites where reception was difficult due to the terrain or obstructions, the cause of the problem was in each case an inadequate or faulty aerial system. It's worth bearing in mind that even with a good installation some deterioration is inevitable. This can be minimised by secure aerial mounting and taking all possible steps to ensure that no moisture can enter the junctions. The holes in air-spaced coaxial cable should be sealed at terminations to prevent even small amounts of moisture affecting the properties of the cable – this is a very common cause of low gain.

With the start of TV4 transmissions this November, there's bound to be an increase in the number of calls to attend to cases of poor reception, especially where the new transmissions are on the highest or lowest channel of the group. Get ready for a certain amount of aerial adjustment, maintenance and replacement!

One final point. Aerial manufacturers never seem to promote their products, except occasionally to the trade. As a result the public is left with the impression that there's nothing particularly special about the hardware on their rooftops. One wonders whether a bit of public advertising might lead to better aerial installations – and better pictures!

**Table 1: Summary of poor reception survey.**

| | |
|---|---|
| Total number of calls | 105 |
| Definite aerial faults | 92 |
| Aerial inadequate | 25 |
| Set faults | 13 |
| Use of signal strength meter helpful | 89 |
| Aerial location: | |
| Outside | 86 |
| Loft | 8 |
| Set-side | 4 |
| Communal aerial | 7 |

# TEST CASE

# 232

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

Like another regular contributor to this magazine, we increasingly often find ourselves becoming confused and despondent when faced with the bewildering array of technology awaiting our attention in the workshop. On some days we feel we could hardly repair a wheelbarrow, let alone a switch-mode power supply or a VCR. Amongst the battles almost lost recently was an encounter with a little Sony colour set, a Model KV1300UB.

We sometimes find it hard to realize that these sets have been around for twelve or more years, giving very little trouble. We've had to condemn quite a few of them for no other reason than that the tube has lost emission – it's not really economical to replace the tube in these 13in. Trinitron sets. This particular specimen had a good tube however, the reported complaint being an "unstable picture". What we found when we switched the set on was that the size of the picture varied in a random way – both the height and width were simultaneously fluctuating quite wildly. The picture would sometimes settle down for a brief period, but for most of the time the fault was present.

All sorts of horrible possibilities occurred to us. We started off by connecting a meter across the chopper's reservoir capacitor C608. The voltage here should be a steady 110V, but fluctuated in sympathy with the picture size variations, jittering around the 100V mark. Was the power supply being loaded down, or had it developed a bad case of nervousness? A milliameter connected in series with the h.t. output from the power supply panel (pin 5) revealed that the current flowing was proportional to the h.t. voltage – the ammeter and voltmeter pointers were jittering in sympathy with each other. This suggested that the power supply itself was responsible for the problem.

Now the chopper power supply in this set is very similar to the one used in the Thorn 3000/3500 chassis – a series chopper circuit in fact. The main difference is in the method of generating the chopper's drive waveform and varying its mark-space ratio. Instead of using a monostable circuit, the Sony set uses a pulse-width modulator stage. The circuit is quite simple (see Fig. 1). A squarewave from the line oscillator is integrated by R610/C609 and fed to the emitter-follower transistor Q601. The resultant sawtooth waveform developed across R612 is a.c. coupled by C615 to the base of the pulse-width modulator transistor Q603, with d.c. restoration by D609. The sawtooth switches Q603 on and off, the on-off times depending on Q603's base bias. This is obtained from the error detector transistor Q604, via R616. The error-detector stage is also straightforward – Q604's emitter is held at a steady 11·6V by zener diode D610, while its base is fed with a sample voltage from the 110V h.t. line via the potential divider network R621/VR601/R622.

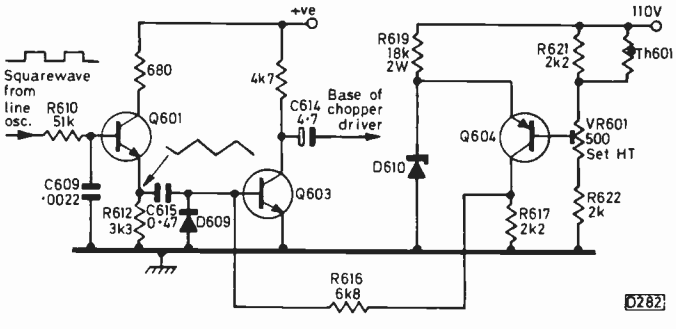



*Fig. 1: Emitter-follower (Q601), pulse-width modulator (Q603) and error detector/amplifier (Q604) stages of the chopper power supply used in the Sony Model KV1300UB.*

Since the h.t. was jumping about, we decided to concentrate on the error detector circuit. Zener diode D610, transistor Q604 and the preset VR601 were all checked and found to be in order. We also disconnected the over-voltage sensing transistor Q605 (not shown in Fig. 1) which shares D610 as its reference source and the slider of VR610 as its sensing point. A clue is given by the fact that errors within a feedback loop should be compensated for within the loop. A little further checking revealed the culprit. Which item was consigned to the scrap bin? See next month for the answer and another item in the series.

## *ANSWER TO TEST CASE 231*

### *— page 267 last month —*

Our technician last month finally proved that his diagnostic powers exceeded his abilities as a salesman! It will be remembered that the old Decca colour set (series 10 chassis) was producing acceptable pictures though the line output stage current was excessive, with the result that the fuse in the h.t. supply to the line output stage failed every so often. Now line output pentodes work, virtually under class C conditions – a high-amplitude squarewave is used to switch the valve on and off, the grid current flowing whilst it's on charging the grid coupling capacitor to hold it cut off until the next switch on pulse arrives. Thus the fault we had suggested that something was wrong with the drive conditions.

An oscilloscope check at the control grid (pin 1) of the PL519 line output valve revealed a rather alarming waveform. Instead of the nice 180V peak-to-peak squarewave that should have been present, the waveform was triangular in shape – almost a sawtooth. As a result, rather than enjoying a clean transition from cut-off to heavily conducting, the valve was operating almost under class A conditions. This accounted for the excess current and, since the beam current limiter circuit senses the smoothed voltage at the cathode of the line output valve, the pale picture.

The line oscillator circuit used in this chassis is of the PCF802 sinewave type. The pentode section produces at its anode a clipped waveform which is *RC* coupled to the line output valve. Something here had obviously gone awry, and the problem was solved by replacing the pentode oscillator's anode load resistor R444 (33kΩ) and the line output pentode's grid bias resistor R453 (330kΩ).

# Service Bureau

*Requests for advice in dealing with servicing problems must be accompanied by a £1·00 postal order (made out to IPC Magazines Ltd.), the query coupon printed below and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.*

### THORN 9000 CHASSIS

**The picture has a halo effect at the sides though not at the top and bottom. The halo is about a quarter inch wide and is present for only the first couple of hours after switching on – the picture then jitters and rights itself.**

This sounds like line foldover due to incorrect phasing of the line oscillator. We suggest you replace the decouplers C431 and C432 (both 10μF) in the line oscillator transistor's emitter circuit, then adjust the line hold control L401 for a floating picture whilst linking together test pins 407 and 408.

### BEOVISION 2600 CHASSIS

**There is a pulsating picture on this set. The valves in the line oscillator and e.h.t. generator stages have been replaced and the voltages checked – all remain rock steady apart from the e.h.t. itself, which pulsates with the picture.**

First check the 12HG7 luminance output pentode by substitution. If the fault persists, concentrate on the e.h.t. generator. We presume from your comments that the PL509/519 and PCC85 valves have been replaced with known good ones (the latter is the e.h.t. driver and regulator). The other things to check are R617 (1MΩ, H.S.) in the PL509's bias network, the two e.h.t. presets R621 and R632, and the driver stage's anode load resistor R596 (68kΩ, H.S.). Ensure that 72V is present at pin 3 of the regulator section of the PCC85 – this voltage comes from the boost rail in the line output stage via R609 and R612 (both 330kΩ, 1W H.S.).

### THORN 3500 CHASSIS

**There is no colour for the first quarter to half an hour. This is followed by coloured blinds for a few minutes, then the colour locks in and remains whilst the set is kept on. If the set is switched off for any length of time the above sequence is repeated. By shorting out the colour killer when there's no colour, bands of colour are obtained.**

The reference oscillator in the decoder is wandering. We suggest you replace the burst detector diodes W302/3 (BA155) and check the condition of the presets R309/12/15 in the control loop, then set them up as detailed in the service manual.

### PHILIPS G8 CHASSIS

**The initial fault symptom was lack of line sync for the first quarter of an hour or so. After this warm-up time lock could be obtained by pressing the channel selection buttons. Now however the picture is in lines all the time.**

There are several things to check for this fault. First check C4520 (33μF) in the reactance transistor's emitter circuit. Then check zener diode D4531 which stabilises the line oscillator supply and zener diode D2166 which stabilises the supply to the video/a.g.c./sync chip. C2160 (125μF) across D2166 is also worth checking. It's quite possible however that the chip is defective – type TAA700 or TBA550Q.

### DECCA 100 CHASSIS

**The picture would break up from the left, with white dots which would blot out the screen – a snow storm with a rushing sound. Initially switching on and off a few times would restore the picture, but the fault became more frequent until eventually the raster went and a new line output transformer had to be fitted. This cleared the trouble for a few days, then the old fault came back.**

The original fault was almost certainly due to heavy arcing in the line output stage. This may be occurring in one of the plug/socket connections to the line output or convergence panels, or alternatively on one of these two boards. We've had the fault several times, but seldom twice in the same place. Examine these areas closely for bad joints, and if necessary peer at the panels in a darkened room when the fault is present.

### RIGONDA VL100M

**There's a blank raster, with flyback lines, but no timebase locking. The voltage at the base of transistor T21 is about 20V instead of −1·1V.**

Transistor T21 is the sync separator, and the high voltage at its base suggests that the coupling capacitor, which is fed from a point in the video output transistor's collector load circuit, is leaky. The capacitor to check is C28 (0·22μF) on the signals panel. If you have to replace the transistor, an AC187 should do.

### THORN 8500 CHASSIS

**The height varies, up to 2½in. at the top of the picture reducing to a slight foldover or bright line, then jumping back (in hours or days) to full height or a loss of only an inch or so for various periods. When the top of the picture goes, neither the height control nor the vertical shift control will restore the missing part of the scan. With full height, these two controls work normally. The linearity is not affected (below the top loss) and no dry-joints can be found by tapping around the field timebase panel.**

We've had this one ourselves – it turned out to be due to the flyback clamp diode W414 (1N4002). If necessary, check the upper field output transistor VT410 (it conducts in the reverse mode during the flyback) and the bootstrap capacitor C438 (10μF).

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***TELEVISION APRIL 1982***

### PYE 697 CHASSIS

**I've had trouble with teletext lines appearing near the top of the screen on this chassis. On most sets the problem can be cured by adjusting the height control, as the lines usually appear at the extreme top of the picture, but occasionally we get a set in which the lines are an inch or two from the top, making our usual remedy impractical. The picture is in all other respects excellent however.**

This chassis always suffered from slow field flyback, and the only way to improve the suppression of the teletext lines is to readjust RV24 (the crossover preset) carefully. It's on the inside edge of the panel, and is not as critical an adjustment as one has been led to suppose.

### THORN 1500 CHASSIS

**Picture highlights tend to blur across the screen – the fault is particularly noticeable on very bright captions in ITV advertisements and the shine on people's faces.**

If the highlights tend to go glassy and grey, with defocusing, the c.r.t. is gassy or low emission. If the trouble is confined to streaking and smearing however, check the video output transistor's collector load resistors R40/41, the video coupling capacitor C37 (64$\mu$F), the h.t. decoupler C38 (12$\mu$F), and C32 (50$\mu$F) which decouples the video emitter-follower's base bias. The video output transistor VT9 is a remote possibility for this fault.

### GRUNDIG 5010

**The problem with this set is field collapse, with the 32V supply to the field output stage low at 8V instead of 32V. The field output transistors have been replaced, also fuse Si627 in the 32V line, but the problem remains. The h.t. supply is normal and the line output stage o.k.**

Check the d.c. current flowing via Si627. If less than 1A, check the 32V line smoothing capacitors C628/9 (220$\mu$F and 2,200$\mu$F) by substitution and check for the presence of the field generator waveform (27). Check that the service switch (on the c.r.t. base) is correctly set, also the field scan coupling capacitor C474 (1,000$\mu$F). If the current through Si627 is greater than 1·5A, suspect leakage to chassis from the 32V line – an ohmmeter is the best aid here.

### TELEFUNKEN 709 CHASSIS

**On dark scenes during a programme there's severe vertical bounce – it appears as though the field oscillator is going unstable. Advancing either the brightness or contrast control setting improves the situation: reducing the setting of either control results in the symptom being present all the time. The field hold control locks the picture very well when the brightness control is advanced beyond its normal setting.**

The problem could well be due to overloading in the i.f. strip – this will cause field sync pulse distortion. Check the voltage at pin 3 of the vision i.f. unit – with a normal signal input the voltage here should be in the region of 21-23V. If the voltage is low, the first i.f. transistor T101 will be turned hard on. In this event, check the a.g.c. circuit. The clamp diode Gr172 sometimes goes open-circuit, and the two transistors T171 and T172 can also be responsible for trouble here. Also check the a.g.c. reservoir capacitor C174 (12$\mu$F). The brightness and contrast controls are in the luminance channel and affect the d.c. level of the sync pulses – this explains the reason for there being less sync pulse distortion at higher settings.

### DECCA BRADFORD CHASSIS

**There's a hissing noise when the set is first switched on – it appears to come from the line output section. At this stage the picture is perfect, but after about forty minutes the picture has background interference – the noise continuing.**

The problem could be due to the tripler, in which case replacement will be necessary, but before condemning it examine the line output stage in total darkness, looking for a blue discharge. The trouble is often due to the fifth harmonic tuning capacitor C435 – it's mounted on the line output transformer's tags. If this proves to be the case, mount the replacement well clear of the transformer.

### GRAETZ 2541

**I'm stuck with a no e.h.t. fault on this set! When it was first obtained the symptom was that the raster disappeared after about five minutes normal viewing, but now the raster has gone completely. The PL509 line output valve is overheating badly, the voltage at its control grid being only −15V instead of the expected −70V or −80V. Replacing the PCF802 line oscillator valve failed to improve matters, neither did replacement of the small capacitors in this stage. The voltages here are o.k. except for pin 6 (pentode anode) which is low at 100V instead of 185V. The boost voltage is also low of course, but no fault can be found in the line output stage – new valves have been fitted, the width circuit checked and the boost capacitor and line output transformer tested by substitution. The set seems to be very similar to the ITT CVC5.**

Most of the circuitry is indeed the same as the CVC5. The line oscillator pentode receives a start-up supply from one of the h.t. rails, but during normal operation is supplied from the boost line. The relevant feed resistor (180k$\Omega$) can fail, giving the symptoms you describe – we notice that it's R506 (2W) in the Graetz circuit. Another possibility is a defective e.h.t. rectifier – disconnect it from the line output transformer and see what happens.

### PHILIPS KT3 CHASSIS

**The problem we have with this set is lack of sync and colour. Any ideas?**

Check for dirty contacts on the sync panel – next to the screened i.f. panel. If o.k., suspect the TDA2571 (or TDA2571A) sync/line oscillator i.c. – the same type must be used as a replacement, as the two cannot be interchanged.

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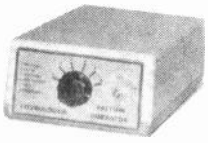

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***Fast Mail Order service to any part G.B. Delivery 2-3 days.***
*Just phone for a quotation. Delivery Manchester area free same day. Two year guarantee. Fitting while you wait or in your home £20 extra. Also PIL types & Toshiba.*

| | | |
|---|---|---|
| 18" | A47 – 342×343× | £37.00 |
| 19" | A49 – 120×/192× | £37.00 |
| 20" | A51 – 220×/110× | £38.00 |
| 22" | A56 – 120×/123×/140× | £38.00 |
| 25" | A63 – 120× | £39.00 |
| 26" | A66 – 120×A67 – 120×/140×/150 | £39.00 |

**G8 transistorised colour TVs *Ready Serviced* and *Polished* for resale £89 inc. delivery.**
**Philips 1500/01 Video Long Play Kits £99.**

**061 799 0854 24 hour answering service.**
**43 Clarke Cres, Little Hulton,**
**Nr. Manchester M28 6XM.**

## ARE YOU

### USING YOUR SPARE TIME PROFITABLY?

If not, you're losing money. Money that you could be making by selling **used colour televisions from home** in the evenings. In fact, provided you start correctly and know exactly how to operate, you can easily earn a substantial CASH INCOME with a starting capital of less than £20. Our new unique publication **"How to Deal Successfully in Used Colour Televisions"** enables you to follow in the footsteps of many experts who have a great deal of combined experience in this lucrative home business, and who have 'pooled' their knowledge to help you. After all, to follow the advice of someone who has travelled the ground before you, is to be given the best possible start. And the hundreds of valuable trade secrets, hints, tips and suggestions in the guide show exactly how anyone of average intelligence can **succeed immediately.**

Every aspect, from securing the first television right through to rapid expansion of sales, is covered with the detailed knowledge of experts to ensure **certain success.** Indexed information on almost all makes of television is presented in clear tabular form, describing performance, reliability, price and service. In particular, the tips on expanding the business are very practical, and are almost automatic when put into practice. Pages of unique advice on advertising ensure that maximum sales are secured, and sources of supply are described in detail – for both televisions **and** new/used spares. Monochrome sets are also covered, as are "invisible" cabinet repairs. **Plus FREE on-going advice and FREE regular updating service.**

**You can start tomorrow – but you'll need our guide.** The latest big illustrated edition is out now, and costs just **£4.95** – a small price to pay for financial independence!

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GLOBUS INDUSTRIES LTD., UNIT 18, DARLEY ABBEY MILLS, DERBY.

**To: Globus Industries Ltd., Unit 18, Darley Abbey Mills, Derby.**
Please send by return post "How to Deal Successfully in Used Colour Televisions".
I enclose cheque/p.o. for **£4.95**.

NAME.....
ADDRESS.....
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# SENDZ COMPONENTS

**D. Whitworth,**
**63 Bishopsteignton, Shoeburyness,**
**Essex SS3 8AF.**
**Telephone: 0702 32992**
**VAT 15%, 50p Post.**
**Good despatched on receipt of order.**

**NEW PHILIPS** Infra-red Transmitter, 9 c.h. & Vol & brightness change **£7.00**

**THORN** Front Panels. 6 slider pots & knobs & touch button. Ultrasonic transducter & I.C. & Components & Mains Switch **£3.75**

| | | | |
|---|---|---|---|
| ZTX 109K | 3p | BC548 | 4p |
| BC207 | 3p | TIP29 | 10p |
| BC208 | 3p | SN76550/3R | 10p |
| BC147 | 4p | BFT34 | 10p |
| BC148 | 4p | IR106A | 20p |
| BC338 | 4p | | |
| BC237 | 3p | | |

**DECCA** 80-100 Thyristors **35p**

| | |
|---|---|
| TDA1003 | 15p |
| TBA540 | 40p |
| TDA2560 | 50p |
| TBA540Q | 40p |
| SN76660 | 30p |
| TBA800 | 30p |
| SN76707 | 50p |
| TBA810 | 60p |

CVC 45 Line O.P. Trans **£4**

CVC 45 Triplers **£3.50**

3500 Triplers **£3.50**

| | | | |
|---|---|---|---|
| **RANK TOSHIBA** Tube Base | 25p | LP1162 O/P STAGE | £1.50 |
| | | Y933 | 5p |
| | | IN914 | 5p |
| | | BA248 | 5p |

20 BY298 3 Amp fast recovery diodes **£1.50**

4000 Thorn Frame Panel **£5.00**

4000 Thorn Power Supply **£3.00**

4000 Thorn Line OP Panel **£20.00**

Post **£4.** 15" T.V. Tube Hitachi; New **£6.00**

NPN PNP 80V 6 Amp TO66 O.P. Trans Piar **25p**

Mixed Packs, Mounting Kits and Washers for Power Transistor **50p**

**DECCA** Chroma Panel 80-100 **£10 NEW**

**DECCA** I.F. 80-100 **£3.50**

**BRIDGE REC** Wire leads KBP04 **15p**

G11 Time Base Panel **£12.00**

A.E.C. V/cap Resistor Unit U.H.F. with I.C. SAS 660 SAS 670 **£3.00**

KT3 200×25×25 385v **£1**

BF458 **10 for £1**

U321 T/Unit on Panel Cum 40 ITT **£7.00**

**GEC** Line O/P Trans & Rec Stick for Portable **£3.00**

G11 Power Supplies **£12**

| **REC & TRANS** | **EACH** |
|---|---|
| 40K Transducer | 50p |
| TIC 126 12A 800V | 30p |
| BPW41 | 15p |
| BD437 | 25p |

**PHILIPS** NE511N **£1.20**

LD57 CA Infrared L.E.D. **15p**

SAA5010 **£2**

BD226 **20p**

BUX84 **50p**

LM337M **30p**

**PYE** Line O.P. Trans Mono **£3.00**

BY229/400 **30p**

Co. Ax. Plugs **9p**

BYX72/300 **20p**

2SD180 TO3 80V .6A **15p**

2 SB407 Sanyo TO3 **10p**

Thorn T605 1 V NPN TO66 80V 6A **10p**

50 Mixed High Voltage Ceramic Condenser **£1.00**

20 GRC Black Spark Gaps **£1.00**

Mono Rank Line Trans T704 A **£3.50**

4000 Thorn Mains Dropper **35p**

20 I.C. Socket Mixed **£1**

G11 Line Driver Transformer **35p each**

2 SD350A BU208A **£1**

G11 IF Detector **£3.00**

G11 Teletext Transmitter **£19.00**

G11 Chrome/Lumin Can **£3.00**

KT3 LOPT **£3**

BG200/43 Tripler **£3**

TCA2540 **40p**

BU208A **£1**

RCA CA270 **40p**

KT3 2SD 200 Line Transistor **£2**

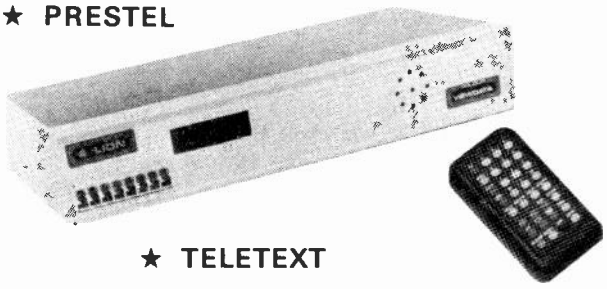
**V.H.F.** 3 Transistor Rotary Tuner Units D.X. T/V **£1 NEW**

ITT CVC 32 Line O.P. Trans **£6.50**

## LION TELETEXT PRESTEL ADAPTOR

**why buy two seperate adaptor's when one will do?**

★ PRESTEL



★ TELETEXT

Our adaptor has the plug-in Lion Teletext or Prestel and Teletext board which is used in our Television TXV 56 and our Ferguson Colourstar adaptor. Features include: Full Infra Red Remote Control, Printer Facility, Full alphanumeric Keyboard or microcomputer input, Cassette Recording Output, Autodial of Viewdata numbers, 8 Page Memory Option. Local Editing Facility and many other features.

*Realistic Prices:*

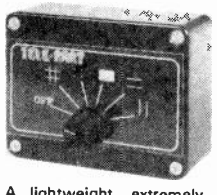
AXV03 **£250** AXV04 **£199** (teletext only)

# LION TV

**18 HARCOURT TERRACE, LONDON SW10**
**Tel: 01-373 5218**

## TELE-PART

**13 WORCESTER ST., WOLVERHAMPTON, WV2 4LJ**
**Tel: (0902) 773122**
**Telex: 336810**



### Telepart Pattern Generator

- *Exceptionally light and durable*
- *Pocket size for outside service*
- *PP3 battery power source*
- *Five different test patterns for colour and mono TV*
- *Cross hatch grid*
- *Dot matrix*
- *White raster*
- *Horizontals*
- *Verticles*

A lightweight, extremely portable and versatile pattern generator for black/white and colour T.V. alignment and service at the customers home. At the turn of a switch, the generator can provide five essential test patterns for correct installation, fast checks and repairs. Pattern stability is first class and compares favourably with other more costly bulky generators only suitable for bench work. The generator is pocket size measuring 10×7.5×4 cm and weighs only 190 grams.

**PRICE £14.95 (Subject to V.A.T.)**
POST & PACKING £1.15

### Telepart Colour Bar Generator

- *Exceptionally light & durable*
- *Compact 13×17.5×5.5 cms*
- *Battery powered for mobility*
- *Cross hatch grid*
- *White raster*
- *Grey scale*
- *Colour bars*
- *Sound*

A Versatile Generator for Servicing or aligning mono or colour TV receivers. Lightweight and very compact for outside service. Features sound facility often not found on more costly generators.

**PRICE £49.95 (Subject to V.A.T.)**
POST & PACKING £1.15

### Power Supply

A Power Supply can be supplied for the Telepart COLOUR BAR GENERATOR. This compact unit mounts by 2 screws into the Battery compartment and converts the unit to a bench instrument.

**PRICE £5.50 (Subject to V.A.T.)**

*Allow up to 28 days for delivery.*

# POST A PART, ELECTRONICS.

## SEMICONDUCTORS

| | | | | | |
|---|---|---|---|---|---|
| BC153 | 10p | BD131 | 25p | BU126 | 1.00p |
| BC154 | 10p | BD183 | 1.00p | ME0404 | 7p |
| BC171 | 7p | BF137 | 20p | ME0412 | 7p |
| BC172 | 7p | BF240 | 8p | ME6002 | 7p |
| BC208 | 7p | BF255 | 10p | NKT241 | 7p |
| BC237 | 10p | BF256c | 35p | NKT276 | 20p |
| BC238 | 7p | BF256LC | 35p | PN107 | 7p |
| BC250 | 7p | BF257 | 30p | R2010B | 1.00p |
| BC251 | 7p | BF259 | 40p | R2443 | 25p |
| BC307 | 10p | BF274 | 10p | R2540 | 1.00p |
| BC308 | 7p | BF337 | 25p | R2781 | 1.25p |
| BC347 | 7p | BF391 | 7p | RCA16446 | 30p |
| BC394 | 7p | BF394 | 8p | TIS90 | 20p |
| BC455 | 7p | BF459 | 80p | TIS91 | 20p |
| BC546 | 7p | BF596 | 7p | 2N2193 | 7p |
| BC549 | 7p | BFR87 | 25p | 2N3703 | 20p |
| BC556 | 7p | BU105 | 75p | 2SA473 | 12p |
| BC559 | 7p | BU108 | 1.00p | 2SC346 | 7p |
| BC595 | 7p | BU207 | 1.00p | TIC106C | 30p |
| BCX34 | 10p | BU208 | 1.00p | R2265 | 1.35p |

## MIXED PACKS

| | | | |
|---|---|---|---|
| 300 mixed resistors | 1.50 | 20 mixed valve bases | 1.00 |
| 300 mixed capacitors | 1.50 | 10 spark gaps | 1.00 |
| 150 mixed electrolytics | 2.00 | 10-16 pin Quil IC socket | 90p |
| 100 W/W resistors | 1.00 | 20 assorted T.V. knobs | 1.00 |
| 20 mixed conv pots | 1.00 | 10-16 pin Quil to Dil IC socket | 90p |
| 40 mixed potentiometers | 1.50 | 100 mixed diodes | 1.00 |
| 20 mixed sliders | 1.00 | 50 mixed mica washers | 65p |
| 40 mixed presets | 60p | 300 mixed resistors & capacitors | 1.50 |
| 20 mixed VDR & thermistors | 1.00 | 10-16 pin Dil to Dil IC socket | 1.00 |
| 20 mixed ferrite cores | 50p | | |

## DIODES

| | | | | | |
|---|---|---|---|---|---|
| AA112 | 8p | BZU15C12R | | IN2070 | 8p |
| AA119 | 8p | | 14p | IN5254B | 8p |
| AA143 | 8p | BY204 | 8p | IN4742A | 8p |
| BA115 | 8p | BYX22/400 | 8p | IS025 | 8p |
| BA131 | 8p | BZY79C 20V | | IS1658 | 8p |
| BA154 | 8p | | 8p | ITT638 CV9 | |
| BA157 | 8p | DA002 | 8p | | 6p |
| BB103 | 8p | SCR957 | 30p | ZX150 | 8p |
| BR303 | 26p | IM102255 | 8p | SKE1/02 | 18p |
| BY127 | 12p | IN60 | 8p | MR854 | 30p |
| BY133 | 10p | IN5349 | 8p | MCR406 | 35p |

## INTEGRATED CIRCUITS

| | | | | | |
|---|---|---|---|---|---|
| BAV40 | 50p | SN74123N | 40p | TBA480 | 1.00 |
| BRC/M/200 | 1.00 | SN74154N | 1.40 | TBA1440C | 1.00 |
| BRC/M/300 | 1.00 | SN76110N | 40p | TOA2680 | 40p |
| DM74123N | 50p | SN6622N | 40p | TOA2690A | 40p |
| SN15846N | 40p | TAA570 | 1.00 | TBA540 | 90p |

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General purpose mono scan coils, Thorn etc 3.40
Tube base ITT CVC32 85p
Thorn 4000 red/green/blue static controls and blue lateral control 3.75
Thorn 4000 coil L401 55p
Thorn 4000 coil L701/2/3 25p
Korting shift pot 50R 75p
Philips G9 lum. delay line 1.25
7 segment display red (Toshiba) TLR306 1.45
4 segment display red (Toshiba) TLR307 1.10
4 push button switch assy. 20K resistance 2.55
3500 6 push button unit plus knobs, Thorn w/cap 1.00
Most values of presets available. Horizontal or vertical, miniature or standard. 10 of any value 1.00

## E.H.T. TRAYS

| | | | |
|---|---|---|---|
| Thorn 8000 EHT doubler | 3.12 | Thorn 4000 | 5.00 |
| LP1174 | 3.50 | Pye 18" early type | 3.50 |
| PYE731 | 4.00 | Pye 18" late type | 4.00 |
| Thorn 8500 | 5.00 | Thorn 900, 950 | 2.50 |
| Thorn 9000 | 5.00 | Thorn 3000 | 6.00 |

## E.H.T. STICK FOR THORN

950/1400/1500 triplers E.C.T. type 80/150 5p
E.H.T. stick. 83/200 5p

## FUSES 20mm

| | | | |
|---|---|---|---|
| 50MA | 10 for 70p | 500MA | 10 for 40p |
| 315MA | 10 for 50p | 1 Amp | 10 for 40p |

Thorn 3000 metal 2A cut out 1.25
Thorn 8500 plastic 2.5A cut out 1.25
Degause thermistor PT32F ITT/GEC + fits some Pye/Bush etc. 25p
Degause VDR type E299DVH P230 3000/8000 25p

## TRANSFORMERS/LOPT

| | |
|---|---|
| Mains TX 3000/3500 | 10.00 |
| Mains TX 8000/8500 | 10.00 |
| S.O.P.T. 8000/8500 | 3.50 |
| 3000/3500 Scan TX | 6.00 |
| 3000/3500 EHT TX | 6.00 |
| 8000 LOPT | 9.35 |
| 8500 LOPT | 10.65 |
| 9000 LOPT | 10.15 |
| Mono portable LOPT. Thorn, GEC, etc. | 3.75 |
| Mullard diode splitting LOPT. GEC, etc. | 14.75 |

## DROPPERS

| | |
|---|---|
| Pye 78+16' | 40p |
| Pye 147+260 | 40p |
| Thorn 6+1+100 3K | 50p |
| Thorn 56+1K+47+12 | 1.00 |
| Thorn 350+20−148+1K5+317 | 1.00 |
| Thorn 50+40+1K5 | 50p |
| RBM 250+14+58TV161 | 50p |
| 185+185 28W | 40p |
| 190+190 28W | 40p |
| 140+140 28W | 40p |

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3000, 8500 Thorn focus pot 1.25
9000 Thorn focus pot 1.00
IC inserters, 16 pin 50p
Large IC extractor 50p
Crystals 4.433619MHz 50p
EHT lead for split diode LOPT 1.00
Litesold 20 watt 240V soldering iron element 65p each or 4 for 2.00
EHT final anode cap 47p
6MHz ceramic filter 30p
ITT bridge rec. FXS 244/2A 15p
Castors, sets of 4 2.50
Direct panel mounting. 20mm fuse clips pair for 25p

## WIRE WOUNDS

| | | | | | |
|---|---|---|---|---|---|
| 1.5R 5W Thorn 3K | 30p | 270R 5W | | 15p |
| 2R 5W Thorn 3K | 30p | 270R 7W | | 16p |
| 2.2R 4W | 15p | 280R 17W | | 23p |
| 3.3R 9W | 30p | 330R 5W | | 15p |
| 4R 11W fusible | 25p | 330R 7W | | 16p |
| 7R 9W fusible | 25p | 330R 11W fusible Thorn | | 25p |
| 8.2 7W | 15p | 370R 17W | | 23p |
| 10R 7W | 15p | 820R 4W | | 15p |
| 12R 9W | 20p | 1K2 9W Thorn 3K/4K | | 18p |
| 15R 5W fusible | 25p | 1K2 11W fusible | | 25p |
| 15R 7W | 16p | 2K2 5W fusible | | 25p |
| 15R 11W Thorn 3K | 30p | 2K2 7W | | 16p |
| 15R 17W | 23p | 2K2 7W fusible | | 25p |
| 22R 4W | 15p | 2K2 9W fusible | | 25p |
| 22R 9W fusible | 25p | 2K3 5W | | 15p |
| 27R 7W | 16p | 2K7 9W fusible | | 25p |
| 27R 7W fusible | 25p | 3K9 5W fusible | | 25p |
| 36R 17W | 23p | 3K3 4W | | 15p |
| 32R 4W | 15p | 4K7 7W fusible | | 25p |
| 32R 9W fusible | 25p | 5K1 7W | | 16p |
| 100R 5W fusible | 25p | 8K2 7W | | 15p |
| 220R 7W Korting fusible | 30p | 8K2 9W 8K Thorn | | 23p |
| 220R 17W | 23p | 10K 7W | | 15p |
| 235R 9W fusible | 25p | 10K 9W | | 16p |
| 240R 9W Thorn 4K | 30p | 39K 4W | | 15p |

## EX-EQUIPMENT SPARES

Convergence yoke 3000/3500 1.75
Scan coils 3000/3500 please state which 2.75
3000/3500 LTB (tested) L501/L502/L503/L504/T502/T501, 50p each
3000/3500 PSU (tested) T602/L601 50p each
3000/3500 chroma delay line DL301 (tested) 65p
3000/3500 lum. delay line L203 (tested) 65p
3500 convergence (tested) T751, L751, L752, L753, L754 50p each
3000/3500 frame output transformer (tested) 1.00

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8500 IF/decoder panel Ex-equipment, untested 4.75
Mains on/off switch, rotary 20p
Mains on/off switch, push 20p
A1 switch. Thorn 3000/3500 50p
A1 switch. Thorn 4000 – fits ITT/Pye 50p
A1 pot 5M 3000/3500 70p
100K 40 turn pots for w/cap tuners 25p
Double fuse holder on small pax. board (20mm type) 10p
Single fuse holder on small pax. board (20mm type) 5p
In line fuse holder (1¼" type) 50p

Ex-equipment untested 3000/3500 panels any specified panel 3.75
UHF aerial socket & lead. Pye, ITT, Thorn 25p
UHF aerial socket & lead. GEC 25p
UHF aerial socket & long lead. GEC 35p
UHF aerial socket & mounting bracket for Thorn 4000 40p
UHF TV aerial for portable 50p
625 aerials + fittings available. Price list on request
Coax plugs 12p
Switched flush fitting aerial outlet (white) 1.20

## CARBON RESISTORS

12R ¼W, 22R ¼W, 27R ¼W, 39R ¼W, 56R ¼W, 56R ½W, 62R 1W, 68R ¼W, 68R ½W, 68R ¼W, 75R ¼W, 82R ¼W, 100R ¼W, 120R ¼W, 120R ½W, 130R 2W, 150R ½W, 180R 1W, 220R ¼W, 220R 2W, 240R ¼W, 240 R1W, 270R ¼W, 270R 1W, 300R ¼W, 330R ¼W, 470R ¼W, 560R ½W, 680R ¼W, 820 R½W, 820 R1W, 1K ¼W, 1K 1W, 1K 2W, 1K 5¼W, 1K 5.1W, 1K 8¼W, 2K 2.1W, 2K 7.1W, 4K 7¼W, 11K ¼W, 12K ¼W, 18K 2W, 22K 1W, 33K ¼W, 36K ¼W, 47K ¼W, 68K ¼W, 100K ¼W, 110K ¼W, 270K ¼W, 330K ¼W 330K 1W, 390K ¼W, 500K ¼W, 1MEG ¼W, 1MEG 2W, 2M 2¼W, 2M 7¼W, 4M 7.1W, 10M ¼W any 10 for 25p

Thorn 9K thick film units FR1 or FR3 1.25
10 Meg thick film focus resistor 65p

## CAPACITORS

| | | | |
|---|---|---|---|
| 3.3PF | 350V | 5000PF | 2KV |
| 6.8PF | 63V | 3300PF | 250V |
| 8.2PF | 350V | 4700PF | 400V |
| 10PF | 350V | .0047MF | 500V |
| 12PF | 1000V | .0075MF | 2KV |
| 22PF | 63V | .01MF | 250V |
| 30PF | 63V | .1 MF | 600V |
| 47PF | 350V | .15MF | 400V |
| 182PF | 63V | .22MF | 200V |
| 250PF | 2000V | .22MF | 250V |
| 330PF | 63V | .022MF | 250V |
| 330PF | 160V | .047MF | 400V |
| 330PF | 8KV | .1MF | 250V |
| 470PF | 250V | .1MF | 2KV |
| 560PF | 63V | .22MF | 400V |
| 1000PF | 250V | .33MF | 250V |
| 1500PF | 250V | .39MF | 250V |
| 1800PF | 160V | .47MF | 250V |
| 2700PF | 63V | | |

Any 10 @ £1.00

## ELECTROLYTICS

| | | | |
|---|---|---|---|
| 1MF 63V | 20/£1 | 100MF 100V | 10/£1 |
| 1.5MF 63V | 20/£1 | 100MF 160V | 10/£1 |
| 2.2MF 25V | 20/£1 | 125MF 16V | 10/£1 |
| 4MF 64V | 20/£1 | 150MF 25V | 20/£1 |
| 4MF 350V | 10/£1 | 160MF 25V | 20/£1 |
| 6.8MF 40V | 20/£1 | 160MF 40V | 10/£1 |
| 10MF 40V | 20/£1 | 220MF 40V | 10/£1 |
| 10MF 160V | 10/£1 | 250MF 25V | 10/£1 |
| 15MF 16V | 20/£1 | 330MF 10V | 20/£1 |
| 15MF 63V | 20/£1 | 330MF 35V | 10/£1 |
| 22MF 10V | 20/£1 | 330MF 63V | 10/£1 |
| 22MF 40V | 20/£1 | 470MF 6.3V | 20/£1 |
| 22MF 63V | 20/£1 | 470MF 10V | 10/£1 |
| 22MF 160V | 10/£1 | 470MF 25V | 10/£1 |
| 32MF 275V | 10/£1 | 470MF 40V | 10/£1 |
| 33MF 40V | 20/£1 | 640MF 10V | 20/£1 |
| 33MF 50V | 20/£1 | 680MF 16V | 20/£1 |
| 33MF 250V | 10/£1 | 680MF 40V | 10/£1 |
| 47MF 350V | 10/£1 | 1000MF 10V | 10/£1 |
| 50MF 25V | 20/£1 | 1500MF 16V | 10/£1 |
| 68MF 250V | 10/£1 | 2200MF 25V | 6/£1 |
| 100MF 18V | 10/£1 | 3300MF 25V | 10/£1 |

## MULTI SECTION CAPACITORS

| | | | |
|---|---|---|---|
| 175+100+100 350V Thorn 3K | 2.00 | 200+200+100 350V | 70p |
| 100+150+50 350V | 50p | 200+100+50 300V | 60p |
| 200+32+300+100 350V | 50p | 150+150+100 300V Thorn 1K5 | 1.90 |
| 2500+2500 63V Thorn 8K | 1.20 | 32+32+16 350V | 40p |
| 200+100+100+50 350V | 50p | 32+32 350V | 30p |
| | | 200+100 32EV | 70p |
| | | 200+47 250V | 65p |

## CAN TYPES

| | | | |
|---|---|---|---|
| 2MF 20V | 50p | 800MF 250V | 70p |
| 22MF 375V | 50p | 1250MF 40V | 50p |
| 50MF 350V | 50p | 1250MF 50V | 50p |
| 100MF 150V | 65p | 1500MF 70V Thorn 3K | 1.00 |
| 220MF 400V Thorn 9K6 | 1.30 | 2000MF 30V | 50p |
| 200MF 450V Thorn 4K | 1.30 | 220MF 40V Thorn | 1.00 |
| 400MF 350V Thorn 8K | 90p | 2500MF 35V | 65p |
| | | 2500MF 40V | 65p |
| 800MF 250V print type | 80p | 300MF 25V | 50p |
| | | 3300MF 25V | 60p |

---

**39 HIGH ROAD, NORTH STIFFORD, GRAYS, ESSEX, RM16 1UF.**

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PLEASE ADD 60p P&P, PRICE INCLUSIVE OF VAT, ADD POSTAGE FOR OVERSEAS ORDERS

**THOUSANDS OF ADDITIONAL ITEMS AVAILABLE, ENQUIRIES INVITED**

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Amount .....
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**22/26 Bush**
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***At Give Away Prices***

# EX RENTAL T.V.s.

Over 1500 weekly from Britain's Major Rental Comp. Direct from source. Mixed Mono & Colour arriving daily. We are able to supply a few established Dealers regular supplies at very good prices. All sets guaranteed complete. Regular deliveries to London: S. West: N. East: Scotland etc.

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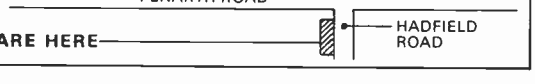

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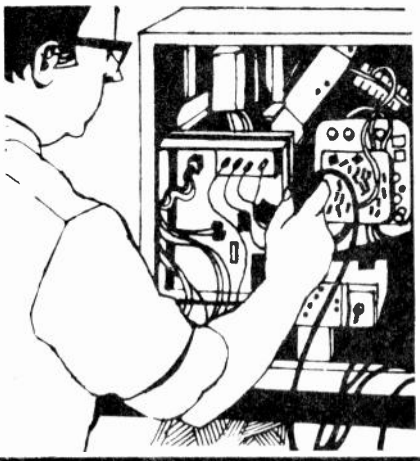

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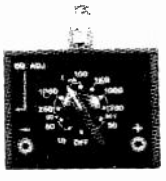

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| AF239 | 25p |
| AU113 | £1.20 |
| BA159 | 7p |
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| BB105 | 7p |
| BC107 | 7p |
| BC108 | 7p |
| BC109 | 7p |
| BC139 | 7p |
| BC147 | 7p |
| BC148 | 7p |
| BC149 | 7p |
| BC154 | 7p |
| BC157 | 7p |
| BC158 | 7p |
| BC171 | 7p |
| BC173 | 7p |
| BC174 | 7p |
| BC182L | 7p |
| BC183 | 7p |
| BC207 | 7p |
| BC212 | 7p |
| BC213 | 7p |
| BC237 | 7p |
| BC238 | 7p |
| BC245 | 7p |
| BC250 | 7p |
| BC251 | 7p |
| BC252 | 7p |
| BC257 | 30p |
| BC300 | 30p |
| BC303 | 30p |
| BC307 | 7p |
| BC308 | 7p |
| BC327 | 7p |
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| BC365 | 10p |
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| BC454 | 7p |
| BC460 | 25p |
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| BC559 | 7p |
| BC131 | 30p |
| BC132 | 30p |
| BC135 | 15p |
| BC136 | 15p |
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| BC221 | 20p |
| BD228 | 25p |
| BD238 | 20p |
| BD239 | 12p |
| BD331 | 20p |
| BD332 | 20p |
| BD253B | 35p |
| BD416 | 25p |
| BD595 | 35p |
| BD596 | 35p |
| BD681 | 25p |
| BD807 | 20p |
| BD534 | 20p |
| BF127 | 20p |
| BF137 | 20p |
| BF157 | 20p |
| BF180 | 20p |
| BF181 | 20p |
| BF182 | 20p |
| BF185 | 20p |
| BF195 | 7p |
| BF198 | 7p |
| BF199 | 7p |
| BF200 | 20p |
| BF240 | 7p |
| BF245 | 7p |
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| BF264 | 15p |
| BF273 | 7p |
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| BF338 | 24p |
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| BR100 | 25p |
| BSX20 | 7p |
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| BT109 | £1.00 |
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| BT151/800R | 70p |
| BTY80 | 20p |
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| BU108 | £1.00 |
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| BU126 | 80p |
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| BY227 | 10p |
| BY296 | 10p |
| BY298 | 10p |
| BY299 | 10p |
| BYF3123 | 40p |
| BYF3126 | 40p |
| BYX38/600 | 50p |
| BYX38/300 | 25p |
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| BYX71/600 | 30p |
| BYX72/300 | 20p |
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| 2N4444 | £1.00 |
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| W004 Bridge | 15p |
| W005 Bridge | 20p |
| 9000 Thorn O/P Transistors with Heatsink T903 8v | £1.00 |
| SW150 Surface Wave Colour TV Filter | £1.00 |
| TiC 126N Thyristor | |

| | |
|---|---|
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| 1800/4KV | 5p |
| 4.7NF/5KV | 10p |
| 180/8KV | 10p |
| 210PF/8KV | 10p |
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| 330PF/8KV | 10p |
| 1000PF/10KV | 10p |
| 1200PF/12KV | 10p |

| ITT SPARE PANELS | |
|---|---|
| CVC9 Power Supply Board | £1.50 |

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| TDA2560 | £1.00 |
| TDA7315 | £1.00 |
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| THORN R1038 | 70p |
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